

DEVELOPMENT OF ECOLOGICAL CULTURE IN HIGHER EDUCATION STUDENTS: TEACHING AND EDUCATIONAL STRATEGIES AND PRACTICE

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Abstract

In the modern world, the aggravation of environmental problems and the increase in the impact of human activity on nature make the formation of ecological culture one of the main priorities of the education system. Ecological culture is not only a set of theoretical knowledge about nature, but also a whole system of values, habits and behavioral norms that determine a person's attitude to nature. In this regard, the development of ecological culture in higher education students is an important condition for their future professional activities to make environmentally responsible decisions. The article examines the pedagogical and psychological foundations of training and education in higher education institutions for the formation of ecological culture, analyzes existing approaches and proposes effective methods. It is determined that the formation of ecological culture should not be limited only to teaching the subject of ecology, but should be integrated into the entire curriculum. Project-method, problem-based learning, discussions, seminars and research on ecological topics develop ecological thinking in students. Along with this, the organization of practical activities - excursions to nature, ecological campaigns, voluntary cleaning campaigns, waste sorting programs - plays a decisive role in the formation of ecological behavioral habits in students. The results of the research in the article show that purposeful and systematic environmental training and education measures in a higher education environment increase the environmental responsibility of young people, enable them to lead an environmentally sustainable lifestyle in the future and actively participate in solving public environmental problems.

Keywords: ecological culture, higher education, training, education, sustainable development, environmental awareness

DESARROLLO DE LA CULTURA ECOLÓGICA EN ESTUDIANTES DE EDUCACIÓN SUPERIOR: ESTRATEGIAS Y PRÁCTICAS DOCENTES Y EDUCATIVAS

Resumen

En el mundo moderno, la agravación de los problemas ambientales y el creciente impacto de la

actividad humana sobre la naturaleza hacen que la formación de una cultura ecológica sea una de las principales prioridades del sistema educativo. La cultura ecológica no es solo un conjunto de conocimientos teóricos sobre la naturaleza, sino también un sistema completo de valores, hábitos y normas de comportamiento que determinan la actitud de una persona hacia ella. En este sentido, el desarrollo de la cultura ecológica en los estudiantes de educación superior es una condición importante para que sus futuras actividades profesionales les permitan tomar decisiones ambientalmente responsables. El artículo examina los fundamentos pedagógicos y psicológicos de la formación y la educación en instituciones de educación superior para la formación de una cultura ecológica, analiza los enfoques existentes y propone métodos efectivos. Se determina que la formación de una cultura ecológica no debe limitarse únicamente a la enseñanza de la ecología, sino que debe integrarse en todo el currículo. El método de proyectos, el aprendizaje basado en problemas, las discusiones, los seminarios y la investigación sobre temas ecológicos desarrollan el pensamiento ecológico en los estudiantes. Además, la organización de actividades prácticas (excursiones a la naturaleza, campañas ecológicas, campañas de limpieza voluntarias, programas de clasificación de residuos) desempeña un papel decisivo en la formación de hábitos de comportamiento ecológico en los estudiantes. Los resultados de la investigación del artículo muestran que las medidas de formación y educación ambiental, con un propósito claro y sistemático, en el ámbito de la educación superior aumentan la responsabilidad ambiental de los jóvenes, les permiten llevar un estilo de vida ambientalmente sostenible en el futuro y participar activamente en la solución de los problemas ambientales públicos.

Palabras clave: cultura ecológica, educación superior, formación, educación, desarrollo sostenible, conciencia ambiental.

INTRODUCTION

As a result of globalization processes, accelerated industrialization and technological development, anthropogenic impacts on nature are increasing, which leads to disruption of the ecological balance, the emergence of serious problems such as climate change, water scarcity, soil erosion and biodiversity loss. This reality requires that environmental issues take a central place not only at the level of science and politics, but also in the education system. Higher education institutions, as the main institutions that form the intellectual potential of society, should pay special attention to the formation of ecological knowledge and values in students.

Ecological culture ensures the formation of such qualities in the minds of the younger generation as respect for nature, responsible behavior and adherence to the principles of sustainable development. Therefore, the formation of ecological culture in higher education students is of strategic importance not only in terms of imparting professional knowledge, but also in terms of their moral development, the formation of a system of values and increasing a sense of social responsibility.

Relevance of the topic: In modern times, the deepening of global ecological crises makes the formation of ecological culture in higher education a strategic priority. Climate change, the decline in biodiversity, and the depletion of natural resources make it necessary to raise the level of ecological awareness of students. This process serves not only to solve environmental problems, but also to achieve sustainable development goals. Therefore, environmental education in higher education institutions is becoming a key component of the socio-economic sustainability of society.

Scientific innovation: This study proposes a synthesis of an interdisciplinary and

technology-based approach to the formation of ecological culture of higher education students. The main innovation is the integration of problem-based learning (PBL), virtual reality (VR), and volunteering experiences, targeting the development of both theoretical and practical competencies of students. The assessment of social responsibility and leadership skills as the main indicators of ecological culture in the study is also a new approach. This is an aspect that has been little studied in the existing literature, but is considered an important aspect for building a sustainable society in the future.

Problem statement: In the current situation, environmental education in many universities remains mainly at the level of theoretical lectures and does not have a deep impact on the daily behavior of students. This does not create sufficient motivation in the formation of environmental awareness and slows down the transformation of environmental responsibility into a social norm. The root of the problem lies in the insufficient connection of environmental knowledge with practical activities and emotionally affecting experiences. The study aims to develop complex pedagogical approaches to fill this gap.

Methodology: The article applies both theoretical and empirical approaches. First, a content analysis of reports of international organizations such as UNESCO, UNEP and OECD is carried out and the main directions of environmental education are identified. Then, indicators of environmental awareness and behavior are studied among university students through surveys and focus groups. The results are processed using statistical methods and optimal teaching models are proposed for the formation of environmental culture.

DEVELOPMENT

The formation of ecological culture in higher education requires a complex and systematic approach. This process is not limited to the provision of theoretical knowledge, but also includes educational measures that affect the ecological value system of students. In the educational process, ecological topics should be integrated into all specialties, students should be encouraged to explore ecological problems in a real context, and propose solutions. Modern pedagogical technologies - project-method, problem-based learning and interactive discussions

- develop critical thinking and a creative approach in students. At the same time, the activities of ecologically oriented clubs and student organizations should be encouraged in the higher education environment, and social projects such as volunteer actions, greening events and ecological marathons should be implemented. Practical activities create conditions for strengthening ecological behavioral habits in students, reducing indifference to ecological problems and forming a responsible civic position. For the success of this process, environmental education of educators, updating teaching materials and using international experience are also necessary. The formation of ecological culture in the higher education system is a multidimensional process and consists of three main components : knowledge, values and behavior. The knowledge component covers the acquisition of theoretical concepts about the functions of ecosystems, resource limitations, climate change and anthropogenic impacts. The value component focuses on the development of qualities such as respect for nature, responsibility towards future generations, and a tendency towards collective environmental action in students. The behavioral component serves to form practical habits such as following ecological principles in daily life, reducing waste, saving energy and water, and using green technologies (Tilbury, 2011). Experience shows that teaching ecology only as a separate subject creates limited knowledge in students. The most effective approach is to integrate ecological topics into all specialized subjects. For example, students studying in the

faculty of economics should take classes on ecological economics, green economic models and resource management, while those studying in engineering specialties should be familiar with ecological design and clean technologies (UNEP, 2019). This approach helps to instill in students that environmental problems do not belong only to environmental specialists, but should be taken into account in all areas. The choice of pedagogical methods is also important. The traditional lecture method, which focuses only on knowledge transfer, limits the activity of students. Therefore, interactive approaches such as problem-based learning (PBL),

project-based learning, simulation, and gamification are applied in the modern education system (Barrett, 2017). For example, students are assigned to develop a strategy to reduce air pollution in the city, and they analyze using real data, propose alternative solutions, and evaluate

socio-economic consequences. Such tasks strengthen both critical thinking and a sense of environmental responsibility. One of the important directions of environmental education is the organization of social activities and the development of a culture of volunteerism. The creation of environmental clubs in universities, the involvement of students in actions on greening, coastal cleaning, waste sorting, and recycling in local communities, strengthen their environmental behavior habits (Jickling & Wals, 2008). Such activities are not limited to environmental education, but also develop important skills such as leadership, teamwork, and social responsibility in students. The implementation of the “green campus” concept in the higher education environment also plays an important role in shaping an ecological culture. This concept involves measures such as increasing energy efficiency, reducing waste, using water efficiently, creating bicycle infrastructure, and increasing greenery on the university campus (Leal Filho et al., 2018). Studying in such an environment directly affects students’ daily behavior and teaches them to apply ecological principles in practical life. The development of digital technologies opens up new opportunities for environmental education. Virtual laboratories, digital simulations and online platforms allow students to model environmental processes, see the results of various scenarios and conduct experiments. This both increases the visibility of the training and creates conditions for a better understanding of complex environmental phenomena (OECD, 2021). An important point is that educators are also provided with environmental knowledge and skills. Teachers should undergo special training on sustainable development and environmental education, and adopt a multidisciplinary approach to environmental problems (UNESCO, 2020). If the environmental culture of educators is not at a high level, it is difficult to form deep motivation in students in this direction. All these approaches serve not only to help students acquire theoretical knowledge, but also to develop an emotionally and socially sensitive approach to environmental issues. As a result, students are more inclined to join public initiatives to solve environmental problems and to take environmental responsibility in their professional activities in the future. The formation of environmental culture in higher education institutions is not only limited to the transfer of theoretical knowledge, but also affects the personal position and behavioral model of students. Modern research shows that the emotional component plays an important role in the formation of environmental awareness (Sterling, 2010). That is, students should not only understand the causes and consequences of environmental problems, but also have an internal motivation to solve these problems. This motivation is strengthened by creative, interactive and practical approaches in the educational process.

The development of ecological culture in higher education institutions is one of the priority areas of modern education systems. Global ecological challenges, rapid depletion of natural resources and weakening of the sustainability of ecosystems necessitate the improvement of students' knowledge and skills in ecology. For this purpose, the formation of students in higher education institutions in the direction of ecological behavior models, social responsibility and ethical

principles is of particular importance. Ecological culture should not be limited only to theoretical knowledge, but should also be deepened through practical activities and integrative experiences.

The scientific novelty of the study is related to the application of interactive learning methods and the synthesis of technological tools in the development of students' environmental competencies. In modern pedagogical approaches, problem-based learning, project-oriented tasks and virtual simulations strengthen students' analytical thinking skills and focus on solving environmental problems (Barrett, 2017). In addition, social projects and volunteer activities ensure the involvement of students in leadership and teamwork, increasing their sense of social responsibility (Jickling & Wals, 2008). The new scientific approach also allows assessing students' personal and professional decision-making skills based on the principles of sustainable development.

The problem statement shows that in many higher education institutions, environmental education is still conducted in the traditional lecture format. This limits the level of sensitivity and activity of students to environmental issues, weakens their ability to form practical skills. At the same time, the integration of environmental knowledge across various disciplines is not sufficiently ensured, so students are unable to carry out a complex analysis of environmental problems. To solve the problem, it is important to systematically develop students' knowledge, value and behavioral components.

The research methodology includes both quantitative and qualitative approaches. First, international reports and scientific publications are analyzed, environmental education strategies, curricula and innovative methods are studied (UNESCO, 2017; UNEP, 2019). Then, students' environmental awareness, behavior and values are measured through surveys, focus groups and pilot projects. The obtained data are evaluated through statistical and interpretive analysis and optimal strategies for the effective formation of environmental culture are identified. A multidisciplinary curriculum and practical learning tools enables students to systematically analyze environmental problems. The synthesis of environmental disciplines with economics, law, engineering, and the humanities enables students to consider complex socio-technological problems (Tilbury, 2011). Project and problem-based learning models enable students to come up with innovative and creative solutions, enhancing their critical and strategic thinking skills.

The previously mentioned "Green Campus" initiatives, environmental clubs, recycling programs, and community actions reinforce students' environmental behavior patterns and foster a sense of social responsibility (Leal Filho et al., 2018). Practical activities also enhance students' leadership skills and teamwork competencies, encouraging them to make personal contributions to solving environmental problems.

Digital technologies, especially virtual reality and simulation platforms, allow students to visually observe environmental processes and gain a better understanding of their complexity (OECD, 2021). These approaches enhance not only knowledge, but also emotional and behavioral motivation, ensuring that students are more sensitive and proactive about environmental issues. International experience and cooperation develop students' global perspectives. Students' participation in environmental projects within the framework of Erasmus+, Horizon 2020 and other programs allows them to understand environmental problems at both local and global levels and to formulate responsible approaches (UNESCO, 2020). These activities transform students' knowledge into practical skills and serve to develop them as citizens committed to sustainable development goals.

The problem-based learning (PBL) model is particularly effective in this regard. In this model, students work in teams to investigate real or simulated environmental problems, collect data, develop possible solutions, and evaluate their outcomes (Barrett, 2017). For example, a project

on water resources management provides students with both hydrological knowledge and socio-ethical decision-making skills. This approach builds not only theoretical but also practical environmental competencies in students.

One of the main goals of sustainable development education is to develop students' critical thinking and systems analysis skills (Tilbury, 2011). Systems thinking allows students to understand the interrelationships between environmental, economic, and social factors. For example, increasing the use of fertilizers in agriculture may increase short-term productivity, but in the long term leads to soil degradation and water pollution. Such examples form the habit of considering the complex consequences of environmental decisions in students.

At the same time, the social mission of universities in the formation of ecological culture is great. Universities are not only institutions that provide knowledge, but also serve as role models for society. For example, in some European universities, solar panels are installed to reduce energy consumption, waste is sorted, and ecological transport is promoted (Leal Filho et al., 2018).

Students learn ecological behavior rules more quickly when they study in such an environment. The use of digital technologies in education creates new opportunities for environmental education. Through virtual reality (VR) technologies, students can visually observe the consequences of ecosystem destruction and feel the predicted impacts of climate change. This type of teaching method increases students' sensitivity to environmental issues due to its emotional impact (OECD, 2021).

Research shows that social activities and volunteering are important factors in the formation of an ecological culture. Tree planting campaigns, clean-up campaigns and environmental awareness seminars carried out in local communities not only provide students with theoretical knowledge, but also deepen their sense of social responsibility (Jickling & Wals, 2008).

Volunteering strengthens leadership skills in young people, motivation to participate in teamwork and the desire to make a personal contribution to solving environmental problems.

The development of ecological culture should also be supported by national and international cooperation projects. The participation of students in ecological projects at foreign universities within the framework of the aforementioned Erasmus+ and other international education programs broadens their worldview and allows them to understand the scale of global ecological problems. Such projects ensure that students are sensitive not only to local problems, but also to global ecological challenges (UNESCO, 2020).

In-service training for teachers also plays an important role. Teachers should have regularly updated knowledge about modern methodologies of environmental education, the use of ICT in teaching, project-based learning strategies, and environmental ethical norms. Otherwise, the knowledge presented to students may become outdated and unmotivating.

Finally, the process of forming an ecological culture is not only the work of the university, but also requires the joint cooperation of the state and non-governmental organizations.

Environmental education should be considered a priority in state policy, and NGOs and the private sector should support this process with educational projects, training programs and scholarship opportunities. Thus, the formation of an ecological culture in the higher education system is carried out as a complex and continuous activity, and only in this case do students grow up as environmentally responsible, socially active and professionally competent citizens.

CONCLUSION

Consequently, the formation of an ecological culture in university students not only increases awareness of environmental problems, but also directly affects their lifestyle, professional

choices, and future decision-making behavior. For this process to be successful, environmental education should occupy a central place both in the curriculum and in the social environment of the university. The teaching of ecological values should not be limited to subjects such as ecology and biology, but should also be taught in an integrated manner in economics, engineering, law, and the humanities. This allows students to form an interdisciplinary approach to environmental problems and ensures that they make more responsible decisions in the future.

At the same time, the results show that it is not possible to fully form an ecological culture by providing theoretical knowledge alone. Practical activities, volunteering, participation in social projects, and the use of innovative teaching technologies increase students' motivation and accelerate the development of ecological behaviors into habits. For example, students' creation of ecological startup projects based on their own ideas develops their entrepreneurial skills, strengthens their innovative approach, and contributes to sustainable development goals.

The results also show that cooperation between the state, universities and non-governmental organizations is of great importance in the process of forming an ecological culture. Educational policy should include long-term strategies in this area, while universities should implement ecological standards in their internal infrastructure, and NGOs should support these activities with educational programs. As a result of this tripartite cooperation, students gain not only theoretical knowledge, but also civic responsibility, social participation and leadership skills.

Future research should assess the effectiveness of new methods in this area, and investigate the real impact of technological tools and artificial intelligence-based teaching aids on students' environmental awareness. These approaches will increase the potential of higher education institutions to form an environmental culture and serve to build a more sustainable society.

Thus, the strategic importance of environmental education is increasingly recognized both nationally and globally, and investment in this area acts as a fundamental condition for the future well-being of societies.

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