Education's role in fostering environmental awareness and advancing sustainable development within a holistic framework

Vitaliy Hnatyuk | Natalia Pshenychna | Svitlana Kara | Valentyna Kolodii | Liliya Yaroschuk

Abstract The paper explores the pivotal role of education in nurturing environmentally conscious citizenship and advancing sustainable development. It delves into how education raises public awareness regarding critical environmental issues like pollution, biodiversity loss, and climate change. The analysis also probes the influence of education in shaping environmental values, skills, and decision-making abilities crucial for responsible ecological stewardship. Additionally, the paper examines innovative approaches and methodologies applicable in educational programs to enhance environmental literacy and promote active citizen engagement in addressing environmental challenges. The research seeks to investigate the nexus between perception, attitude, and environmental behavior among higher education students majoring in diverse fields such as electrical engineering, mechanics, and economics. Involving 453 students from Ukrainian higher educational institutions, the study employed the Likert scale to gauge students' environmental education, perception, attitude, and behavior. Findings revealed that students actively participating in academic education exhibit engagement in environmental initiatives such as volunteering, event participation, and recycling, along with a keen interest in green technologies and alternative energy sources. Moreover, statistical analysis indicated no significant difference in the awareness of the importance of environmental education across various faculties.

Keywords: environmental education, environment, attitude

1. Introduction

Education is a key aspect in the process of transforming society toward sustainable development, providing individuals with a unique opportunity to implement their concepts of society in practical life. The importance of education in this context is determined not only by national frameworks but also by global initiatives (Boeve-de Pauw, 2019). Ensuring the quality of the educational process is a necessary cornerstone for achieving the principles of sustainable development. In accordance with the principles outlined, education contributes not only to the transfer of knowledge but also to the formation of people’s awareness and responsibility regarding environmental and social issues. In today’s world, education is a significant tool for overcoming the challenges posed by environmental pollution, biodiversity loss and climate change. Education is recognized as a key tool that not only provides knowledge but also shapes the values, perceptions and awareness necessary to address current environmental challenges. The key issue is the need to integrate the principles of sustainable development into educational programs (Moustairas et al., 2022). Education acts as a critical factor in the development of modern society, which strives for harmony between humanity and nature. Education not only transfers knowledge but also forms the values and skills necessary for the development of an environmentally conscious and socially responsible citizen. In the context of sustainable development, education acts as a catalyst for change, promoting an understanding of environmental issues, social justice and economic efficiency (Arabadzhiev et al., 2020).

Education fosters a deep understanding of the principles of sustainable development, and this understanding becomes the basis for individual and collective decision-making in favor of an environmentally balanced, equitable and economically sustainable society. This approach determines the importance of including innovative pedagogical practices in educational programs. Thus, environmental education has become a tool for implementing the ideals of sustainable development and ensuring harmonious interaction between humans and nature and society. In the period from 2002 to
2008, various Ukrainian higher education institutions began to teach new disciplines, including “Technoeology”, “Engineering Ecology”, “Landscape Ecology”, “General Ecology with the Basics of Neoecology”, “Social Ecology”, “Agroecology”, “Geoecology”, “Paleoecology”, “Bioecology”, “Environmental Monitoring”, “Ecology of Biological Systems”, “Terrestrial and Aquatic Ecosystems”, “Human Ecology”, and “Economic Ecology”. Even new fields such as “Space Ecology” or “Space Ecology” have been established, which studies the interrelationships between the Earth’s biosphere and outer space (Obrecht et al., 2022). At that time, the educational and methodological commission of scientific and pedagogical staff of agricultural higher educational institutions aimed at developing educational programs and materials for ecology was extremely important. This proactive effort fully eradicated the shortage of essential environmental education materials (Bayev et al., 2022).

The importance of this work lies in the fact that different authors and teams had the opportunity to express their ideas about the structure of ecology as a science and to focus on global and regional issues. It is evident that many of the questions posed by the classics of ecology are limited by the scope of the publications, which sometimes prevents their full consideration. Different authors have focused their studies on various aspects of ecology, such as the dynamics of environmental factors, the interaction of biocenoses, solving environmental pollution problems, and analyzing global biosphere processes (Linder et al., 2022). This diversity of approaches and topics, on the one hand, made the study of ecology a challenging task for students but, on the other hand, provided an opportunity for specialists from different fields to pay attention to solving specific environmental issues in their areas. The authors of textbooks and educational programs were unanimous in considering the major theoretical aspects of general ecology, such as the characterization of environmental factors and the dynamics of populations and ecological systems or biocenoses. Ensuring the accessibility and quality of environmentally oriented higher education is becoming an urgent task since solving environmental problems directly affects the future of our planet (Hawke and Spanning, 2022). Educated and conscious graduates of higher educational institutions can influence the decision-making of society, governments and businesses, contributing to sustainable development and nature conservation (Mónus, 2022). According to Mr. Karsen, “It is our duty to educate the next generation to take care of nature and preserve it since the future of our planet depends on it”.

In this context, it is important to explore ways to ensure quality environmental education. Our research is focused on analyzing possible ways to create favorable conditions for the development of environmental education at all levels of the educational system. The aim is to contribute to the formation of a more sustainable and conscious society that is ready to respond effectively to current environmental challenges. It is equally important to take into account that students entering higher educational institutions already have basic environmental knowledge and personal experience. Therefore, it is critical to highlight how students may use their newly gained information in the real world and how the curriculum relates to the particular field they are studying.

2. Literature Review

The concept of eco-consciousness reflects social, natural and specific ecological laws that determine the functioning of the “society-nature” system (Rawtani et al., 2022). In the modern era, the subject of eco-consciousness implies the interconnections and relations between the environment and society, which are implemented in social relations related to the activity of the “society-nature” system. The Conference on Education and Development in Rio de Janeiro in 1992 identified the need to rethink the role of education in the context of sustainable development. Agenda 21 is a global action plan to support sustainability and social development, with a focus on empowerment, including education (Xavier et al., 2019). According to this approach, education is crucial for environmental protection and sustainable development (Linder et al., 2022). The modern idea of higher education emphasizes the importance of the environmental training of students and takes into account national experience and international practices in this area. In the context of growing environmental problems and threats to the environment, the development of environmental education is becoming increasingly important. Graduates of higher educational institutions play a key role in solving these problems. Thus, researching and comparing the approaches of different countries and universities to the implementation of environmental training in the educational process becomes an important task (Nguyen et al., 2022). The Ukraine is also actively developing its environmental education. Higher educational institutions include courses on ecology and sustainable development in their curricula. In addition, there are specialized faculties and programs aimed at studying ecology and natural science. The cooperation of universities with nongovernmental organizations and research centers also ensures that studies are conducted in the field of ecology.

One of the directions of developing environmental education in Ukraine is the ecologization of education, which involves the inclusion of environmental aspects at all levels of education. This may include the introduction of mandatory courses on ecology and the integration of environmental aspects into the curricula of various subjects (Zacher et al., 2023). In addition, an important element of environmental education is fostering a more responsible attitude toward resources. Universities can implement practices aimed at the rational use of energy, water and other resources (Pisová, 2023). Another perspective is the humanization of education, which aims to develop students’ civic and environmental values. This includes teaching responsible consumption, respect for natural resources, and understanding of social and environmental challenges in the modern world (Mónus, 2022). Many Ukrainian universities initiate and actively consider environmental issues to be an

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important component of their activities. For instance, the National University “Kyiv-Mohyla Academy” is recognized for its extensive efforts in the field of ecology and environmental issues aimed at supporting sustainable development. Moreover, Ivan Franko National University of Lviv is actively working on sustainability projects and green technologies, participating in local environmental initiatives (Moustairas et al., 2022). Nevertheless, despite these positive examples, many other Ukrainian universities have not yet paid due attention to environmentally oriented higher education and its promotion. An important part of developing students’ environmental awareness is their active participation in green initiatives and projects on campuses (Ricoy et al., 2022). Some universities have already established student green clubs where students can join forces to carry out various projects, from sorting garbage to organizing environmental events (Al-Mulla et al., 2022; Bayev et al., 2022).

At the same time, to effectively engage more participants, such initiatives should be scaled up and supported by universities. Partnerships between universities and public organizations, research centers, and enterprises specializing in environmental issues can be effective tools for sharing knowledge and resources (Han, et al., 2022). The introduction of legislative and regulatory measures is another important step toward environmentally oriented higher education since this will oblige higher educational institutions to include environmental aspects in their curricula and support sustainable development on campuses (Piscitelli et al., 2022). The German Higher Education Sustainability Act, which sets important standards for promoting sustainability in educational institutions, is an example. In Canada, many provinces are taking steps to introduce environmentally oriented education in higher educational institutions (Hawke & Spannring, 2022). For instance, the province of British Columbia has established requirements for integrating sustainability and environmental issues into the curriculum.

The accreditation of educational institutions plays an important role in ensuring the quality of educational education (Sabbir, 2022). Accreditation agencies should set standards for this area and comply with them. These standards include the minimum requirements for the presence of environmental education in educational programs and methods of teaching. Higher educational institutions that do not meet these standards may fail to be accredited. These agencies also actively support the development of environmental education and monitor higher educational institutions to ensure their compliance with standards (Obrecht et al., 2022; Artyushok et al., 2023).

One example is the National Higher Learning Commission (HLC), which sets standards for higher educational institutions in the central and western states of the United States. One of the criteria for obtaining accreditation from HLC is “environmental sustainability”, which involves the integration of environmental aspects into the educational programs and activities of higher educational institutions.

In the context of the ecologization of higher education, it is important for universities to cooperate with nongovernmental organizations, establish effective legislation, develop accreditation standards, and actively engage students in green initiatives (Iwasaki, 2022). These activities contribute not only to improving the quality of environmental education but also to the formation of environmentally aware professionals and citizens capable of promoting the sustainable and ecological development of society.

The authors of the article (Husamah et al., 2022) emphasize the importance of promoting sustainable development through education, taking into account the interconnection between economic, social and environmental dimensions. In particular, it considers the possibility of introducing the principles of sustainable development into curricula and pedagogical practices.

3. The Research Methods

The survey involved 453 respondents, who were students of Ukrainian higher educational institutions with 3-4 accreditation levels. The survey was conducted in Ukraine, which ensured the uniformity of the measurement tools and the participants’ convenience. The average age of the survey participants was 20 years. Approximately 66.2% (300 respondents) were males. The majority of respondents (69.6%) were studying for a bachelor’s degree, 30% were studying for a master’s degree, and 1.4% were studying for a doctoral degree. (PhD), respectively. (Resource and Analysis Center "Society and Environment", 2023).

The methodological basis of our research was the Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis procedure, which was adapted for a comprehensive assessment of environmental education in Ukraine (Boeve-de Pauw, 2019). This SWOT analysis involves four main stages:

An overview of internal and external factors: The key aspects of environmental education in Ukraine are analyzed, taking into account both internal and external factors that may influence its development. This helps determine the strengths and weaknesses of the internal system and identify opportunities and threats from the external environment.

Formation of a list of ranked factors: After reviewing the factors, a list is generated, ranked by the level of importance. This stage makes it possible to identify the main aspects that should be considered when developing strategies to improve environmental education. SWOT analysis for environmental education in Ukraine is applied in the context of studying environmental competencies.

Strengths: Increasing interest: Public interest in environmental issues in Ukraine is high, which may contribute to the popularity of environmental education.

Educational programs: Higher educational institutions include courses on ecology and sustainable development in their curricula, which creates a basis for the development of this field.

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Weaknesses: Funding: Insufficient funding can limit opportunities to develop environmental education and introduce modern methods and technologies.

Unequal level of access: Unequal access to quality environmental education in different regions of Ukraine can lead to disparities in understanding environmental issues among the population.

Opportunities: International cooperation: The possibility of cooperation with international organizations and universities makes it possible to exchange experiences and implement best practices in the field of environmental education.

Growing public awareness: Public interest in environmental issues creates fertile ground for increasing the popularity of environmental education.

Threats: Environmental issues: The threat of environmental problems and crises can generate a justifiable increase in interest but also put pressure on the system of environmental education.

Instability of the education system: Periodic changes in the education system and insufficient attention to environmental issues in educational programs can be obstacles to the development of environmental education.

This SWOT analysis enables the identification of potential opportunities and challenges for developing environmental education in Ukraine and highlights strengths and weaknesses that should be taken into account when developing strategies and programs.

The SWOT analysis matrix was used to determine the relationships between the identified internal and external factors. This helps highlight opportunities for maximizing strengths and strategies for minimizing the impact of weaknesses on the overall state of environmental education. The last stage includes a detailed analysis of the combinations of factors in each sector of the SWOT analysis and in the entire matrix. This makes it possible to identify the most promising strategies for improving environmental education in Ukraine and for effectively using opportunities and resources.

Environmental education was measured using a Likert scale. The Likert scale is a sociological measurement tool used to assess attitudes, beliefs, approval or disapproval of specific statements or topics. It can be applied to measure various aspects of environmental education, perceptions, attitudes and behaviors of students.

Initially, statements were made that reflect aspects of environmental education. A scale was created for each statement where the respondent could choose his level of agreement or disagreement from 1 to 5. 1 means ‘strongly disagree’, and 5 means ‘strongly agree’.

Questionnaire survey: Respondents were given a questionnaire where they had to express their opinions on each statement by choosing the corresponding indicator on the scale.

Analysis of the results: After the data were collected, the responses were analyzed. Statistical parameters were calculated for the answers received.

Interpretation: The results made it possible to evaluate the level of environmental education, perception, attitudes and behavior among students. The use of the Likert scale makes it possible to quantify environmental beliefs and preferences, providing a comfortable and objective way to analyze them.

Correlation and multivariate cluster analyses were used to determine the quality of environmental education, identify its impact on students’ behavior and commitment, and process the collected data. The dataset was subjected to analysis by means of independent t tests, and hypotheses were determined by means of statistical analysis in Statistica 7.1 and Microsoft Excel (Nahursky et al., 2022).

Statistica 7.1 and Microsoft Excel software were used to verify the hypotheses and establish the statistical relationships and correlations between different variables. This approach made it possible to systematically determine the impact of environmental education on students’ preferences, attitudes and commitments, as well as to identify possible trends in their behavior in the context of environmental issues.

4. Results

The results of the conducted study on environmental awareness and respondents’ attitudes toward environmental issues among 453 participants, students of Ukrainian higher educational institutions, made it possible to determine the level of their awareness and practical actions in the field of environmental protection. Using the database of respondents’ answers, the software solution presented the following results, as shown in Table 1.

Table 1 presents a SWOT analysis of environmental education in Ukraine. It examines the internal and external factors influencing environmental education and identifies strategies to utilize strengths, confront threats, address weaknesses, and seize opportunities. Based on the analysis, it is important to use the strengths of environmental education to implement favorable opportunities (“SO”), improve strategies to resist external factors (“ST”), solve problems using external opportunities (“WO”), and avoid the development of negative situations (“WT”).

The results presented in Figure 1 clearly indicate that the Ukrainian population has the greatest environmental value. A significant majority of respondents (over 90%) prioritized environmental protection, which indicates a high level of personal interest in environmental issues. It should be emphasized that Ukrainians experience a significant impact of environmental factors on the quality of their lives, and environmental issues directly affect their daily existence. Almost 90% of respondents...
believe that they can personally contribute to nature conservation, which indicates a belief in their own ability to influence the state of the environment. It should also be noted that the majority of respondents believe that society as a whole should pay more attention and resources to environmental protection. This demonstrates the willingness of citizens to take an active part in environmental initiatives and demand more effective measures to preserve nature (Figure 1).

Table 1 Matrix of SWOT analysis for environmental education in Ukraine.

<table>
<thead>
<tr>
<th>Opportunities (O)</th>
<th>Threats (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengths (S)</td>
<td>“SO” – Favorable strategies of the combination of factors that use the strengths of environmental education in Ukraine to implement favorable opportunities. They are aimed at strengthening the positive aspects of environmental education and development.</td>
</tr>
<tr>
<td>“ST” – Strategies of resistance</td>
<td>Strategies that allow environmental education to withstand external factors that may pose a threat. The goal is to support sustainability and respond to challenges.</td>
</tr>
<tr>
<td>Weaknesses (W)</td>
<td>“WO” – Strategies for solving problems. Combinations of factors that show directions for solving existing problems in the field of environmental education in Ukraine, using external opportunities to improve the situation.</td>
</tr>
<tr>
<td>“WT” – Ways of developing a negative situation</td>
<td>Combinations of factors characterizing environmental problems that may be aggravated by external circumstances. They determine the directions of development of the negative situation in the field of environmental education in Ukraine.</td>
</tr>
</tbody>
</table>

Source: Gal (2023)

Over the past six months, the respondents have been actively engaged in various environmental protection initiatives, including participating in clean-up campaigns, advocating for sustainable practices, and implementing recycling programs within their communities or organizations (Figure 2).

Figure 2 shows the respondents’ actions in the last 6 months in the sphere of environmental protection. The number of respondents who selected each specific action is as follows:

- Difficult to answer: 14 persons;
- None of the above: 45 persons;
- Reduced energy consumption: 195 persons;
- Most of the waste sold for disposal: 163 people;
- I chose a more environmentally friendly mode of transportation: 131 persons.
- Avoiding the purchase of single-use plastic products, except for bags: 131 people;
- Reduced household water consumption: 104 persons;
- I bought goods from local producers: 91 persons;
- I avoided buying products with excessive packaging: 82 persons;

Figure 1 Respondents’ activities in the last 6 months in the sphere of environmental protection. 
Source: Resource and Analysis Center "Society and Environment" (2023)
− I bought products with eco-labeling: 59 persons;
− Used the car less: 36 persons.

These data show the distribution of measures taken by respondents to reduce their environmental impact and support sustainable consumption. It also provides information on the level of responsibility and participation of respondents in environmental protection in relation to different actions. Over the past six months, 43% of the population of Ukraine has shown a high level of environmental awareness and responsibility. In particular, they reduced energy consumption, sorted garbage for recycling, chose environmentally friendly transportation, and avoided buying disposable plastic products. Moreover, 23% of respondents reduced their household water consumption (Mulska et al., 2022). Nevertheless, it is worth noting that one in ten respondents had not been involved in environmental protection activities over the past six months. Some indicators, such as the use of single-use plastic bags, remain high, with 48.2% of the population not reducing their use. In addition, respondents are not very unanimous in their opinion on buying locally produced or eco-labeled goods.

A statistical evaluation of the data on respondents’ environmental viewpoints was also conducted (Table 2).

Table 2 Descriptive Statistics.

<table>
<thead>
<tr>
<th>The environmental standpoint of respondents</th>
<th>Designation</th>
<th>Valid N</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Std.Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The population is approaching the breaking point.</td>
<td>Var1</td>
<td>15</td>
<td>0.469190</td>
<td>0.053164</td>
<td>0.905852</td>
<td>0.263290</td>
</tr>
<tr>
<td>People can change the natural environment based on their needs.</td>
<td>Var2</td>
<td>15</td>
<td>0.559233</td>
<td>0.120104</td>
<td>0.921379</td>
<td>0.265694</td>
</tr>
<tr>
<td>People’s interference in nature often has catastrophic consequences.</td>
<td>Var3</td>
<td>15</td>
<td>0.440907</td>
<td>0.004986</td>
<td>0.931310</td>
<td>0.306540</td>
</tr>
<tr>
<td>Human ingenuity must prevent destructive impacts on the earth.</td>
<td>Var4</td>
<td>15</td>
<td>0.454734</td>
<td>0.045167</td>
<td>0.916991</td>
<td>0.294312</td>
</tr>
<tr>
<td>People are seriously misusing the environment.</td>
<td>Var5</td>
<td>15</td>
<td>0.464671</td>
<td>0.042033</td>
<td>0.927208</td>
<td>0.292507</td>
</tr>
<tr>
<td>The earth has many natural resources that can be explored and utilized.</td>
<td>Var6</td>
<td>15</td>
<td>0.260237</td>
<td>0.000578</td>
<td>0.669432</td>
<td>0.210419</td>
</tr>
<tr>
<td>Flora and fauna have the right to exist, just like humans.</td>
<td>Var7</td>
<td>15</td>
<td>0.511750</td>
<td>0.108278</td>
<td>0.989449</td>
<td>0.326493</td>
</tr>
<tr>
<td>The natural balance can cope with the influence of industrialized countries.</td>
<td>Var8</td>
<td>15</td>
<td>0.377717</td>
<td>0.025486</td>
<td>0.849109</td>
<td>0.274189</td>
</tr>
<tr>
<td>Even with our ingenuity, people obey the laws of nature.</td>
<td>Var9</td>
<td>15</td>
<td>0.552528</td>
<td>0.209614</td>
<td>0.960613</td>
<td>0.245095</td>
</tr>
<tr>
<td>The “environmental crisis” may be exaggerated.</td>
<td>Var10</td>
<td>15</td>
<td>0.477804</td>
<td>0.007201</td>
<td>0.898732</td>
<td>0.281082</td>
</tr>
<tr>
<td>The earth is like a spaceship with limited resources.</td>
<td>Var11</td>
<td>15</td>
<td>0.552755</td>
<td>0.049831</td>
<td>0.977259</td>
<td>0.299820</td>
</tr>
<tr>
<td>Dominance over nature has its limits.</td>
<td>Var12</td>
<td>15</td>
<td>0.449814</td>
<td>0.043014</td>
<td>0.964396</td>
<td>0.352942</td>
</tr>
<tr>
<td>It is easy to disrupt the natural balance.</td>
<td>Var13</td>
<td>15</td>
<td>0.440024</td>
<td>0.006065</td>
<td>0.976084</td>
<td>0.287800</td>
</tr>
<tr>
<td>People will eventually learn to control nature.</td>
<td>Var14</td>
<td>15</td>
<td>0.455904</td>
<td>0.074511</td>
<td>0.844618</td>
<td>0.257914</td>
</tr>
<tr>
<td>If the situation does not change, a serious environmental disaster is expected.</td>
<td>Var15</td>
<td>15</td>
<td>0.595765</td>
<td>0.011798</td>
<td>0.992443</td>
<td>0.336990</td>
</tr>
</tbody>
</table>

Figure 2 Respondents’ activities in the last 6 months in the field of environmental protection.

Source: Resource and Analysis Center “Society and Environment” (2023)
Valid N (number of valid responses): Number of respondents who participated in answering a specific statement.
Mean (average value): The average of the respondents’ answers to a particular statement, indicating the overall attitude of the group.
Minimum (minimum value): The lowest value among the respondents’ answers.
Maximum (maximum value): The maximum value among the respondents’ answers.
Std. Dev (standard deviation): The standard deviation indicates the distribution of responses around the mean value.

Table 2 shows the analysis of environmental awareness among respondents using descriptive statistics. The survey includes 15 statements that assess attitudes toward environmental issues. The results show that respondents demonstrate certain environmental awareness, although diversity in their responses is observed. Some aspects, such as the impact of humans on nature and the rights of flora and fauna, are viewed more positively, while others, such as the exaggeration of the environmental crisis, may be controversial among respondents. The results also indicate a high level of awareness of a possible environmental disaster. This research provides an important contribution to understanding the population’s environmental attitudes and can be useful for developing effective environmental initiatives and educational programs (Figure 3).

**Figure 3** The results of multivariate cluster analysis of respondents’ environmental awareness.

Based on the results of the cluster analysis, it is possible to draw conclusions about groups of respondents with similar beliefs or views on environmental issues. Distance values indicate the degree of difference between the groups. Based on the values obtained, it can be stated that the respondents show certain environmental awareness and understanding of environmental problems. Nevertheless, the answers are diverse, indicating different levels of awareness and attitudes toward certain aspects of the environment.

5. Discussion

Higher education has significant potential to interact with various external and internal stakeholders in solving environmental issues. Universities can have a positive impact on sustainable support by collaborating with training institutions and research centers and using their infrastructure and expertise (Verytelnyk, 2019). They can play a key role in supporting and disseminating environmental education, teaching people about the environment and contributing to the development of a green society (Henderson & Loreau, 2023). In general, universities play a crucial role in sustainable development. The development and application of environmental education methods are influenced by both the environment and education because of their interdependence within the framework of sustainable development (Hadjichambis & Hadjichambi, 2022). It is important for environmental education to be adapted and aligned with new environmental, political, economic and cultural realities (Izhar & Nugraha, 2022; Tymoshenko et al., 2022). This approach will make it possible to take into account current challenges and influence the formation of environmental awareness in modern society. Several key factors can be identified when considering students’ attitudes and behaviors toward the environment, namely, the importance of the environment to them, the level of outrage or concern about environmental issues, the influence of the cultural environment, active
participation and volunteerism, the level of attention to environmental issues, and attitudes toward recycling (Saqib, et al., 2023).

Support for sustainable development can be implemented through a variety of approaches, such as environmental education through lectures and the transfer of good practices; hands-on environmental education such as travel, tree planting, and water purification; and environmental education including learning about marine biodiversity, storm impacts, and climate change (Nwanaji-Enwerem, et al., 2022). The higher educational institution, in this case, should ensure that all aspects of the educational process are coordinated and provide a proper balance of information. In addition, it is essential for a higher educational institution to promote students’ awareness of national and global environmental issues and to provide them with the knowledge and skills to understand and prevent actions that may harm the environment (Gal, 2023).

Figure 4 represents a diagram of the links of environmental education, from which the following main directions are highlighted:

- Environmental education in the environment
- Environmental education for the environment
- Environmental education about the environment
- Environmental education for the environment

![Figure 4 Environmental Education: Summary Diagram.](Source: Hadjichambis & Hadjichambi (2022)]

5.1. Environmental education in the environment

Educational institutions should modernize their curricula, introducing a new approach to education that will promote students’ interest in environmental education. This approach includes utilizing talent and laboratories, as well as developing skills through hands-on training in the natural environment. For instance, the study of plants and the impact of seasons on attitudes toward the environment and social behavior can be part of this educational process (Dandawate et al., 2022).

Practical initiatives, such as cleaning up parks and rivers, recycling garbage from tourist routes and conducting practical classes in nature, including visits to factories, can play an important role in shaping environmental awareness (Boeve-de Pauw, 2019). Creativity can serve as a tool for transforming waste into a work of art, whether it is fashion, painting or architectural design. This approach can significantly enrich the learning process and increase the effectiveness of environmental education.

5.2. Environmental education for the environment

Such education involves promoting the active participation of students in higher educational institutions that are considered key actors and supporters of environmental education. It encourages new citizens to take action, which is of particular importance. Encouraging students to create and take care of their own internal environment, such as a university campus, is
relevant since most of their time is spent in this learning environment. It becomes their main space for learning. It is important to encourage students to use energy from renewable sources, such as solar and wind energy, and to take care of the environmental aspects of their actions. The creation of green areas and initiatives aimed at using environmentally friendly technologies and natural resources can serve as an example for preserving nature and creating a sustainable environment (Sydorchuk et al., 2014).

5.3. Environmental education about the environment

In-depth discussions are aimed at clarifying, criticizing and comparing facts and views aimed at interacting with nature and the environment. The training covers the consideration of specific situations and decisions aimed at protecting and preserving the environment for future generations.

It is also important to consider the presentation of case studies and information materials about disasters and the measures taken to prevent them. The creation of online groups and volunteer initiatives between universities allows for interaction on the scale of solving environmental problems. In addition, cross-cultural assessment facilitates the analysis of environmental issues in different cultures and contributes to the development of international strategies to address them.

5.4. Environmental education for the environment

Environmental education for students promotes the development of their consciousness and active participation in solving environmental issues. Students can freely express their opinions, respond to environmental issues in everyday life and participate in critical situations.

The use of online platforms is an important aspect of this process. Creating a virtual environment allows students to identify solutions, model environmental scenarios, and develop ethics and efficiency in environmental settings.

This particular research was conducted at one university; therefore, its results cannot be generalized. At the same time, they provide a basis for future studies and the development of environmental education.

Given the limitations of the region and the specific university, this research opens up opportunities for future studies in other regions and universities. Comparing students’ perceptions, attitudes and environmental behaviors can lead to surprising conclusions (Arabadzhyiev et al., 2020).

Additional training on environmental education can help rethink and redesign cultural factors that influence environmental decisions. It can also facilitate the transfer of best practices and outcomes of environmental education by promoting studies and addressing widely held themes and cultural norms with positive impacts on nature. Explorations in the fields of environmental science and intercultural studies can help to solve contemporary society’s environmental issues by identifying practical approaches to sustainable development.

6. Conclusions

The present academic paper analyses the significance of education as an important tool in shaping environmentally conscious citizenship and promoting sustainable development. The role of education in public awareness of environmental problems has been emphasized. The level of environmental awareness and actions of citizens have been studied. The influence of education on the formation of the environmental values, skills and abilities necessary for making responsible decisions in the field of ecology has been considered. Education is a key factor in the development of environmental literacy and the active participation of citizens in solving environmental issues. The results of the survey on environmental protection were analyzed. The study, which involved 453 students from Ukrainian higher education institutions, confirmed that academic education promotes the active participation of students in activities aimed at environmental protection. Although the respondents appear to have some understanding of environmental issues, there are still areas that require improvement. In particular, initiatives to avoid the use of single-use plastic products and support environmentally friendly vehicles are needed; however, there are shortcomings in the selection of local producers and the use of eco-labeled products. This indicates the need for ongoing education and dissemination of environmental values among citizens. The results show that students are interested in environmental initiatives and innovative solutions in the field of green energy. Some innovative approaches and methods that can improve students’ environmental literacy were also highlighted. Quantitative analysis revealed no statistically significant difference in the level of awareness of the importance of environmental education among different faculties. Correlation and multivariate cluster analyses confirmed the existence of a positive relationship between the variables of students’ perceptions, attitudes and behaviors toward environmental issues. The information provided can serve as an important contribution to improving environmental education and developing a sustainable lifestyle among the student community.

Ethical considerations

Not applicable.

Conflict of interest
The authors declare no conflicts of interest.

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**References**


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