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PAPER

Pedagogical Aspects of the Formation of Ecological Competence of Specialists of the Maritime Branch

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ABSTRACT

The negative anthropogenic impact on the biosphere has caused the deterioration of the ecological situation throughout the world. In Ukraine, this process has been aggravated by the consequences of Russian aggression. The modern postindustrial society needs highly qualified specialists who are able to think critically, act quickly and decisively in nonstandard situations associated with damage to the natural environment. Our study is devoted to various aspects of improving the methods of using modern pedagogical technologies aimed at developing environmental competence among future specialists in the navigation and management of marine vessels. Based on the results of our study, the pedagogical conditions that have the greatest impact on the formation of environmental competence of future specialists of the maritime branch were identified and characterized. To such conditions, we attributed the increase in the motivation of applicants for environmental protection and careful use of the environment in the process of carrying out future professional activities; introduction of modern forms of education (environmental trainings, project method) to enhance the educational process; and increased attention to problem-solving and decision-making in stressful situations, taking timing into account. It should be noted that future specialists have a significantly increased level of environmental competence, which primarily affected the quality of solving practical problems of an environmental nature and the speed of decision-making. The results obtained in our study were used in the development of curricula and educational and methodological support in order to improve the environmental preparation of applicants for education for their practical professional activities in matters related to ensuring environmental safety, environmental conservation, etc. Our practical research has had a positive impact on the formation of environmental competence of applicants for maritime education who are in the process of professional training through the introduction of modern forms of education and the implementation of the pedagogical conditions we have defined.

KEYWORDS

ecological competence, ecological education of specialists of the maritime branch, preservation of the environment

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1 PROBLEM STATEMENT

The negative anthropogenic impact on the biosphere has caused the deterioration of the ecological situation throughout the world. In Ukraine, this process has been aggravated by the consequences of Russian aggression.

In light of the global challenges facing modern society, the problem of the formation of environmental competence of the individual is coming to the forefront. Despite a number of society's worldwide efforts to improve the ecological state of the biosphere, an ecological crisis is growing on the planet, caused by ill-conceived and irresponsible human activities. The anthropogenic factor of environmental impact has become decisive, which has led to an increase in the importance of the issue of the formation of human environmental competence.

Many authors note that the situation of the global ecological crisis requires understanding of new approaches to the analysis of the interaction between nature and society on the basis of the formation of a certain environmental competence. The problem of insufficient ecological competence and the need for each person to develop this competence are the subject of a number of psychological and pedagogical studies. At the same time, the competence-based approach as an effective target basis of education today finds very wide application at different levels – general, professional, additional education – as well as in various subject areas (including environmental).

It should be noted that today there is no single approach to the definition of the concept of environmental competence. Different authors differ in its understanding from the indicator of the quality of environmental education and the component of life competence to the reflection of a person's relationship with the entire social and natural environment surrounding him or her. It is also interpreted as a category of environmental activities associated with environmental consciousness, thinking and values, etc. At the same time, there are a number of requirements of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) of 1978, which specifies internationally recognized requirements for environmental competence for specialists of the maritime branch, which must be taken into account in the educational process.

Thus, it becomes obvious that the environmental competence of a future specialist is an important component of that person's life and professional competence, without which that specialist cannot be considered fully ready for professional activities.

Ukraine, like many other countries of the world, is moving from the established adaptive model of higher education, inherent in industrial and postindustrial society, to a qualitatively new model of higher education, which is characteristic of the information society – the knowledge society. At the present stage of social development, improving the activities of the higher education system requires a comprehensive design of models of all its links, modeling the process of training future specialists in such a way that it provides professional and life competence, high-quality professional knowledge and skills, professional mobility and sustainability, competitiveness of graduates [1]. All of the above-mentioned needs lead to an understanding of the need to revise the meaning of the definition of "environmental competence" and the concepts associated with it and to find ways to improve the efficiency of its development among applicants for higher education, in general, and among future specialists in the maritime industry, in particular.

The development of environmental competence requires a clear mutual agreement of individual forms and means of its development, especially in the context

of professions directly related to potentially environmentally hazardous activities, which include the profession of navigator.

2 ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

In world practice, environmental education is recognized as one of the main factors in the ecologisation of all types of human activity and is one of the priority areas of educational activity. The following scientists have dealt with the problems of environmental education and upbringing: S. Alekseev, V. Brovdiy, O. Voznyuk, S. Glazachev, N. Dagbaeva, S. Deryabo, M. Drobnokhod, A. Zakhlebny, I. Zverev, S. Kravchenko, M. Kostitsky, V. Krisachenko, G. Pustovit, A. Sidelkovskiy, I. Suravegina, S. Shmaley, et al. A. Gurenkova and L. Lukyanova have devoted their studies to the formation of environmental competence of future water transport specialists [2]. M. Babyshena, V. Voloshin, V. Dobrovolska, S. Zubrilov, V. Istomin, S. Levkovsky, E. Mann-Borgese, S. Misevich, M. Padun, V. Pozdnyakova, A. Svarichevska, V. Shmakov, et al. have considered various aspects of the environmental competence of future specialists in the maritime industry. S. Khanmamedov and V. Gorbov have studied the relationship between professional and environmental competencies of seafarers.

The issues of modeling the professional training of future marine specialists are reflected in the works of such scientists as V. Dulin, G. Emad, O. Kasyanov, V. Rot, E. Skachko, L. Stupina, N. Repin, V. Fadeeva, et al.

Despite the research conducted by researchers on the problem of the formation of environmental competence of future navigators and other maritime professionals, this problem has not been finally resolved due to the complexity of the phenomenon of environmental competence. The issue of formation of a navigational profile of environmental competence among applicants for education requires finding ways to increase efficiency to ensure the competitiveness of future specialists in both the domestic and international labor markets.

3 STATEMENT OF BASIC MATERIAL AND THE SUBSTANTIATION OF THE OBTAINED RESULTS

The modern postindustrial society needs highly on qualified specialists who are able to think critically and act quickly and decisively in nonstandard situations associated with damage to the natural environment. Our study is devoted to various aspects of improving the methods of using modern pedagogical technologies aimed at developing environmental competence among future specialists in the navigation and management of marine vessels.

The objectives of the study were:

- determination of the phenomenology of environmental competence for a specific category of applicants for education – bachelors with a specialization – 271.01 “Navigation and Control of Ships”;
- substantiation of pedagogical conditions for the formation of environmental competence of future officers of the civil fleet by means of interactive technologies;
- ability to experimentally check the effectiveness of the implementation of pedagogical conditions for the formation of environmental competence of applicants for education.

In our study, we set out to show that the formation of environmental competence in the process of obtaining environmental education by applicants serves as a conductor of environmental culture in the content of training, performs a personality-developing function in the methodology and technology of training, and implements the function of orientation in the organizational and practical construction of training.

We set up a psychological and pedagogical experiment on the basis of the Danube Institute of the National University "Odessa Maritime Academy", during which trainings, seminars and workshops on the development of environmental competence were developed and conducted. Applicants for education took part in didactic games of an ecological orientation, solved problematic tasks, etc. Considerable attention was paid to self-training using the project method.

Based on the results of the experiment, the depth and consistency of environmental knowledge obtained by future bachelors, necessary for the implementation of professional activities from the standpoint of environmental conservation, was investigated; special attention was paid to the study of the ability of applicants for education to achieve introspection and objective self-assessment of professional activity from the standpoint of compliance with environmental laws, norms and rules adopted in the international community.

Providing quality environmental education cannot be limited to one academic discipline. Environmental knowledge is interdisciplinary in nature. An important component of life and professional competence, without which now no specialist can be considered fully trained to carry out professional activities, is one's environmental competence. The national system of maritime education in Ukraine is based on the state educational policy and the concept of the state maritime policy, the purpose of which is the comprehensive development of the individual, providing the national economy with qualified specialists capable of fulfilling the duties of ensuring the safety of navigation, protecting human life, and protecting the aquatic environment [2]. In other words, a modern navigation specialist should have a fairly high level of environmental culture. In general terms, agreeing with S. Ignatov, by understanding the ecological culture of the individual, we will understand (1) the degree of ecological development due to the development of the ecological culture of society and (2) the value of information and environmental education of the individual, which allows that person to navigate adequately in various environmental situations and to observe adequate behavior [3].

According to N. Semenyuk, ecological culture expresses the degree of development by the subject of nature-transformation activities, the correspondence of *social* and *natural* as components of a single system. Ecological culture underlies ecological activity and ecological behavior, which include a combination of a socially developed way of self-realization by a person in nature, cultural traditions, life experience, moral feelings and a person's attitude to nature [4].

Let's define ecological competence based on the fact that it is a part of ecological culture. The Ukrainian researcher L. Lukyanova understands the systemic integrative quality of a person as the ecological competence of a specialist which is determined by the totality of abilities to solve problematic issues and tasks of different levels of complexity that may appear in everyday life and professional activity on the basis of the established value attitudes toward nature, knowledge, educational

and life experience, individual abilities, needs and motives [5]. A specific combination of different abilities of the subject of activity forms the basis of professional behavior aimed at solving environmental issues. Let us turn to the documents of the international project "Definition and Selection of Competencies" (DeSeCo) [6]. In it, although environmental competence is not called out directly in that text, it is noted that social competence should cover a more voluminous area and include a component related to the regulation of relations in the system "man – society – nature". The need to determine the list of competencies based on a common vision of the world's future is indicated.

The specifics of the professional activity of maritime navigation specialists lie in the need to constantly improve the quality of professional training of marine specialists in order to competently carry out their own professional activities in compliance with the requirements of the International Maritime Organization (IMO), the STCW Convention 78/95 with the Manila amendments of 2010 [7]. The Manila Amendments state that maritime professionals must be aware of vulnerable sea areas regarding pollutant release; areas where navigation is prohibited or to be avoided; special areas under the MARPOL Convention; limitation of oil spill response equipment; an action plan for rising volumes of garbage, bilge water, sludge, sewage, etc.; and consequences of pollution in a cold climate. Also in this document, in sections relating to the requirements for familiarization, initial training and safety briefing for marine specialists, such requirements are noted for them, such as:

- possession of methods and means to prevent pollution of the marine environment from ships;
- a basic working knowledge of the relevant IMO conventions relating to the safety of life at sea and the safety and security of the marine environment;
- knowledge of the precautionary measures to be taken to prevent pollution of the marine environment;
- possession of equipment related to the prevention of pollution of the marine environment;
- knowledge of the degree of importance of measures to protect the marine environment [7].

From a practical point of view, for applicants for education, this means the need to acquire:

a) systems of knowledge about the environment (social and natural in their interconnection and interdependence) [2];
b) motivation to ensure professional activities based on compliance with the principles of safety and environmental protection;
c) practical experience in using knowledge to prevent environmental problems in the field of professional activity;
d) forecasting the appropriate behavior and activities in the professional sphere and everyday life;
e) the need to communicate with nature and the desire to participate in its restoration and conservation [2].

Thus, agreeing with the opinion of N. V. Kurylenko, we note that environmental competence can be defined as an integrated result of students' educational activities, which is formed primarily due to mastering the content of environmental subjects and gaining experience in using environmental knowledge in the process of teaching special and professional curricula [8].

Based on the position of a systematic approach, in order to ensure a transdisciplinarity, comprehensive impact, a model was built for the formation of environmental competence of future navigators. This model was created on the basis of the current educational process at the Danube Institute of the National University "Odessa Maritime Academy". Various aspects of the training of future navigators were analyzed, the shortcomings of the existing environmental training were identified, pedagogical conditions were identified that contribute to improving the efficiency of the development of environmental competence and methods for this development were determined.

To implement theoretical calculations, we set up a psychological and pedagogical experiment. In total, 398 students took part in the experiment, 197 of whom were the control group, and 201 were the experimental group; the training was carried out in accordance with the constructed model.

Let us briefly describe the model developed by us. Under the model, we will understand a certain system of a lower order in comparison with the educational process of the formation of environmental competence, which contains the main components of this process and takes into account its main aspects.

Since the educational process is an open system, the external environment has a decisive influence on it. From our point of view, the most important factors of influence are the social order and the legal framework. It is the social order that determines the need for a certain number of specialists of a particular profile and regulates the level of competence necessary for society. By the legal framework, we mean both national and international standards, rules and documents that perform the regulatory function of content of environmental competence. The main ones include: "On the Protection of the Environment", "Water Code of Ukraine", the law of Ukraine "On the Basic Principles (Strategy) of the State Environmental Policy of Ukraine for the period up to 2030"; the Antarctic Treaty; the International Convention on Intervention on the High Seas in Case of Oil Pollution Accidents; the Stockholm Declaration (on environmental matters); the Convention for the Prevention of Marine Pollution by Emissions of Wastes and Other Matter; the United Nations Convention on the Law of the Sea; the Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation; Convention on the Protection of the Black Sea from Pollution; etc.

For ease of perception, the model itself is conditionally divided into several blocks. The first block is methodologically targeted. It involves the definition of goals and objectives. The goal is to form the professional qualities of future navigators in the process of professional training. This overall goal is detailed into three types of goals:

– *social goals* are the development of various aspects of environmental culture that meet the requirements of modern society. These goals are the ideal qualities of the individual, corresponding to the level of development and the demands of society;

– *didactic goals* have to master the content of environmental education, acquire and develop the skills and abilities of applicants for education on environmental issues, in accordance with modern requirements, due to the development of science, culture, education, and society;
– *personal goals* are realized by stimulating the personal innovative search activity of future navigators, developing their spiritual and creative potential, meeting urgent professional needs, forming the basis for further personal growth, etc.

We will describe the scientific apparatus of the model very briefly (Figure 1). Agreeing with N. Kurylenko [8], we consider the main approaches to be as follows:

– *scientific approach*, which covers definitions, patterns, information that is basic for interaction in the "man-nature-society" system. This principle is responsible for ensuring scientific and innovative knowledge in the process of professional environmental training;
– *systematic approach*, which is aimed at understanding professional environmental training as a holistic education that has meaningful, structural and functional connections;
– *value approach*, which is based on the awareness of the need for a responsible attitude to the natural environment and personal contribution to the conservation of nature in the process of professional activity;
– *normative approach*, which is aimed at the assimilation of a set of environmental standards, laws, and rules governing professional activities;
– *personal-activity approach*, which provides the formation of professional skills of environmental activities.

The next element of the model includes principles. Under the principles of formation of environmental competence of future navigators, we mean the most general initial provisions, which are the basis for the selection of methods and techniques for the process of professional training of applicants for higher education.

Let's briefly describe them. The principle of consciousness, activity and independence is based on the purposeful motivated activity of the applicant. The principle of accessibility means that applicants are required to receive the latest knowledge, as far as they are able to perceive it. The principle is closely associated with the principles of thoroughness, systematicness and consistency. The principle of linking learning with practical activities has a significant role. The principle of continuity and the principle of innovation require knowledge of existing solutions, concepts and the ability to identify key contradictions in these concepts and search for new options for resolving the problem. The principle of verification requires establishing the veracity of scientific statements based on the results of empirical verification.

We also considered special principles: the principle of consistency and continuity; the principle of integrity and integration; the principle of interconnection of local, regional and global approaches in the educational process; the principle of unity of the content and tasks of environmental education and upbringing; the

principle of transdisciplinarity of ecological knowledge; the principle of ecological profiling of professional training; and the principle of emotional value of perception of the natural environment in practical activities.

It was determined in the study that in the process of vocational training in a higher-education institution, in order to form the environmental competence of future navigators in the process of professional training, it is necessary to use modern methods and innovative tools and forms of training. This includes the use of information and computer technology tools that provide simulation modeling of situations that reproduce as closely as possible the real conditions of on-board watchkeeping to ensure the reproduction of critical situations through the use of modern simulator technologies and systems in real time.

Strengthening the practice-oriented direction of the educational process of training future navigators must take into account the requirements of the International Convention on the training, certification of boatmasters and watchkeeping. This includes the acquisition of experience in the organization of keeping a navigational watch and gaining experience in emergency modes and ship-alarm modes. This condition is especially important, since studies show that applicants can have an understanding and awareness of the relevance of environmental problems, but their attitude towards them might remain abstract.

Another pedagogical condition is the development of independent work skills among applicants. It is important for independent work to be active and have both a creative character and a research direction.

The next pedagogical condition is the creation of a comfortable learning environment [14] where:

- applicants for education feel free, their personal interests are stimulated;
- each applicant is motivated through their own personal feelings and emotions;
- the applicant feels like the main active person in the educational process;
- prospects for simultaneous provision of differential and individual approaches are being created;
- the activity of applicants and their independence and creativity are stimulated.

The implementation of the conditions defined by us was carried out by:

- using ecologization of special educational disciplines;
- attracting applicants to research activities that integrate the content of special and environmental education and participation in various environmental projects.
- introduction of an optional course, “Technology of Activities of Navigators for the Protection of the Marine Environment”.

In terms of technology, the formation of environmental competence of future navigators is expressed not simply in the development of unrelated knowledge and skills of an environmental orientation, but in the mastery of a complex procedure of environmental-cognitive activity, which is of a personal-activity nature. Such a procedure can be, for example, the method of projects; that is, the justification, development and implementation of environmental projects by applicants.

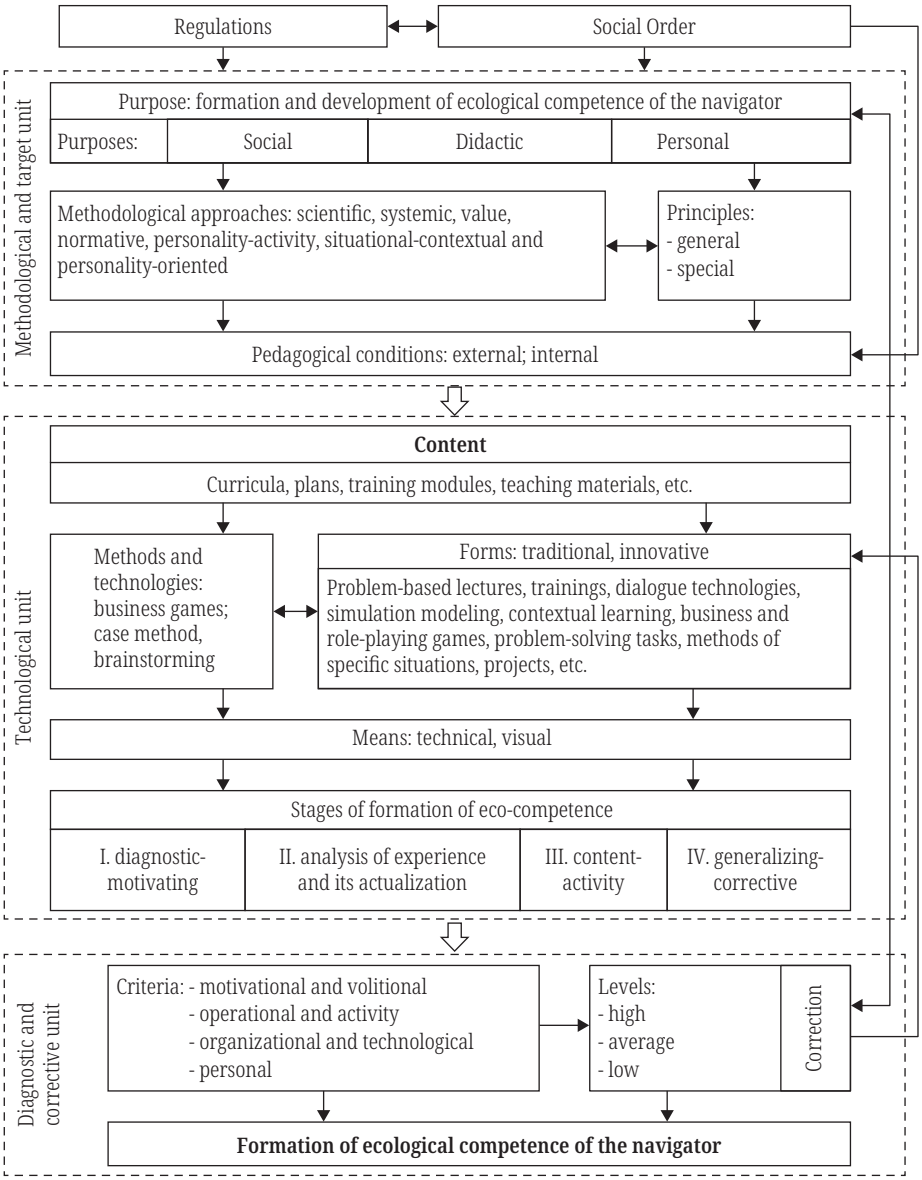

Fig. 1. Model of formation of ecological competence of navigators

The expanded application of this method provides a combination of a culture of scientific and environmental knowledge with personal experience in environmental activities and has a formative potential that stimulates the growth of the main components of the structure of environmental competence.

The themes of projects developed and implemented by applicants can be varied: environmental audit of the marine area (here we can note its various locations), study and protection of established ecosystems, resource conservation in professional activities, ensuring the biochemical safety of ballast water, and development and implementation of environmental education activities. During the implementation of projects aimed at achieving practical improvements in the state of the environment in its three interrelated aspects – environmental, social and economic – future marine specialists must formulate the goal and objectives of environmental

activities (actions); predict expected results and ways to identify them; and use evaluation criteria (indicators of sustainable development). The next step is to develop an action plan – to determine the list of tasks, deadlines, distribution of functions between participants, necessary resources, possible difficulties, and risks and ways to overcome them, etc. The leading component of environmental competence is practically activity based.

We see the implementation of the conditions for enhancing the use of information and computer technologies mainly in three directions. This is an introduction to the active use of interactive textbooks and manuals in the classroom, conducting web searches, and introducing simulation modeling of situations on virtual simulators that reproduce as closely as possible the real conditions of keeping a ship's watch, ensuring the reproduction of critical situations using modern simulator technologies and systems in real time.

A description of the forms and means of training is of undoubted interest, but that discussion is beyond the scope of this article.

It should be noted that we consider it appropriate to consider the formation of environmental competence of future specialists in the maritime sector in four stages. The first stage is preparatory, or diagnostic, and involves formation of a conscious attitude of applicants for education to recognize the need to master the environmental components of all academic disciplines, since the development of environmental competence is transdisciplinary in nature. The second, analytical stage involves the analysis and updating of the acquired experience on environmental safety and environmental protection. At this stage, the main attention is paid to the development of the psychological readiness of future navigators to make managerial decisions and keep watch with the help of innovative forms of training. Particular attention is paid to problem solving. At the third, content-activity stage, the integration of theoretical and practical training takes place. Particular attention is paid to simulation modeling in real time. The fourth, generalizing and corrective, consists of reflection and correction of the acquired knowledge, skills and experience.

We also identified three levels of environmental competence formation: high (creative), medium (professional-sufficient) and low (elementary).

The low level is characterized by the fact that the future specialist shows only a fragmented nature of environmental knowledge, poor awareness of environmental law and situational compliance with the rules of environmentally friendly behavior. At the same time, he is able to listen, understand and remember the solutions to an environmental problem; give its description and characteristics; and is able to understand, distinguish and correlate the delivered task with the possibility and methods of its implementation.

At the average (professional-sufficient) level, the applicant for education has an established concept of environmental legal norms. The applicant shows the ability of partial planning of environmentally oriented solutions, based on large arrays of operational and informational data. He or she is also capable of effectively performing tasks requiring the application of environmental knowledge in a familiar situation. The applicant is able to choose an expedient sequence of actions, make the right decision to get out of the ecological crisis and apply it in practice.

A high (creative) level of environmental competence is characterized by deep environmental knowledge, in particular in environmental law; recognition of its universal value of nature, demonstration of a positive attitude towards it, awareness of the need and importance of environmental protection; and ability to carry out environmental monitoring. The applicant is able to solve professional problems that

require understanding and applying environmental knowledge in a nonstandard situation.

The development and approbation of the model we proposed for the formation of environmental competence of navigators have made it possible to raise the issue of ecologisation of education in the maritime sector in our country to a new level and to draw the attention of students and teachers to this issue, which is of paramount importance for all humankind.

Each person interacts with the environment in a certain way (resource consumption, own professional activity). There are no professions that do not affect the state of the environment. The difference lies only in the amounts, characteristics and methods of exposure. And the reduction of one's own negative impact on the environment during professional activities is a sign of a high level of professional environmental competence.

Our practical research has had a positive impact on the formation of environmental competence of bachelors of navigation and management of ships in the process of professional training through the introduction of modern forms of education and the implementation of the pedagogical conditions we have defined.

4 CONCLUSIONS

The analysis of the obtained results of our study testifies to the expediency of using the proposed improvements in the methodology of environmental training of future specialists in navigation and ship management through the introduction of modern forms of education, along with traditional ones.

Features of the formation of environmental competence of future specialists of the maritime branch are reflected in the need to implement this process in an environmentally oriented professional educational environment, as well as in the psychological and pedagogical structural and content characteristics of environmental competence.

Based on the results of our study, the pedagogical conditions that have the greatest impact on the formation of environmental competence of future specialists of the maritime branch were identified and characterized. To such conditions, we attributed increased motivation of applicants for environmental protection and careful use of the environment in the process of carrying out future professional activities; introduction of modern forms of education (environmental trainings, project method) to enhance the educational process; and increased attention to problem-solving and decision-making in stressful situations, taking timing into account.

It should be noted that future specialists have significantly increased their level of environmental competence, which primarily affects the quality of solving practical problems of an environmental nature and the speed of decision-making.

The results obtained in our study were used in the development of curricula and educational and methodological support in order to improve the environmental preparation of applicants for education for their practical professional activities in matters related to ensuring environmental safety, environmental conservation, etc.

The work we have accomplished does not exhaust all aspects of the formation of environmental competence of future specialists in navigation and ship control. There is a huge field of activity for the introduction of modern teaching aids, for example, the creation of virtual simulators for solving problematic goals in real time.

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