

DOI: <https://doi.org/10.34069/AI/2023.72.12.4>How to Cite:
Sovhira, S., Braslavska, O., Rozhi, I., Dushechkina, N., & Ieresko, O. (2023). Environmental culture in ecologists: keys to their professional training. *Amazonia Investiga*, 12(72), 45-58. <https://doi.org/10.34069/AI/2023.72.12.4>



Environmental culture in ecologists: keys to their professional training

Екологічна культура екологів: ключі до їх професійної підготовки

Received: November 9, 2023

Accepted: December 28, 2023

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Abstract


The article reveals the pedagogical conditions for the formation of the environmental culture of ecologists in the process of preparation for professional activity. An important component of the environmental culture of ecologists is the creation of the desired structure or order in nature and the education of high humanistic life values and guidelines in human life. The components that are important in the formation of the environmental culture of ecologists are singled out. The main functions required by environmental education, which must be taken into account when training ecologists, are highlighted. Based on the analysis of the environmental culture of the individual, the article defines its integrative essence, the content of environmental education, and pedagogical conditions for its successful implementation. Having analyzed the ecological culture of the individual, revealing its integrative essence and the content of environmental education, we conducted an experimental study to confirm the applicability, optimality, and effectiveness of the proposed pedagogical conditions for the formation of the environmental culture of an ecologist. The results

Анотація


У статті розкрито педагогічні умови формування екологічної культури екологів у процесі підготовки до професійної діяльності. Важливою складовою екологічної культури екологів є створення бажаного устрою чи ладу в природі і виховання високих гуманістичних життєвих цінностей та орієнтирів у людському житті. Виокремлено компоненти, які є важливими у формуванні екологічної культури екологів. Висвітлено основні функції, яких вимагає екологічна освіта, які необхідно враховувати при підготовці фахівців-екологів. На основі аналізу екологічної культури особистості у статті визначено її інтегративну сутність, зміст екологічної освіти та педагогічні умови її успішної реалізації. Проаналізувавши екологічну культуру особистості, виявивши її інтегративну сутність та зміст екологічної освіти, ми провели експериментальне дослідження з метою підтвердження застосовності, оптимальності та ефективності запропонованих педагогічних умов формування екологічної культури еколога в процес професійної підготовки. Експеримент включав такі етапи: підготовчий, констатуючий

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of the experimental study confirmed the applicability, optimality, and effectiveness of the proposed pedagogical conditions for the formation of the environmental culture of an ecologist in the process of professional training.

Keywords: environmental culture, pedagogical conditions, ecologists, professional activity, ecological education.

Introduction

Nowadays, not only the flora and fauna, but all natural resources are on the verge of exhaustion. According to the World Wildlife Fund, 30-40 years ago, only one species of animal disappeared every day on Earth, and now one species disappears in just 1 hour. In the conditions of such a situation, which can be called a crisis, it is important to raise the environmental education of the entire population of the planet to a high level, to activate the spread of ecological knowledge, to form an environmental culture among the population, and in particular, first of all, the environmental culture of student youth. So, we see the threat to life and human civilization posed by the global problems of today, which cause the need for environmental education and become quite relevant in the modern information society (Diachenko-Bohun et al., 2019). Environmental education for the entire population of the planet must be actively implemented in the practice of preschool and school life of each individual and continue throughout the life of a person. But, as experience shows, many teachers are not ready to organize and carry out ecological and pedagogical activities in educational institutions. This leads to the fact that the environmental knowledge of education seekers is formed at a low level (Stetsula & Orshanskyi, 2023).

Therefore, high-quality natural education for future ecologists, and biology teachers, able to interest students in education, familiarize them with the methods of scientific research (description, experiment, observation, synthesis, analysis, explanation, classification, etc.), arouse their interest in ecological and biological research, to encourage cognitive, educational and research activity by one's own example) (Rudyshyn et al., 2023).

The search for ways of interaction between harmonious nature and society leads to the formation of the theory and practice of environmental education, an intensive process of environmentalization of the general culture of

та формувальний. Результати експериментального дослідження підтвердили застосовність, оптимальність та ефективність запропонованих педагогічних умов формування екологічної культури еколога в процесі професійної підготовки.

Ключові слова: екологічна культура, педагогічні умови, екологи, професійна діяльність, екологічна освіта.

mankind, and in this matter, the preparation of ecologists for professional activities and their activities to improve the stability of environmental education for the entire population of the planet is important.

There is a contradiction between the insufficient development of this problem in the educational field and the general recognition of the need for environmental education. Therefore, the purposeful process of the formation of ecological knowledge and the formation of the environmental culture of ecologists during the professional and practical training of a modern specialist is one of the main ones today. Therefore, we analyze the literature that reveals research on the preparation of ecologists for professional activities and ways of forming the environmental culture of ecologists.

The training of competent specialists for environmental activities in the professional sphere, and the formation of environmental culture in them is one of the main levers in solving the environmental problems of Ukraine, the urgent issue is the training of citizens with a high level of environmental awareness and culture.

However, the problem of forming the ecological culture of future specialists in the field of ecology remains insufficiently studied. In particular, the problem of the formation of the environmental culture of ecologists has not been studied until now.

The topicality of the problem, its insufficient theoretical and practical development, and the need to resolve certain contradictions led to the choice of the topic of our article.

In the context of environmental education, the following aspects are highlighted in the article: the components that are important in the formation of environmental culture of ecologists are characterized; the main functions of

environmental education, which must be taken into account when training specialists in ecology, are defined; the formation of environmental culture of ecologists during preparation for professional activity is characterized; computer multimedia educational programs used for the formation of environmental culture of ecologists during preparation for professional activities in the educational process of a higher educational institution are selected; student interviews of the group are highlighted; the integrative essence, the content of environmental education and the pedagogical conditions for its successful implementation are determined; the general tasks of the experiment and the implementation of pedagogical conditions for the formation of ecological culture of ecologists are disclosed.

Literature review

For natural science pedagogical education, one of the leading directions for the realization of its humanistic goals is to acquaint students with the global problems of the modern world, which are solved through the unity of natural and humanitarian knowledge. Hence, the task of the higher school arises, which should ensure the formation of environmental competence and readiness of future specialists to implement the educational principles of sustainable development of society.

The theoretical and methodological foundations of the substantiation of the principles and approaches to the construction of a system of continuous environmental education in educational institutions of various levels were implemented by T. Safranov (2021), he analyzes the state of higher environmental education, defines the socio-economic foundations of society, and describes the environmental component of education, which is a basic component of state environmental policy.

Also, T. Saienko, & S. Boichenko (2013) raise questions regarding the relevance and development of the system of environmental higher education on the example of technical universities. Scientists have shown the determining factors of the formation of a nature-harmonious, harmonious, eco-safe society and revealed the components of education for balanced sustainable development of society; it is proved on the actual material that in times of global ecological crisis, the spread of eco-pedagogy is a necessary condition in the direction of noosphere genesis and is a basic component of the process of transformation of society.

The process of developing the environmental competence of students is considered through the prism of the formation of a cognitive component, environmental values, and motives for behavior in the environment, which are determined by external educational and educational influences, the level of development of environmental self-awareness and culture of the individual and its activities. The formation of environmental culture, consciousness, and worldview of students of higher education institutions was studied by N. Stetsula, & L. Orshanskyi (2023), they used the example of pedagogical institutions of higher education, talk about the need for modern ecological training of teachers of natural sciences.

The formation of environmental competence at various stages of personality ontogenesis has been the subject of scientific research S. Rudyshyn, O. Lutsenko, A. Kmets, & V. Konenko (2023) give concrete examples of the importance of educational and research activities of future biology teachers and ecologists in the practice and theory of their professional training; The possibilities and role of the school's ecological and biological office are shown.

In turn, the scientists of Ibero-American countries consider the problem of environmentalization of education and pay attention to the importance of environmental knowledge in the process of forming the ecological culture of the individual. Such scientists as D. Ludwig, & L. Polisel (2018), in the article, describe the current debates about the integration of traditional and academic ecological knowledge (TEK and AEK) struggle with a dilemma of division and assimilation. R. González Salas, M. Vidal del Río, I. Pimienta Concepción, & C. Lizcano Chapeta (2021), conduct research to form an environmental culture in the student body. Y. Pérez, N. Y. Bravo, & I. Valdés, (2017) define a new definition of ecological culture based on research conducted at the University of Cienfuegos, which aims to consider it as a process and the result of formative environmental influences that allow a university professor to understand, explain and guide the cognitive activity, practical, axiological (or evaluative) and communicative, oriented to the preservation of the environment of his students. The authors, based on the formulated concept of the models, determine the process results, indicators, criteria for evaluation, and tools that will be presented to professors, managers, and specialists of the university to practically confirm the development achieved by

the teachers of the environmental culture of universities.

According to the scientists of Ibero-American countries, there is an emphasis on the need to green the entire educational process, which will enable the formation of a high environmental culture in the world's youth. The formation of the ecological culture of ecologists requires, first of all, a high level of ecological culture of the teacher, and his ecological and methodological literacy.

So, the results of the analysis of scientific and methodological literature allow us to see the analysis of the formation of the current state and prospects of higher environmental education, which scientists consider the central link of the entire continuous system. The analysis conducted by scientists of the current state of environmental education in institutions of higher education, and the analysis of curricula and educational programs of many non-ecological and ecological specialties, notes the absence or insufficiency of the ecological component, that is, in the training of specialists, due attention is not paid to the environmentalization of higher education.

The analysis of pedagogical, educational, and methodological literature on the topic of the study allows us to outline the contradictions that prove the need to improve the process of forming the ecological culture of ecologists, in particular, between:

- modern requirements for the level of ecological and professional training of future ecologists and the actual state of their training in educational institutions;
- the public need for highly qualified specialists in the field of ecology, competitive in the labor market, and the real level of formation of their environmental culture;
- the need for end-to-end environmentalization of the content of the educational process and the need for educational programs of professional training that will contribute to the improvement of the quality of professional environmental education and culture;
- the expediency of future specialists' formation of ecological knowledge and skills regarding the preservation and improvement of the environment and the inadequacy of scientifically based modern pedagogical technologies, the implementation of which ensures the

effectiveness of this process.

Since in recent years, there has been insufficient public interest in the training of ecologists, it is therefore advisable to investigate what measures are worthwhile for the formation of the environmental culture of ecologists in preparation for professional activities.

Goal: to propose and verify the effectiveness of pedagogical conditions for the formation of the environmental culture of ecologists in preparation for professional activity.

Methodology

Logical basis of the research is the philosophical propositions of the scientific theory of knowledge of social phenomena: about the unity of activity, consciousness, and mental neoplasms; about harmonious and integral development of the personality, interrelationship, and interdependence of axiological and anthropometric approaches in the socialization of the personality, development of his spiritual cultures. The specific methodology of the research was based on the ideas of the theory of the activity essence of a person and his creative activity, educational concepts of integrity as a principle of social phenomena and processes, a systemic approach with a multi-level and comprehensive analysis of objects pedagogical activity.

The practical significance of the research lies in the introduction of pedagogical conditions into the educational process of educational institutions (the development of the general culture of the individual as a prerequisite for the formation of the environmental culture of ecologists, the purposeful design of an informational and ecological educational environment, ensuring the positive motivation of future ecologists for the formation of an ecological culture, fostering the need for constant professional self-improvement in future ecologists, the inclusion of future ecologists in environmental protection activities).

To achieve the goal, the methods of scientific knowledge, which are generally scientific, were used:

- theoretical – study and analysis of psychological-pedagogical, philosophical, methodical literature, scientific work of scientists on the problem of the formation of the environmental culture of ecologists in preparation for professional activity – to

- outline the conceptual boundaries of the researched problem;
- modeling – to develop ways of forming the environmental culture of ecologists in preparation for professional activity; comparison of the obtained data – to clarify dependencies and cause-and-effect relationships;
 - analogy, logical-systemic analysis, classification, deduction, induction, and generalization of practical and scientific-theoretical data – to determine the pedagogical conditions for the formation of the environmental culture of ecologists in preparation for professional activity;
 - empirical – observations, questionnaires, tests, and methods – to find out ways of implementing pedagogical conditions and checking their effectiveness for the formation of the environmental culture of ecologists in preparation for professional activity;
 - pedagogical experiment (declarative, formative) – to check the effectiveness of the specified pedagogical conditions for the formation of the environmental culture of ecologists in preparation for professional activity.

Having analyzed the environmental culture of the individual, revealing its integrative essence and the content of environmental education, we conducted an experimental study to confirm the applicability, optimality, and effectiveness of the proposed pedagogical conditions for the formation of the environmental culture of an ecologist in the process of professional training.

During the empirical research, the activities of all subjects of professional training were studied. As part of the empirical research, the documentation was studied, the classes and activities conducted by teachers to form the environmental culture of higher education students, the organization of scientific and methodical work, the activities of teachers in the training of ecologists, the role of the administration's management activities in the formation of the environmental culture of ecologists were analyzed. More than 800 people participated in the empirical study.

The purpose of the experiment: to check the effectiveness of the pedagogical conditions identified by us on the formation of the environmental culture of ecologists.

The implementation of the pedagogical experiment was carried out in three stages: preparatory, main, and final.

At the preparatory stage, the purpose and tasks of the research were determined, the experimental plan was developed, methods of measurement and processing of results were selected, control and experimental groups were selected, and their homogeneity was checked.

At the main stage, an experiment was conducted.

At the final stage, the results of the experiment were analyzed, their reliability was confirmed, and conclusions were drawn about the pedagogical effect of the experiment.

The following research methods were used in the experiment: observation, conversation, and testing. The conducted analysis allows us to conclude that at the ascertainment stage of the experiment, most ecologists do not have sufficiently formed knowledge and skills of the ecological element.

The reliability and validity of the obtained results, and the objectivity of their assessment were ensured by the methodological soundness of the initial positions and the qualitative mechanism for evaluating the quality under study, the use of a complex of complementary research methods, and the involvement of a group of respondents from a higher educational institution in the analysis of its results.

To assess the homogeneity of experimental and control data, statistical processing was performed using MS Excel and SPSS (Statistical Package for Social Science).

The results of the experimental study confirmed the applicability, optimality, and effectiveness of the proposed pedagogical conditions for the formation of the environmental culture of an ecologist in the process of professional training.

Results and discusión

Environmental education is a holistic cultural phenomenon, a combination of the processes of education, training, and personality development. Nowadays, all the countries of the world community are faced with solving the environmental and acute socio-economic problems of the planet. The international regulatory and legal educational base of the last decade emphasizes the need for effective environmental education for all mankind. It is this that determines the need for environmental culture and consciousness, which correspond to and are based on new criteria for assessing the relationship between nature and human society

and contribute to the preparation of citizens with a high level of ecological knowledge and, first of all, the formation of the environmental culture of ecologists (Rubel, 2013).

1. Components that are important in the formation of the environmental culture of ecologists

In the context of environmental education, scientists single out the following components that are important in the formation of the environmental culture of ecologists:

- scientific knowledge about connections and relationships in the system "man – society – nature" (a system of concepts, ideas, and regularities that represent the reflection of moral, technical, philosophical, and legal aspects of ecology in their development);
- knowledge about appropriate methods of individual activity and its environmental culture in the natural environment;
- the experience of the emotional and value attitude of humanity to the formation of the environmental culture of the individual and nature, which includes value orientations, feelings, beliefs, motives based on which the environmental culture of a person is formed and the readiness for practical activities and awareness of a person's place in the world;
- experience in practical, creative environmental activities to form the environmental culture of the individual.

All forms and types of human activity related to the rational solution of the environmental problem are included in such activities for all social activity and environmentalization of social production; an environmental culture is formed, which covers various types of human activity: both in the ideal and in the material spheres related to the development, knowledge, preservation, and transformation of the environment (Stefankiv & Maksymovych, 2012). Such components are important in the formation of the environmental culture of ecologists. It should be noted that the professional training of ecologists is an important and necessary component of the ecological education of mankind. After all, the professional staff of environmental protection and the field of protection are specialists whose training ensures successful activity in all-natural diversity, helps to solve problems, and fulfills the tasks set for the ecological sphere at the modern stage (Starovoit, 2005).

Among the strategic main directions of the modern development of environmental education is the development of cooperation in the field of science of international relations, environmental education, environmental protection, preservation of the biosphere and civilization, and rational use of natural resources. This strategic direction, in our opinion, is especially important in the formation of the environmental culture of ecologists, in their professional training, because the peculiarity of the future professional activity of an ecologist is the solution to professional issues in a global dimension not only within the borders of one country but also far beyond its borders (González et al., 2021). As the most important means of professional communication for future ecologists in the conditions of constant expansion of international contacts and development, perfect knowledge of a foreign language enables the formation of an environmental culture in preparation for the professional activities of ecologists and the entire community and causes increased motivation in language learning (Sura, 2005).

The general goal of the formation of environmental culture of ecologists during foreign language professional training of future ecologists is to ensure their readiness in the academic and professional environment for effective communication, that is, their behavior in real situations of professional and academic life. Communication in a foreign language will allow the future specialist to secure a worthy place not only in the domestic but also in the global labor market (Rubel, 2013).

2. The main functions of environmental education, which must be taken into account when training specialists in ecology

Let us name the main functions required by environmental education, which must be taken into account when training specialists in ecology:

- 1) formation of ecologically adequate ideas about relationships in nature itself and the system "Man – Nature – Society". This enables the individual to learn how and what is happening in the natural world, between nature and society, between man and nature, and how, from the point of view of ecological expediency, it is worth acting;
- 2) formation of a system of skills, abilities, and strategies of interactions with nature;
- 3) forming an attitude towards the natural world. Ecological knowledge guarantees

- ecologically appropriate behavior of the individual under the condition of an appropriate attitude towards nature;
- 4) performance of an important informative function, since ecology provides a person with extensive information about natural resources that provide the material basis for the existence of an individual, about the natural environment, clarifies the place of a person in nature, reveals his connections with the universe and it;
 - 5) the development of communicative effective interaction of professional communication in a foreign language environment, regardless of the educational and social status of a person, the communicative capabilities of the individual through the clarification of concepts that serve as an important component of the modern communicative minimum of each individual;
 - 6) environmental education and culture form the personality of a person and citizen, developing their psycho-emotional and intellectual spheres, providing an opportunity to think logically in preparation for professional activity and throughout life, forming an attitude towards nature as the world of their existence, form in ecologists the ability to predict the consequences of their behavior in society and nature, to realize the destiny of the earth as one's own, and one's destiny as the destiny of the earth (Diachenko-Bohun et al., 2019).

Innovative technologies in education are a mandatory element of the formation of the environmental culture of ecologists in preparation for professional activities to achieve high-quality education, i.e. competitive education, which would be capable of providing each environmental specialist with creative self-assertion in various social spheres, contributed to the creation of conditions for independent achievement of any goal by the environmental specialist (Silva & Ramos, 2023).

3. Formation of ecological culture of ecologists during preparation for professional activity

The formation of the environmental culture of ecologists during preparation for professional activity is characterized by the following:

- empirical orientation – conducting innovative classes developed by teachers in various areas of environmental education;

- theoretical orientation – improvement of the created integrated and innovative courses of environmental direction, combining numerous subjects provided by the curricula.

Innovative technologies show students of higher education "the world as a whole", overcoming the disciplinary diversity of the scientific presentation of the material. Freed up due to such an approach to education, the educational time is used to implement full-fledged profile differentiation in the educational process. After all, 98% of students in higher education consider the computer a work tool. And only a small proportion of students consider it necessary for entertainment and as an opportunity to communicate with friends.

4. Computer multimedia educational programs are used for the formation of the environmental culture of ecologists during preparation for professional activities in the educational process of a higher educational institution

Computer multimedia educational programs used for the formation of the environmental culture of ecologists during preparation for professional activities in the educational process of a higher education institution allow:

- to convey a larger volume of educational material in a minimum time than when working from a textbook;
- timely and quickly replenish theoretical information with new events and environmental facts (Dovhopola, 2019).

During the formation of the environmental culture of ecologists during preparation for professional activities, video clips, and voice accompaniment, bright pictures on the topic cause great interest, which contributes to a more effective discussion during the discussion of a certain topic. A more pronounced individual approach is facilitated by the use of computer technology. The use of computer multimedia programs increases the effectiveness of education and takes into account the individual characteristics of the student (Omonov & Nomozov, 2022).

An important aspect of the intellectual development of the individual in the process of forming the environmental culture of ecologists is the development of figurative thinking, which ensures in the process of cognition the selection of spatial relations and properties in the phenomena and objects of reality, the creation of

three-dimensional images on this basis and operation in the process of solving environmental problems with them (Bida et al., 2021).

An important component of any creative activity is imaginative thinking, which is based on the use of flexible associations of moving tasks of ecological content. The effectiveness of assimilation of the material during its study has a special influence on the level of development of figurative thinking, which constantly requires not only the operation of images but also the creation of images during the formation of the environmental culture of ecologists (Diachenko-Bohun et al., 2019).

The quasi-professional activity of ecologists in preparation for professional activity is organized with the help of the specifics of the real educational process of teaching biology and ecology in educational institutions, the relationship between the teacher and students of education, modeling in laboratory-practical classes the conditions of environmentalization of education (Zavelevsky et al., 2022).

Specific situations-tasks were modeled by us in the "Methodology of teaching ecology" classes. As an example, the following tasks were proposed for the formation of the environmental culture of ecologists in preparation for professional activity: demonstrate an experiment to confirm a certain physiological process, organize a thematic survey, simulate fragments of various types of classes using an excursion into nature, interactive teaching methods, organize an ecological game, observation on the pre-school educational and research plot, in a corner of living nature and directly in nature, which allowed students to feel like a practical specialist.

Within the framework of a modern classroom lesson on environmental disciplines, special attention should be directed by the teacher to the planning of cognitive, educational, and independent activities of students (Stetsula & Orshanskyi, 2023).

For the formation of the environmental culture of ecologists during preparation for professional activity, professional practice is important, and interactive forms of organization of training of higher education students are mandatory (Ivanchuk et al., 2023).

Industrial practice is an essential period for a student to work as an ecologist. Failures that occur during pedagogical practice. Due to the

lack of formation of the environmental culture of specialists, they push students away from the future profession and reduce the desire to work, internal and external positive motivation is usually transformed into an external negative one. Therefore, students need the help of methodologists and teachers. The above contributes to the successful entry of the future specialist into the professional environment, which in turn ensures the professional development of an ecologist and is a prevention of maladaptation. Student interview groups were created for interns to avoid difficulties that arose in the process of practice, they were allowed to receive daily individual consultations from methodologists and ecologists.

5. Student group interviews

Student interview groups, which were created for:

- understanding, systematized vision, analysis of one's own professional behavior and professional actions, as well as awareness of professional mistakes;
- mutual cooperation in the process of pedagogical practice and professional cooperation of trainee students, which provided them with the necessary knowledge;
- self-development and reflection;
- effective analysis of the quality and appropriateness of the technologies and methods of the educational process used by them during practice, adaptation to the future profession, exchange of experience, formation of professional skills, and practical and theoretical process during professional development;
- involvement of all participants of the intervention group in the group solution of problematic professional situations.

Interviews were aimed at solving difficulties from the general organization of the educational process and from a specific topic. The proposed interactive technology for the formation of the environmental culture of ecologists in preparation for professional activities involves a certain stage: the creation of an intervention group (5-6 people); choosing a group moderator; definition of group work rules; individual announcement of each of the participants of a personal problem that arose during practice; the choice for everyone of an actual problem for further mutual discussion (Dovhopola, 2019).

Group work, research activities, and work in pairs on projects with the use of modern equipment are of great importance for the formation of the environmental culture of ecologists in preparation for professional activity.

Due to the combination of modern information communication and pedagogical technologies, it is possible to improve the quality of professional training of future ecologists, to form an environmental culture. Web quests are an example of such effective integration. Based on the use of information technologies, we will implement project-based training. Therefore, it is effective to conduct a web quest from the "Ecology" course based on the Google Blogger service with a detailed description of the process of completing all tasks. The formed educational and research skills of students, future ecologists, are improved during laboratory and practical classes, and their professional skills are improved during the implementation of research tasks of field practice in ecology, zoology, genetics, etc. The digital measuring complex is widely used in these classes. The devices of the complex make it possible to study the reaction of plants to the degree of illumination, pH of the environment, etc (Bondar et al., 2015).

Educational excursions are an integral part of the formation of educational and research abilities and skills and contribute to the formation of the environmental culture of ecologists. Students, in natural conditions during educational excursions: collect material, investigate objects, perform scientific works, and get involved in the creation of an ecological trail (Rudyshyn et al., 2023).

6. Integrative nature, content of environmental education, and pedagogical conditions for its successful implementation

Based on the analysis of the environmental culture of the individual, its integrative essence, the content of environmental education, and the pedagogical conditions for its successful implementation were determined:

- 1) creation of an innovative material and technical base in institutions of higher education, with the help of which, through independent educational and research activities and cognitive activity, the searching and creative abilities of future ecologists are developed;
- 2) innovative technologies in education are a mandatory element of the formation of the

environmental culture of ecologists in preparation for professional activity;

- 3) a high and perfect level of proficiency in a professionally oriented foreign language, which leads to the reorganization of the process of modern training of future ecologists for the formation of an environmental culture of ecologists;
- 4) the development of figurative thinking, which ensures in the process of cognition the selection of the reality of spatial relations and properties in phenomena and objects, the creation of three-dimensional images;
- 5) based on the contextual approach of applying quasi-professional activities, which is implemented by modeling future professional activities;
- 6) professional practice with the use of interactive forms of organization of training of higher education seekers;
- 7) introduction of group work, research activities, and work in pairs on projects using modern equipment for the formation of the environmental culture of ecologists.

Having analyzed the environmental culture of the individual, revealing its integrative essence and the content of environmental education, we conducted an experimental study to confirm the applicability, optimality, and effectiveness of the proposed pedagogical conditions for the formation of the environmental culture of an ecologist in the process of professional training.

During the empirical research, the activities of all subjects of professional training were studied. As part of the empirical research, the documentation was studied, the classes and activities conducted by teachers to form the environmental culture of higher education students, the organization of scientific and methodical work, the activities of teachers in the training of ecologists, the role of the administration's management activities in the formation of the environmental culture of ecologists were analyzed. More than 800 people participated in the empirical study.

We will present in detail the experimental part regarding the verification of the effectiveness of the pedagogical conditions for the formation of the environmental culture of ecologists that we have identified.

The purpose of the experiment: to check the effectiveness of the pedagogical conditions identified by us on the formation of the environmental culture of ecologists.

7. General tasks of the experiment and the implementation of pedagogical conditions for the formation of environmental culture of ecologists

General tasks of the experiment:

- Implement pedagogical conditions for the formation of the environmental culture of ecologists.
- Obtain quantitative and qualitative data to verify the reliability of the experimental results.

Methods of data acquisition: observation, testing, and study of the products of scientific and methodical work in the preparation of ecologists.

The experiment included the following stages: preparatory, ascertaining, and formative.

The main goals of the preparatory stage: working out individual substantive and procedural means, and preparation of experimental material necessary for the next stages of the experiment. The realization of the set goals required the definition of tasks:

- 1) on the development of nomenclature of goals and educational tasks of all types and organizational forms of scientific and methodical work;
- 2) regarding the adjustment of the plans of scientific and methodical work of educational institutions, which, according to the goals of the study, are included in the experiment;
- 3) regarding the selection of interactive forms and methods of organizing scientific and methodological work;
- 4) selection and development of diagnostic questionnaires and tests.

The purpose of the ascertainment stage of the experiment was to identify the initial level of formation of components, elements, and levels. The results of the ascertaining stage of the experiment were also used as motivators to intensify the participation of ecologists in scientific and methodological work to form the environmental culture of ecologists. The main tasks of the ascertainment stage of the experiment were as follows:

- 1) measure the level of formation of the environmental culture of ecologists and its individual components;
- 2) interpret the received data.

The following research methods were used: observation, conversation, and testing.

The conducted analysis allows us to conclude that at the ascertainment stage of the experiment, most ecologists do not have sufficiently formed knowledge and skills of the ecological element.

We had experimental groups "A", "B", "C", and control – group "D".

As the research shows, ecologists of groups "A" and "B" have formed an environmental culture at a high level, the ability to manage the processes of self-learning, self-development, and self-education (50.0; 48.3%). The high-level indicator is lower in groups "C" – 35.8; "D" – 32.8%. It should be noted that in group "D" the result of the formation of environmental culture was found at the lowest level. We attribute this to the need to more effectively stimulate the processes of forming an environmental culture in a higher educational institution. Ecologists of all groups showed a stable average level in the formation of environmental culture (53.6; 58.3; 50.0; 67.2%). Thus, all aspects of the functional element are sufficiently developed.

Ecologists of the "B" group found indicators of an average level: 55.0% of respondents know the content of some ecological functions. An additional study using the questionnaire "Formation of environmental culture of ecologists", conducted in this group, confirmed this result. Data on the formation of the operational component correlate with the results of the development of the informational component of this level of environmental culture formation. The analysis of the scaling data showed that the respondents do not realize the importance of implementing pedagogical conditions for the formation of the environmental culture of ecologists.

The teachers of groups "A", "C" and "D" demonstrated the predominance of low (28.6; 30.4; 25.9%) and medium (46.4; 50; 65.5%) levels of formation of this indicator. Teachers of group "B" showed a high (30.0%) and average (63.4%) level.

The formation of the components of the functional element of environmental culture only at the level of co-management has lower indicators. The majority of respondents of groups "A", "B" and "D" are poorly familiar with the content of environmental culture (60.7; 82.1; 79.3%), and 45.1% of respondents of group "B" know only parts of such functions of the

formation of environmental culture and the need to improve the practical component in the formation of environmental culture.

Respondents can recognize only some aspects of the environmentalist's activity style (50.0; 63.4; 48.2; 67.2%) and environmental culture (60.7; 51.7; 53.5; 70.8%). Moreover, some respondents showed zero (7.1; 0; 3.6; 1.7%) and low (17.9; 16.6; 30.4; 17.2%) levels. The respondents are fully aware of the need to introduce pedagogical conditions for the formation of environmental culture in the educational process (71.4; 60.0; 57.1; 50.0%), but they do not fully understand their significance for successful career activities. The conducted analysis made it possible to reveal weak theoretical training in the field of environmental culture formation of future specialists, which does not make it possible to carry out high-quality professional activities of ecologists, combining theory and practice, which confirms the need for the application of pedagogical conditions for the formation of environmental culture of ecologists.

The results of scaling allow us to conclude the level of possession of environmental knowledge, skills, and value orientations of education seekers.

In all groups, except group "B", there is no prevailing level of formation of the ecological element of the students' culture, since the results are divided approximately equally between low, medium, and high levels (approximately 30-35%

at each level). A small number of respondents showed a zero level of the studied element. In group "B" the predominant levels are high (44.3%) and medium (34.1%).

The results of the level of self-governance of the ecological element show that 53.6 have a high level of knowledge of their personal characteristics of environmental culture; 36.7; 28.6; 29.3% of respondents. At the same time, the low level is shown at 28.6; 6.7; 26.8; 44.8% of respondents, believing that they are clearly aware of only their intellectual features. This fact is explained by the weak formation of the respondents' abilities to apply self-knowledge methods (28.6; 3.3; 25.0; 25.9%) to form an environmental culture. The surveyed respondents also have knowledge of ecological mechanisms of self-adaptation at low (42.9; 35.0; 37.5; 37.9%) and medium (42.9; 43.3; 46.4; 44.8%) levels.

Summarizing the analysis of the culture scaling results, we can come to the disappointing conclusion that in the ascertainment stage of the experiment, the level of environmental culture of the ecologist is approximately the same among the respondents of the control and experimental groups. It is necessary to emphasize the correlation of the presented results of different groups with each other, which allows us to conclude the representativeness of the obtained data from the point of view of determining the leading trends in the formation of environmental culture.

Table 1.

Distribution of respondents by levels of environmental culture formation

Group	Levels of formation of environmental culture among respondents			
	1	2	3	4
Control "D"	5	16	20	17
Experimental "A"	4	7	10	7
Experimental "B"	3	12	23	22
Experimental "C"	5	16	18	17

In general, the following conclusions can be drawn from the experiment:

- the respondents do not have the necessary level of environmental culture, and their activities and scientific-methodical work in the institution of higher education in itself do not ensure its formation properly;
- the level of formation of knowledge and skills in the formation of environmental culture of all components among all participants of the experiment is low.

During the formative stage of the experiment, the target, substantive, and procedural components of the environmental culture of specialists were implemented and the effectiveness of the pedagogical conditions for the formation of environmental culture that we identified were verified.

For the respondents of the experimental groups, we have developed scenarios of various organizational forms of scientific and methodical work using interactive methods for the implementation of pedagogical conditions for the

formation of the environmental culture of ecologists:

- 1) creation of an innovative material and technical base in institutions of higher education, with the help of which, through independent educational and research activities and cognitive activity, the searching and creative abilities of future ecologists are developed;
- 2) innovative technologies in education are a mandatory element of the formation of the environmental culture of ecologists in preparation for professional activity;
- 3) a high and perfect level of proficiency in a professionally oriented foreign language, which leads to the reorganization of the process of modern training of future ecologists for the formation of an environmental culture of ecologists;
- 4) the development of figurative thinking, which ensures in the process of cognition the selection of the reality of spatial relations and properties in phenomena and objects, the creation of three-dimensional images;
- 5) based on the contextual approach of applying quasi-professional activities, which is implemented by modeling future professional activities;
- 6) professional practice with the use of interactive forms of organization of training of higher education seekers;
- 7) introduction of group work, research activities, and work in pairs on projects using modern equipment for the formation of the environmental culture of ecologists.

As a result of the experiment, a continuous purposeful pedagogical observation of the activities of the students of higher education was carried out. The obtained data showed that the respondents of groups "A" and "C" welcomed the use of pedagogical conditions. The members of the "B" group took a more relaxed approach to this but agreed with the need for their implementation. In general, the participation of respondents in scientific and methodological work on the formation of environmental culture has significantly increased.

Conversations with respondents at the end of the formative stage of the experiment showed the understanding of the respondents themselves in the need to increase the dynamics of the formation of management culture and the need to introduce pedagogical conditions. They emphasized that many pedagogical conditions are already applied by them in professional activities and emphasized the need for further

improvement of the formation of environmental culture.

Respondents acquired knowledge about the environmentalization of society, and the content of their functions through the use of an innovative material and technical base, with the help of which, through independent educational and research activities and cognitive activity, the searching and creative abilities of future ecologists are developed (35.7; 60.0; 41.1%).

In the experimental groups, an increase in the level of formation of environmental culture with the help of innovative technologies in education was noted, which is a mandatory element of the formation of environmental culture in the preparation of specialists for professional activity, the ability to recognize the style of the manager's activity (67.9; 56.7; 55.4%), and improving the level of proficiency in a professionally oriented foreign language (46.4; 53.3; 41.1%).

To a greater extent than at the beginning of the experiment, teachers are aware of the need for the development of figurative thinking, which ensures in the process of cognition the selection of the reality of spatial relations and properties in phenomena and objects, the creation of three-dimensional images; application of quasi-professional activity, implemented by modeling future professional activity; implementation of interactive forms of organization of training of higher education applicants; introduction of group work, research activities, work in pairs on projects for the formation of environmental culture of ecologists and for career and creative growth (in experimental groups, the dynamics was 14.3; 11.7; 12.5%).

So, the results of the experimental study confirmed the applicability, optimality, and effectiveness of the proposed pedagogical conditions for the formation of the environmental culture of an ecologist in the process of professional training.

Conclusions

In the context of environmental education, the components that are important in the formation of the environmental culture of ecologists are singled out. The main functions required by environmental education, which must be taken into account when training specialists in ecology, are named.

The content is considered and the essence of

the environmental culture of students is shown. Based on the analysis of the environmental culture of the individual, its integrative essence, the content of environmental education, and the pedagogical conditions for its successful implementation were determined.

When determining the sample of subjects, the general specificity of the subject of the study was taken into account. The total volume of the sample is 800 subjects, among whom are environmental students. When forming the sample, the criteria of meaningfulness, representativeness, and equivalence were taken into account. The sample was formed by random selection using the technical procedure for calculating the selection step.

The practical significance of the study was the introduction of pedagogical conditions into the educational process of educational institutions (the development of the general culture of the individual as a prerequisite for the formation of the environmental culture of ecologists, the purposeful design of an informational and ecological educational environment, ensuring the positive motivation of future ecologists for the formation of ecological culture, fostering the need for constant professional self-improvement in future ecologists, the inclusion of future ecologists in environmental protection activities); updating the content of the cycle of practical and professional training disciplines. It is appropriate to use the research materials in the field of project training of future ecologists.

During the experiment, the target, substantive, and procedural components of the ecological culture of specialists were implemented, and the effectiveness of the pedagogical conditions for the formation of ecological culture identified by us was verified.

For respondents of experimental groups, we have developed scenarios of various organizational forms of scientific and methodical work using interactive methods of implementing pedagogical conditions for the formation of the environmental culture of ecologists.

The results of the experimental study confirmed the applicability, optimality, and effectiveness of the proposed pedagogical conditions for the formation of the environmental culture of an ecologist in the process of professional training.

Prospects for further research will be consideration of the stages of quasi-professional activity, which is implemented by modeling the future professional activity of specialists.

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