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THEORETICAL SUBSTITUTION OF THE IMPORTANCE OF FORMING ENVIRONMENTAL COMPETENCE OF STUDENTS FOR THE SUSTAINABLE DEVELOPMENT OF ECOLOGICAL SYSTEMS

Abstract
The study carried out a structural and systemic analysis to determine the impact of environmental problems of modern Ukraine on the formation of students' environmental competence, high school students' in particular. The author analyses the works of environmental researchers and identifies the following types of environmental problems: the impact of the "noise of war" on ecosystems, the global problem of demining through the Ukrainian vector, the potential danger to the environment and the population from petrochemical pollution of the geological environment as a result of hostilities, environmental threats to the objects of nature reserves of Ukraine in the wartime period, etc. A number of important factors that influence motivation and involvement of high school students in activities to overcome the environmental consequences of war are identified: awareness of the environmental risks of war, understanding of the relationship between war and environmental problems, civic engagement and participation in environmental initiatives, development of problem-solving skills, integration of environmental topics into curricula, technological and digital support, motivation to act, development of critical thinking,

preparation for crisis situations, ethical values and preparation for future responsibility.

Keywords: *environmental issues, sustainable development, overcoming the environmental consequences of war.*

Introduction

The role of environmental issues in the world is extremely important and has far-reaching consequences for people, ecosystems and the natural environment in general. Today, the world's main environmental problems are actualised: preservation of biodiversity (destruction of natural environments, pollution of water bodies, loss of habitats for animals and plants, and thus threats to biodiversity, species extinction and destruction of ecosystems, which has serious consequences for ecological diversity and environmental sustainability) human health (many environmental problems, such as air and water pollution, deforestation and soil contamination, have a direct impact on human health; polluted environment can cause the development of various diseases, reduce the quality of life and shorten its duration). In addition, climate change due to greenhouse gas emissions, deforestation and air pollution, etc. are also global issues. This can lead to extreme weather conditions, rising sea levels, changes in the distribution of water resources and other serious consequences for ecosystems and human life. Environmental problems often cause significant economic losses. The destruction of natural resources, the loss of jobs in natural resource-dependent sectors of the economy, and the costs of dealing with the consequences of environmental disasters all have a negative impact on the economy of a country and the world as a whole.

The above-mentioned environmental issues play an important role in the world, affecting biodiversity, human health, climate change and the economy. Addressing these issues requires joint efforts of national and international communities.

The war in today's Ukraine has a negative impact on wildlife due to various factors, such as ammunition explosions, chemical pollution, construction of fortifications, fires, mining, and others.

Materials and Methods

The research presents the results of the search for the development of environmental competence to overcome the environmental consequences of war, ensure sustainable environmental safety in the future; create new generation environmental programmes and action plans for the restoration of territories affected by hostilities. The following methods were used in the course of the study: theoretical: theoretical analysis and synthesis of literary sources; comparison, generalisation; deductive, inductive; systematic, formalisation; idealisation; empirical: pedagogical observation, generalisation of pedagogical experience.

Results and Discussion

A number of Ukrainian scholars have conducted in-depth research on identification and characterisation of the above-mentioned environmental problems. The following areas have been developed: the impact of the "noise of war" on ecosystems (Bezsonov, 2022), the Concept of creating an intelligent information system to support decision-making in the field of environmental safety (Bondar, Mashkov, Prysyazhnyi, Ovodenko, Pechenyi, 2023), the impact of the full-scale aggression of the Russian Federation against Ukraine on the activities of environmental NGOs in Ukraine (Buhaichuk, 2022). The author analyses the global problem of demining through the Ukrainian vector (Horbulin, 2022), the potential danger to the environment and the population from petrochemical pollution of the geological environment as a result of hostilities (Dinyak, Koshlyakova, 2023), and environmental threats to the objects of the Ukrainian protected areas in the wartime period (Roman, 2022). Reflections on how the war affects our environment through the characterisation of Russian crimes on Ukrainian soil (Litvinova, 2023), analysis of the environmental and economic consequences of Russia's war against Ukraine (Perga, 2023; Sak, Bilyo, Tkachuk, 2022). In the context of Ukraine's current losses, studies assessing the impact of hostilities on the state of nature reserves and their biodiversity are urgent (Spryahailo, Bezsmertna, Havryliuk, Iliukha, Osypenko, Spryahailo, Shevchyk, 2023).

A number of Ukrainian scholars have carried out in-depth studies on the identification and characterisation of environmental problems

and have sought to assess the impact of military operations on the state of the nature reserve fund of Ukraine, which has raised the issue of preventing environmental pollution during the war in Ukraine and overcoming the environmental consequences of the war. This, in turn, draws attention to the issue of the readiness of public authorities and social movements to carry out these activities, which is currently unexplored and insufficiently implemented. In addition, it raises the problem of the focus of the modern educational process on the formation of environmentally literate students as future conscious citizens and residents of territorial communities who are able to use the acquired knowledge in practical activities, in particular in the development of environmental programmes and action plans for the restoration of territories affected by hostilities to overcome the environmental consequences of war.

For example, Y. Bezsonov, studying the impact of the "noise of war" on the ecosystems of Ukraine, argues that the issue of noise impact on the environment associated with the operation of military equipment and the use of firearms is poorly understood. This problem makes it impossible to assess the scale of ecosystem changes caused by Russia's military invasion of Ukraine. Author developed a table for determining the amount of environmental damage for noise pollution of ecological systems by specifying the source of noise pollution (military (human resources), trucks, cars, tanks, aircraft, helicopters, cruise missiles, artillery, armoured personnel carriers, multiple launch rocket systems, navy), the number of units, and damages for "increased noise and disturbance" in thousands of UAH). Based on the calculations, the researcher determined the amount of damage in the amount of UAH 180,816.9 thousand per day (averaged).

Summarising the results of the study, Y. Bezsonov draws the following conclusions:

– after the end of the war, fines for violations of environmental legislation should be increased. Calculations have demonstrated this;

– if it is impossible to assess the negative impact of war noise on animals and plants (by species), the amount of damage should be based on the rates of the "quiet season", supplemented according to the realities;

– for the duration of the war, consider the violation of the "season

of silence" as of 24 February and continue every day until its end. Every day of Russian armed aggression disrupts the normal functioning and development of biodiversity in Ukraine (Bezsonov, 2022).

Scientist V. Horbulin, in his scientific study of the global problem of mine clearance through the Ukrainian vector, emphasises the concern of the UN and the progressive international community about the growing number of types of mine weapons and the increasing negative consequences of their use during armed conflicts, the increase in "deaths of both combatants and non-combatants – civilians, among whom a significant proportion of the dead are children... Ukraine ranks fifth in the world in terms of the number of mine casualties and casualties among non-combatants and is among the three countries with the highest number of tragic accidents involving anti-tank weapons during normal life, on the way to school or during games. In addition, the presence of mines and shells complicates the repair of important infrastructure damaged by shelling" (Horbulin, 2022). Among the reasons are the obsolescence of ERW detection equipment, which remained in the USSR without the necessary repair facilities; the lack of modern Ukrainian complexes and means of detecting ERW; and the lack of funding for the production of modern complexes and means of detecting ERW13. The author cites the example of a study by the Scientific Centre for Aerospace Research of the Earth of the Institute of Geosciences of the National Academy of Sciences of Ukraine on the development of technologies for automated mine detection using UAVs' species-specific reconnaissance equipment. This highlights the need to train future specialists in the management of such drones for the demining of Ukraine of the future.

Scientist O. Vasyliuk attributes the reflection-study "Is it possible for war to preserve nature" to a wide range of war impacts on wildlife caused by ammunition explosions, chemical pollution, fortification construction, fires, landmines, and other factors. "If we analyse the impact on wildlife of the Russian-Ukrainian war, which began with the full-scale invasion on 24 February 2022", the author argues, "the most affected ecosystems are forests". The loss of forests as natural ecosystems is a loss of ecosystem services, which are identified with the beneficial properties of nature that create

living conditions. “The restoration of natural ecosystems in damaged areas will create important conditions for the preservation of habitats that deserve protected status, and thus may well be counted among Ukraine’s successes in implementing the EU Biodiversity Strategy 2030 and many other international commitments in the field of nature protection” (Vasyliuk, 2023).

L. Roman, analysing the environmental threats to the objects of the nature reserve fund of Ukraine during the wartime period, emphasises their importance: the creation and expansion of these territories is the most effective mechanism for preserving the biological gene pool, protecting natural ecosystems, unique natural areas, landscapes and rare species of flora and fauna. Having studied some Red Data Book flora of protected areas in certain regions of Ukraine, the scientist concluded that there are no reliable estimates of the areas of vegetation fires and the reduction of biodiversity in the conflict zone. Therefore, there is a need for further research in the post-war period. L. Roman states: “A lot of effort is needed to preserve the uniqueness of Ukraine’s natural habitats during the war and in the post-war period” (Roman, 2022).

O. Dyniak and I. Koshliakova investigated the potential danger to the environment and the population from petrochemical contamination of the geological environment as a result of hostilities, which is one of the most serious environmental problems and disasters of its spread, affecting the lives of all creatures on Earth. It takes a lot of effort, time, and financial costs to eliminate it. Preliminary damage assessment requires an investigation to determine whether long-term and serious damage has been caused. “The latter can be determined only by the results of comprehensive and long-term monitoring of the environment, which will create an effective system of measures that will eliminate the consequences and minimise the damage to the environment from military operations in the shortest possible time” (Dinyak, Koshlyakova, 2023). In addition, the authors emphasise the importance of conducting educational and information campaigns for the public to familiarise them with the consequences of petrochemical contamination of groundwater and to make them aware of the need to develop environmental awareness. The above activates conscious participation of the public in managing water resources and ensuring

their sustainable protection.

A team of researchers led by T. Sak analysed the environmental and economic consequences of the Russian-Ukrainian war and divided crimes against the environment "into categories: energy security, damage to industrial facilities, nuclear hazard, impact on ecosystems, impact on the marine ecosystem, livestock waste, other military actions" (Sak, Bilyo, Tkachuk, 2022). The authors emphasise the criticality of Ukraine's economic losses. They point to the correlation between crimes against the environment in the long term and an increase in mortality and serious illnesses among Ukrainians in the future, in particular those caused by environmental pollution. Emphasising the duration of activities to restore the country's environmental and economic security in all its components, they predict a long-term practice that will become mandatory for high school students to restore safe living conditions in the territories of territorial communities.

The presented environmental challenges caused by the war have actualised environmental competence, which is now an integral part of modern education. In this context, it is important to provide high school students with the knowledge and skills necessary to understand and overcome these problems.

The study of the impact of environmental problems in modern Ukraine on the formation of environmental competence of high school students to overcome the environmental consequences of war makes it possible to identify a number of important factors that affect the motivation and involvement of high school students in activities to overcome the environmental consequences of war. Let us elaborate on them (Tolochko, Bordyug, 2024).

1. Awareness of the environmental risks of war. High school students in Ukraine, living in an environment where military events have a serious impact on the environment, may be more aware of the environmental risks associated with armed conflicts. Understanding environmental issues allows high school students to comprehend the seriousness of the situation and the need for action to address it. They understand the environmental problems that can arise as a result of war and how they can affect their lives and those of future generations.
2. Understand the relationship between war and environmental

issues. Studying the relationship between war and environmental issues, such as water pollution, ecosystem destruction, and emissions of harmful substances, can help students develop a deeper understanding of not only the problem itself but also possible solutions. Understanding the impact of environmental issues on the development of environmental competence helps high school students increase their environmental awareness. They learn to identify environmental risks, distinguish between different types of pollution and assess their consequences.

3. Public activity. Participation in environmental initiatives. Environmental issues mobilise high school students to actively participate in civic initiatives and activities aimed at protecting nature and reducing the negative impact of humans on ecosystems. Knowledge about environmental problems that may arise as a result of war can motivate high school students to participate in environmental initiatives aimed at protecting the environment and minimising the effects of war on nature.

4. Developing problem-solving skills: in-depth understanding of environmental issues related to armed conflict can help develop skills in situation analysis, problem-solving strategies and participation in civic initiatives.

5. Integrate environmental topics into the curriculum. Including topics related to the environmental problems of war in the curriculum can help high school students better understand the complexity of the situation and engage them in active participation in addressing these problems. Interactive lessons, practical assignments and visits to environmental events can increase their environmental competence.

6. Technological and digital support. The combination of technological, digital and environmental competences of high school students creates a powerful tool for overcoming the environmental consequences of war. For example, using drones (technological competence), high school students can take aerial photographs of areas affected by hostilities. The images can be processed using special software (digital competence) to analyse the extent of damage and create maps of the environmental situation. Knowledge of environmental processes (environmental competence) will allow them to develop plans to restore these areas and prevent further environmental disasters.

7. Motivation to act: Understanding the importance of environmental issues and their impact on people's lives encourages high school students to take active steps to address them. They can take part in civic initiatives, be responsible with their own consumption and engage in environmental education. High school students who understand the seriousness of environmental issues may be more motivated to make conscious environmental decisions in their daily lives. This may include participating in environmental groups, collecting garbage, and taking energy-efficient measures.

8. Development of critical thinking: Studying the impact of environmental issues on environmental competence contributes to the development of high school students' critical thinking. They learn to analyse information about environmental issues, distinguish facts from myths and make informed decisions. Environmental issues require high school students to analyse the situation, develop strategies to solve problems and make informed decisions. This helps to develop their critical thinking and analytical skills.

9. Preparing for crisis situations: Understanding the impact of environmental issues on the development of environmental competence also prepares high school students for crisis situations, including war. They can be more aware of the possible environmental consequences of war and be prepared to take action to address them.

10. Ethical values. Preparing for future responsibility Understanding environmental problems and how to overcome them contributes to the development of high school students' environmental values, such as responsibility towards future generations and respect for nature. Developing environmental competence in high school students helps them prepare for future responsibility for the environment and natural resources.

Table 1.18

Factors influencing the motivation and involvement of high school students in activities to overcome the environmental consequences of war

No.	Key Aspect	Description
1	Awareness of the environmental risks of war	High school students living in wartime conditions better understand the environmental risks of armed conflicts and their impact on the environment and future

		generations.
2	Understanding relationship between war and environmental issues	Studying problems such as water pollution, ecosystem destruction, and emissions of harmful substances helps students better understand the problem and find solutions.
3	Civic activity. Participation in environmental initiatives	Knowledge about environmental consequences of war motivates students to participate in nature conservation projects and initiatives aimed at reducing human impact on ecosystems.
4	Developing problem-solving skills	Deep understanding of environmental problems contributes to the development of analysis, problem-solving, and participation in civic initiatives.
5	Integrating environmental topics into the curriculum	Including topics related to the environmental consequences of war in school subjects encourages active participation through practical tasks and interactive lessons.
6	Technological and digital support	Combining technological, digital, and environmental competences (e.g., drone usage, image processing, damage analysis, recovery planning) creates a powerful tool for overcoming the consequences of war.
7	Motivation to act	Understanding the importance of environmental issues encourages students to act: join eco-groups, be conscious consumers, engage in environmental education, participate in clean-ups, and implement energy-saving practices.
8	Development of critical thinking	Students learn to analyze environmental information, distinguish facts from myths, make informed decisions, and develop strategies for solving problems, enhancing their analytical and critical thinking skills.
9	Preparation for crisis situations	Awareness of the environmental consequences of war helps students be prepared for emergencies and act effectively during environmental crises.
10	Ethical values. Preparing for future responsibility	Forming environmental values (responsibility for future generations, respect for nature) prepares students to care for and protect the environment in the future.

Conclusions

Thus, modern Ukraine is facing numerous environmental problems, which is a challenge for society and, in particular, for the younger generation. The development of high school students' environmental competence is particularly important in the context of the environmental crisis. It not only prepares students for active participation in solving environmental problems, but also fosters their responsibility for the environment.

The impact of environmental problems in modern Ukraine on the formation of environmental competence of high school students to overcome the environmental consequences of war can be significant and play an important role in shaping their conscious position and activity to overcome the environmental consequences of war and preserve the natural environment for future generations, encouraging them to take conscious action, develop critical thinking and civic engagement.

Educational programmes aimed at developing environmental awareness will help to create a generation that is able to take a responsible attitude to the environment and actively participate in its preservation and restoration. It is important to equip high school students with the knowledge, skills and motivation to actively participate in environmental restoration and preservation. This will contribute not only to the environmental, but also to the socio-economic revival of the affected regions.

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