CHAPTER 3
THEORY AND METHODS OF VOCATIONAL EDUCATION

CHARACTERISTICS OF THE MAIN COMPONENTS AND CRITERIA OF THE FORMATION OF THE ECOLOGICAL CULTURE OF FUTURE SCIENCE TEACHERS

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Abstract. *Nowadays, the problem of optimizing the interaction between man and nature by increasing the level of environmental culture of young people is relevant. The views of scientists on the specifics of the formation of environmental culture of higher education students are analyzed. Five interrelated components of the readiness of students of higher education for the formation of an ecological culture of students are characterized: motivational and valuable (deep interest of students in studying the ecological state of the environment, their conviction in the education of moral and ecological qualities in schoolchildren), cognitive (the formation of a certain system of psychological pedagogical, chemical, geographical, ecological, biological knowledge, which ensures the development of ecological thinking), procedural (formation of ecological and professional skills, skills and experience necessary for the implementation of environmentally safe activities with students), reflective and personal (formation in higher education students of the skills to realize the results of their ecologically oriented activities, to objectively evaluate them and determine one's attitude towards them). According to the components, the criteria for the formation of the ecological culture of future teachers of natural sciences are defined: value-orientational, cognitive, practical-active, reflective-evaluative. Value-orientational (the formation of the ecological and professional orientation and personal motivation of the future teacher of natural sciences in the process of professional training); knowledge (availability of a certain amount of knowledge from professional disciplines, understanding of the content, essence, signs and stages of ecological and pedagogical activities aimed at the formation of ecological culture in students); practical and active (availability of skills to use typical forms, methods and means of teaching students of natural sciences in educational work; skills of applying pedagogical innovations, the latest technologies, active methods and techniques in one's environmental and professional activities); reflexive-evaluative (formation of environmental-professional reflection in the future teacher of natural sciences; ability to diagnose his environmental-professional activity with the aim*

of its further modeling). According to the selected criteria and indicators, three levels of the formation of ecological culture of future teachers of natural sciences in the process of professional training are defined: low, medium, and high. It has been established that a teacher of natural sciences with a high level of ecological culture formation plays a decisive role in the implementation of ecological education of children and youth. Pedagogical conditions that contribute to the formation of the ecological culture of future teachers of natural sciences are also defined and substantiated.

Keywords: *ecological culture of specialists, ecological knowledge, indicators and criteria of the formation of ecological culture, future teachers of natural sciences, pedagogical conditions, environment.*

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Introduction. Preparing modern specialists for ecologically justified activities in the professional sphere, forming an ecological culture in them is one of the priorities of professional education and one of the ways of implementing the provisions of the National Doctrine of the Development of Education of Ukraine in the 21st Century, the Law of Ukraine «On Education», the Concept of Environmental Education of Ukraine and the Concept sustainable development of Ukraine.

The professional activity of a teacher of natural sciences is aimed at the continuity and humanization of education, at the formation of ecological culture, at the development of creative abilities and at the expansion of the worldview of students. The significance of the problem of the formation of ecological culture is connected, first of all, with the search for effective ways to overcome the ecological crisis, which has reached a global level and threatens the existence of higher forms of life, including humans.

Literature Review. Considerable attention in pedagogical science is paid to the formation of the ecological culture of the individual, starting from early childhood. In particular, methodological approaches based on the principles of philosophy and conceptual provisions of environmental education and upbringing are reflected in the works of H. Bilyavskyi, V. Brovdiy, M. Drobnohod, O. Zakhlebny, I. Zverev, M. Kiselev, H. Pustovit and others.

Various aspects of the formation of the ecological culture of future teachers, in particular, a responsible attitude to the natural environment, the study of ecological and ecological-pedagogical problems, were considered by such scientists as: O. Bazaluk, M. Berbets, O. Vernik, E. Girusov, O. Golovko. The analysis of studies devoted to the problem of the formation of the ecological culture of future teachers of natural sciences showed that the theoretical and methodological foundations (components, criteria, levels) of the formation of an ecological culture in them are insufficiently researched.

Aims. The aim of the article is to reveal in a complex the components, criteria and defined pedagogical conditions that would contribute to the effective formation of the ecological culture of future teachers of natural sciences.

Methods. To realize the goal, the following methods were used: theoretical – analysis of scientific literature, synthesis, comparison, generalization and systematization of the obtained data to compare the different views of scientists on

the problem of forming the ecological culture of the future teacher of natural sciences, distinguishing the structural components of the ecological culture of the future natural science teacher, clarifying peculiarities of the organization of training of future teachers of natural sciences at higher education institutions; empirical – pedagogical observation, questionnaires, testing, conversation.

Results. Ecological culture, like all culture as a whole, is dialectically interconnected with social processes taking place and determined by the laws of their development. As a social phenomenon, the ecological culture of a teacher is directly dependent on those social relations in which an individual enters. On the basis of the theoretical analysis of psychological and pedagogical literature, the study of advanced pedagogical experience, we define the environmental culture of a student of higher education as an integrative quality of the individual, which corresponds to the level of his development in the field of environmental activities.

The state of environmental education and upbringing of students directly proportionally depends on the level of formation of the environmental culture of the teacher and his professional readiness for the specified direction of pedagogical activity. S. Sovgira rightly noted that the formation of the ecological culture of the future teacher of natural sciences should go through: acquisition of ecological knowledge, formation of ecological thinking, worldview, ethical principles of behavior in nature; conducting local history excursions, expeditions, trips, developing an active nature conservation position, forming the necessary qualities of an educator, organizer [1].

In the study of E. Fleshar, environmental education is considered as a process, as a result of which relevant knowledge and skills of theoretical and practical work in the field of environmental protection are formed [2].

L. Nikitchenko identified the following pedagogical conditions for the successful formation of a teacher's professional competence: ensuring the combination of theoretical material with practical activities; activation of students' independent cognitive and research activities; providing the goals of professional training in the process of learning personal meaning [3].

According to L. Fenchak, the main pedagogical conditions for the formation of ecological culture are: implementation of the continuity of environmental education in the process of training specialists by taking into account the specifics and requirements of the educational and qualification characteristics of the specialty; reflection in the content of ecological and educational work of regional ecological problems; environmentalization of educational work based on taking into account folk customs; implementation of an activity approach to the formation of environmental knowledge, beliefs, norms of behavior, etc. [4].

Based on the analysis of the scientific literature, the following components of the formation of the ecological culture of future teachers of natural sciences in the process of their professional training were identified: motivational-value, cognitive, procedural and reflective-personal.

The motivational-value component involves higher education students' awareness of nature as an independent value, the deep interest of future teachers of

natural sciences in studying the ecological state of the environment, conviction in the education of moral and ecological qualities necessary for the active development of methods of cultural assimilation and cultural creation. This component includes an understanding of the need to have ecologically professional motives, beliefs and to define ecologically valuable orientations, as well as awareness of the need to carry out ecologically oriented professional activities.

The indicators of this component are: 1) the presence of natural science students' interest in studying the state of the environment and in solving environmental problems; 2) their awareness of the specifics of their future ecological and professional activity, the desire to carry it out; 3) the presence of a dominant type of motivation for professional activity aimed at the formation of environmental culture in students; 4) the existence of permanent motivational instructions for achieving the set environmental and professional goals [2].

2. The cognitive component includes the formation of a certain system of psychological-pedagogical, chemical, geographical, ecological, biological knowledge, which will ultimately ensure the development of ecological thinking. This system consists of: a) knowledge, on the basis of which certain beliefs, ecological value orientations are formed and ideals are nurtured; b) knowledge that affects the formation of skills to carry out ecologically safe professional activity; c) knowledge, which is the basis for the development of a personal and valuable attitude to the results of ecologically oriented professional activity.

The indicators of this component are: 1) the presence of a certain amount of knowledge in such disciplines as: «Fundamentals of ecology», «Ecology», «Human ecology», «Ecology of plants and animals», «Methodology of teaching biology and natural science», «Methodology of teaching ecology»; 2) the ability of future teachers to operate in their ecological and professional activities with appropriate terms, concepts, categories, rules, formulas; 3) understanding the content, essence, signs and stages of teaching and pedagogical work aimed at forming an ecological culture in students; 4) constant independent work on expanding and deepening one's knowledge of natural sciences, improving environmental professional skills and abilities.

3. The procedural component provides for the formation of environmental professional skills, skills and experience necessary for the implementation of environmentally safe activities with students of general secondary education institutions. In this component, the leading place belongs to the level of mastery of methods and technologies for the development of the cognitive, emotional, volitional and motivational spheres of the personality of the future teacher, forms of his activity aimed at preserving and restoring the environment [5]. The success of the future teacher's ecological professional activity depends on raising his individual cultural level and enriching the experience of applying the system of ecological knowledge to the ability to use typical forms, methods and means of teaching students of natural sciences in educational work; skills to apply pedagogical innovations, the latest technologies, active methods and techniques in one's environmental professional activity; the ability to conduct search and research and scientific expedition work in an ecological direction; the formation of the necessary level of professionalism, the

ability to professional self-improvement throughout life; the ability to apply environmental assessment technologies and develop a clear program of environmental protection measures; the ability to solve various environmental situations, find ways to solve complex environmental problems.

4. The reflective-personal component involves the presence of cognitive qualities, norms of ecological behavior, communication, ecological reflection; certifies the formation of ecological professional reflection in the future teacher, which involves self-assessment and self-correction of his environmental professional activity. The composition of such reflection includes the ability to realize the attitude of higher education students towards them, as well as the ability to diagnose and model their future professional activity taking into account the results of reflection [6].

Indicators of this component are: 1) future teachers' awareness of the need to achieve specific results of ecological-pedagogical and ecological activities; 2) the ability to carry out self-assessment and self-monitoring of the work carried out aimed at the formation of environmental activities at the appropriate level; 3) the ability to diagnose one's environmental professional activity with the aim of further modeling it, taking into account the admitted shortcomings and miscalculations; 4) constant enrichment of the experience of ecological and pedagogical self-expression and ecological and creative self-realization of ecological culture during professional training.

Higher education teachers should use distance education technologies in the process of training future teachers, which will allow more effective formation of the above-mentioned components of the ecological culture of future teachers of natural sciences in the process of their professional training [7].

Value-orientational, knowledge-based, practical-active and reflective-evaluative criteria were determined to assess the levels of ecological culture formation of future teachers of natural sciences in the process of professional training. We present their characteristics.

1. The value-orientational criterion is the formation of the ecological and professional orientation and personal motivation of the future teacher of natural sciences in the process of professional training; the presence of students of higher education in natural sciences interested in studying the state of the environment and in solving environmental problems; their awareness of the specifics of their future ecological and professional activity, the desire to carry it out; the presence of a dominant type of motivation for professional activity aimed at the formation of environmental culture in students; the existence of permanent motivational instructions for achieving environmental professional goals [8].

2. Knowledge criterion – formation of a certain system of knowledge in future teachers of natural sciences for the implementation of environmental professional activities in general educational institutions; the presence of a certain amount of knowledge in such disciplines as: «Fundamentals of ecology», «Ecology», «Human ecology», «Ecology of plants and animals», «Nature protection», «Methodology of teaching biology and natural science», «Methodology of teaching ecology»; the

ability of future teachers to operate in their ecological and professional activities with appropriate terms, concepts, categories, rules, formulas; understanding the content, essence, signs and stages of teaching and pedagogical work aimed at forming an ecological culture in students; constant independent work on expanding and deepening one's knowledge of natural sciences, improving environmental professional skills and abilities.

3. The practical and operational criterion is the formation of future teachers of natural sciences, a set of abilities, skills, and experience in conducting eco-cultural work in institutions of general secondary education, in the process of which the formation of ecological culture in students will be carried out; having the ability to use typical forms, methods and means of teaching students of natural sciences in educational work; skills in applying pedagogical innovations, the latest technologies, active methods and techniques in one's environmental and professional activities; the ability to conduct exploratory research and scientific-expedition work in an ecological direction; the formation of the necessary level of professionalism, the ability to professional self-improvement throughout life; the ability to apply environmental assessment technologies and develop a clear program of environmental protection measures; the ability to solve various environmental situations, find ways to solve complex environmental problems.

4. Reflective and evaluative criterion – formation of environmental and professional reflection in the future teacher of natural sciences; awareness by future teachers of the need to achieve specific results of ecological-pedagogical and environmental activities; the ability to self-assess and self-monitor the work performed at an appropriate level, aimed at forming the environmental culture of students; the ability to diagnose one's environmental professional activity with the aim of further modeling it, taking into account the admitted shortcomings and miscalculations; constant enrichment of the experience of ecological and pedagogical self-expression and ecological and creative self-realization of ecological culture during professional training. The selection of criteria and their indicators made it possible to determine the levels of environmental culture formation of future teachers of natural sciences: low, medium and high. A low level is characterized by a lack of motivation to study the state of the environment and to solve environmental problems; low level of professional and ecological and cultural knowledge, insufficient environmental literacy; lack of awareness of the specifics of their future professional activity; the lack of ability to assess the state of the environment, to influence the solution of environmental problems; lack of ability to assess one's level of achievement, their independence and activity; inability to self-improvement, self-development, self-regulation, quick and effective independent decision-making. The average level is characterized by insufficient motivation for professional growth and the formation of environmental culture; possessing an insufficient amount of knowledge of ecological culture; the presence of certain difficulties in the practical and operational application of knowledge in the process of solving specific professional tasks; with an average level of formation, the ability to solve environmental problems; insufficient motivation for self-improvement and self-

development, speed and efficiency of independent decision-making. A high level is characterized by high motivation for professional improvement in the formation of environmental culture in students; formation. So, we identified four main components of the formation of the ecological culture of future teachers of natural sciences in the process of their professional training: motivational and valuable (deep interest of students in studying the ecological state of the environment, their belief in the education of moral and ecological qualities in schoolchildren), cognitive (the formation of a certain system of psychological-pedagogical, chemical, geographical, ecological, biological knowledge that ensures the development of ecological thinking), procedural (the formation of environmental and professional skills, skills and experience necessary for the implementation of environmentally safe activities with students of general educational institutions), reflectively personal (the formation of students' abilities to realize the results of their environmentally-oriented activities, objectively evaluate them and determine their attitude towards them, as well as the ability to diagnose and model their future professional activity taking into account the obtained results of reflection) [8].

Discussion. The effectiveness of the formation of the ecological culture of future teachers of natural sciences will depend on the implementation of the pedagogical conditions defined by us during their professional training at the institution of higher education. Before considering them, let's define the concept of «pedagogical condition». In the explanatory dictionary of the Ukrainian language, it is noted that a condition is «a necessary circumstance that makes possible the implementation, creation, formation of something or contributes to something» [9, c. 632]. The «Philosophical Encyclopedic Dictionary» provides the following definition: «a condition is a philosophical category that reflects the universal relations of a thing to those factors due to which it arises and exists. Thanks to the presence of appropriate conditions, the properties of things change from possibility to reality» [10, p. 482]. In the philosophical sense, conditions determine the external circumstances that determine the occurrence of a certain phenomenon, the result of purposeful activity [10, p. 482].

Therefore, without the presence of such circumstances, the desired phenomenon cannot occur. Since we reveal the meaning of the concept of «pedagogical conditions», it is logical to say that we are talking about the circumstances related to the organization of the educational process in a higher education institution, with the external educational environment in which cognitive, scientific and research and educational activities of higher education students, aimed at forming their professional knowledge, abilities and skills, development of their worldview culture, professional competence, etc. M. Malkova offers us the following definition of this concept: it is «a set of external and internal circumstances (objective measures) of the educational process», the implementation of which depends on the achievement of the set didactic goals [11, p. 98]. T. Kaminina (2006) clarifies that pedagogical conditions include only those that are specially created in the pedagogical process and the implementation of which ensures the most effective course of it [12]. There is also the following definition: «Pedagogical conditions are a category that is defined

as a system of certain forms, methods, material conditions, real situations, objectively formed or subjectively created, necessary to achieve a specific pedagogical goal» [13, p. 113]. Scientists divide pedagogical conditions into: a) external: positive relations between teacher and student; objectivity of assessment of the educational process; place of study, premises, climate, etc.; b) internal (individual): individual properties of students (state of health, character traits, experience, abilities, skills, motivation, etc.) [14, p. 15]. Summarizing the above definitions, we present our own definition of the pedagogical conditions for the formation of the ecological culture of future teachers of natural sciences in the process of professional training: this is a set of interrelated circumstances that contribute to the organization and implementation of the educational process in a higher education institution, taking into account the needs, interests, and opportunities of students of higher education education, which involves the preparation of a harmoniously developed personality with formed ecological knowledge, abilities and skills, personal and value attitudes regarding nature protection, an ecological worldview, an ecological style of thinking, which enable carrying out ecological activities aimed at modeling and forecasting an ecologically safe environment, solving ecological problems Ukraine and the world.

We have determined the following main pedagogical conditions for the formation of the ecological culture of future teachers of natural sciences in the process of professional training: 1. Targeted design of the informational and ecological educational environment in higher education institutions. 2. Ensuring the motivational and value attitude of future teachers of natural sciences towards professional activities aimed at environmental education of schoolchildren. 3. Greening of the content of education on the basis of interdisciplinary integration. 4. Use of innovative forms, methods and technologies of learning to activate educational and cognitive activities. 5. Introduction of interactive interaction in the «teacher-student-teacher-pupil-nature» format to improve the practical skills of higher education students.

We will characterize the identified pedagogical conditions and reveal the possibilities of their implementation in the educational process of the higher education institution. The first pedagogical condition is the purposeful design of the informational and ecological educational environment in higher education institutions. Summarizing the existing scientific definitions of the concept of «educational environment», we can state that the majority of scientists consider the educational environment as a multi-level system of conditions (circumstances, factors, opportunities) that provides optimal parameters of the educational activity of a certain educational subject in all aspects – target, content, procedural, effective, resource. In the modern world, there is a dependence between the professional success of specialists and the quality of their training in information technologies, which is mostly determined not by the amount of knowledge they have acquired, which changes rapidly, especially in the field of information technologies, but by the level of development of thinking, the ability to learn independently throughout life, to continuously improve oneself. The increase in requirements for the information activity of specialists necessitates the introduction of information technologies in

order to increase the effectiveness, intensity and instrumentality of their professional activity. The use of information resources allows you to get rid of routine work, thereby increasing the quality of professional activity. Traditional didactic requirements characterize such properties of informational educational resources as scientificity, accessibility, problematic, visibility, activation of activity, adaptability, interactivity. Therefore, specialists working in the education system must not only know where and how to find the necessary educational materials in telecommunication networks, but also be able to use similar networks in various educational situations, know how to conduct classes using multimedia technologies, how to apply multimedia learning tools [15]. According to V. Yefimenko (2002) [16], the creation of an information environment for any subject activity as a result of the development of informatization, information and especially telecommunication technologies leads to a radical rethinking of the goals, content, forms and methods of training specialists at a new modern level. At the same time, the main principles underlying the development of information environments are as follows: the open nature of the information system; organization, self-organization and development; the multivariate nature of the development of the information environment; creation of an educational environment as a favorable social environment that actualizes the intellectual, moral and communicative capabilities of the individual, which ensure comfortable integration in society and culture. According to the researcher, these components are: subject-object, functional-target, technological, diagnostic-resultative. The current stage of the development of the Ukrainian educational space is characterized by its systematic reformation, modernization, support for innovative development, transition to multifacetedness not only as a promising direction, but also as a completely new quality. The main condition for the success of informatization of education is a new position of the teacher (knowledge of techniques for working with new computer technology and the ability to effectively use this knowledge to solve pedagogical tasks).

One of the necessary conditions for the successful implementation of the modernization of education at the current stage is the formation of a single informational educational environment at all levels with the provision of their integration. The creation of a single informational educational environment in each educational institution is of primary importance in this process.

The creation of such an environment contributes to the development of educational, pedagogical, managerial and service activities of an educational institution, where information and communication technologies play a leading role, allowing to improve the quality and accessibility of the educational process. It is the teacher who decides how, to what extent and for what purposes information and communication technologies can be used in the educational process. That is, the teacher is one of the most active participants in the creation of a single informational educational space of the educational institution. The introduction of information and communication technologies into the teaching process of all subjects requires the improvement of the teacher's information culture, the introduction of new teaching methods using computer technologies. The formation of information and

communication competence of the teacher and student requires special attention. Without this, it is impossible to carry out the educational process in a single informational and educational space.

The informational educational environment should perform the following functions (Figure 1) [15].

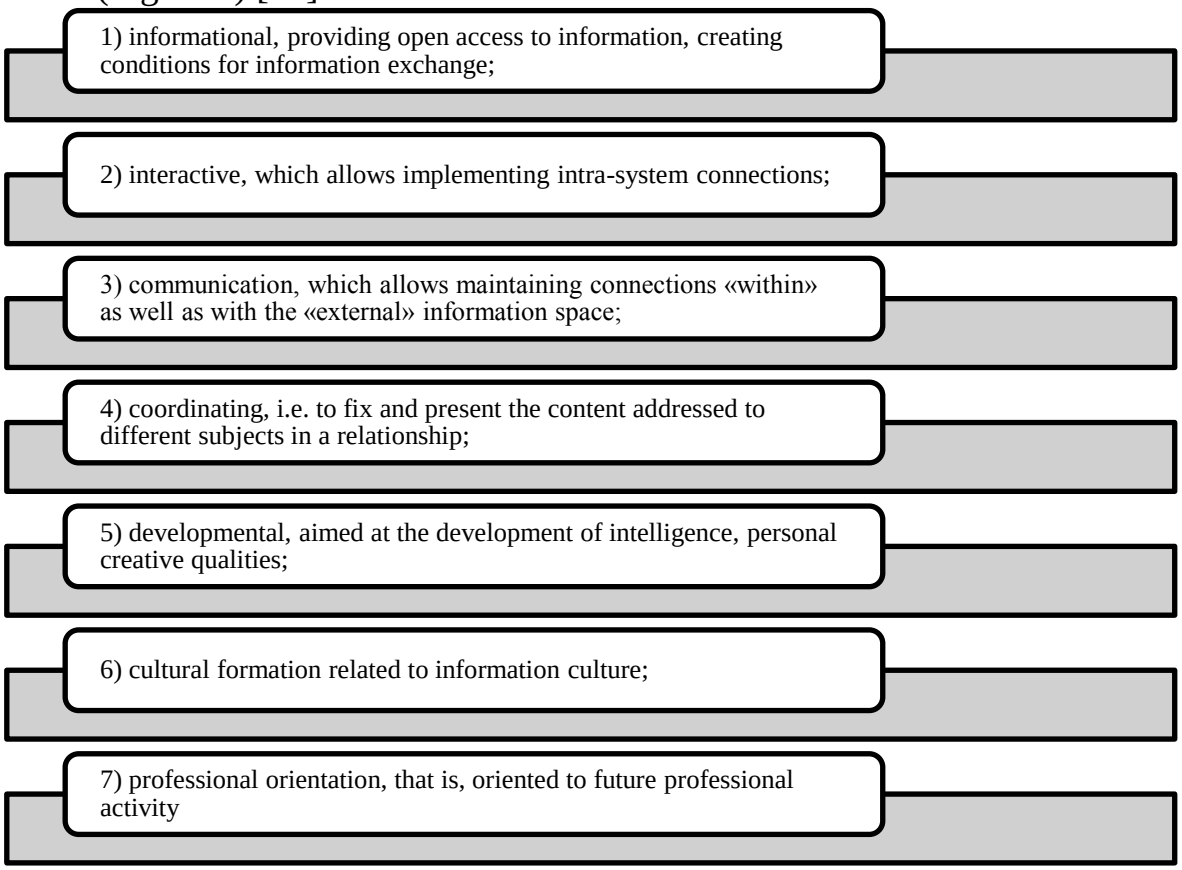

Figure 1. The functions of informational educational environment

Source: developed by the authors

Graduates of a higher education institution in such an informational and educational environment are able to: use computer technologies to prepare for classes; use Internet technologies in the organization of additional education; apply training testing; participate in Internet contests and Olympiads; discuss current issues on the forum, in Skype, on the website of the higher education institution; learn to work with information presented in various forms, select and systematize scientific material, create messages, reports on a given topic, draw up a plan, etc.; participate in telecommunication projects.

The educational environment of a higher education institution is a multi-subject and multi-subject systemic formation that purposefully influences the professional and personal development of a future specialist, ensuring his readiness for professional activity and / or continuing education, successful performance of social roles and self-realization of life activities [17]. The above-mentioned page contains all the information necessary for a student of higher education: lecture texts, plans for practical classes, topics and tasks, additional material for independent and individual work, methodological recommendations for its implementation, a manual, test tasks

for final control, questions for credit (exam). The information-ecological educational environment in this form ensures: satisfaction of the needs of students of higher education in the prompt acquisition of environmental information, which is provided by the training programs of professional disciplines; development of the need for students of higher education to constantly update their environmental knowledge, to form ecological thinking and expand the ecological outlook; the use of computer information technologies during the teaching of professional disciplines and conducting extracurricular environmental activities; creation of electronic catalogs of educational informational environmental materials and regulatory and legal documents on environmental protection; higher education students use the information network – the Internet – to perform independent and individual educational and research tasks on environmental topics; the ability to monitor your rating points, correct your mistakes and increase your rating within a certain period of time. The future teacher of natural sciences must first of all possess a certain amount of knowledge of the academic disciplines that he will teach. Knowledge as an element of environmental education of a student of higher education combines cognitive and active components of education. Cognitive components include not only the volume of ecological knowledge, but also determine the student's internal ecological culture, form in him readiness for active conscious activity to harmonize relations in the "Man-society-nature" system. Therefore, the preparation of students of higher education to carry out ecological and professional activities in the institution of general secondary education should take place on the basis of the synthesis of three main modern trends: 1) trends in the formation of modern ecological concepts; 2) formation of a new attitude towards nature; 3) formation of new strategies and technologies of interaction with nature.

The basic components of the ecological knowledge of a student of higher education are: the concept of the biosphere and biocenoses; circulation of matter, energy and information; Earth in the Solar System and in Space; system man-society-biosphere-space, direct and reverse connections; basic concepts, terms and laws of ecology; main types of regional problems; the basics of environmental economics; environmental audit and control; basics of environmental law; basics of environmental ethics and culture; the basics of environmental management [18]. During the study of the discipline «General Ecology» we consider such topics as: «Ecological culture», «The role of environmental legislation in the stabilization and improvement of the environment, protection and preservation of the natural environment, species diversity», «Participation of Ukraine in international cooperation in the field of environmental protection», «Ecological factors, their influence on the existence and development of organisms in the biosphere», «Anthropogenic degradation of the biosphere». As a result of studying the specified discipline, students of higher education acquire a set of knowledge about the role of interrelationships of all natural processes and phenomena; causes and consequences of local, regional, global environmental crises; about ways to improve the environmental situation. Learning outcomes of this discipline: students of higher education should conduct environmental protection work among the population and

draw conclusions about specific environmental situations. The amount of knowledge acquired and the competences obtained during the study of the course contribute to the formation of higher education students' personal attitude to the environmental problems of Ukraine and the world, their native land, and the field of future activity. This discipline will serve as a basis for the further study by students of higher education of the following natural sciences, it must be clearly consistent with them by establishing inter-subject connections, promote the assimilation and deep understanding of the physico-chemical essence of natural phenomena.

As a result of the study of ecology, students of higher education should develop the ability to evaluate objects, processes, phenomena from the point of view of ecology, orient themselves in modern ecological concepts, carry out effective practical activities for nature protection, and solve various socio-economic tasks and environmental problems. We used this form of education in classes on studying the role of man in the development of the biosphere and its impact on the environment; effects of radiation on plants, animals, and humans; the main sources of environmental pollution in their locality; land reclamation measures; nature protection and ecological problems in agriculture. For such a lecture, we prepared a series of consecutive questions, starting with the exact formulation of the problem itself, and then – questions on individual parts of the still unsolved general problem. The teacher had to be well aware of which of the possible options for solving the problem is optimal, and most importantly, what educational material should be learned in the process of solving a certain problem. In this way, during a problem lecture, the teacher manages the process of solving the problem, helps students of higher education in analyzing conditions and choosing a plan, provides consultations, activates their search and research activities, helps them find means of self-control, considers mistakes with those who admitted, organizes a collective discussion [20].

The formation of regional knowledge competence among future teachers of natural sciences is an important educational task [21]. The future teacher should himself notice the changes in the nature of his region that occur as a result of human activities, record them, analyze and draw appropriate conclusions, observe the environmental protection measures of both the state and individual communities, the activities of individual people to improve the ecological situation in the country, and involve before conducting observations of his students.

Conclusion. So, it has been found that the ecological culture of future teachers of natural sciences as an integrative personal characteristic is a collective unity of motivational and value (interests, desires, aspirations, value orientations, motives for choosing a profession, the need to acquire a system of knowledge and skills for carrying out ecological-pedagogical activities), cognitive (a system of natural-scientific and psychological-pedagogical knowledge that ensures the formation of an ecological worldview and thinking, and also determines methodical strategies and tactics for their formation in students), procedural (a system of ecological-pedagogical skills and abilities necessary for environmental education and upbringing of students), reflective and personal (norms of ecological behavior, communication, ecological reflection, the ability to self-educate and self-improve one's own

ecological and pedagogical activities, self-correction and self-analysis of behavior in an ecological situation, professionally important personal qualities for diagnosing and modeling future professional activity taking into account the obtained results of reflection) components, the presence and degree of formation of which enable the effectiveness of ecological and pedagogical activities. According to the components, the criteria (value-orientational, cognitive, practical-active, reflective-evaluative) and levels (low, medium, high) of the formation of ecological culture of future teachers of natural sciences are determined. Based on the analysis of scientific literature and practical experience, the pedagogical conditions that contribute to the formation of the ecological culture of future teachers of natural sciences are identified and substantiated, and their characteristics are presented. The directions of further scientific research include the following: elucidation of the peculiarities of the professional training of teachers of natural sciences in the leading countries of the world; formation of scientific and research culture of teachers of natural sciences, etc.

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