



FORMATION OF ENVIRONMENTAL COMPETENCE OF THE FUTURE BACHELOR OF NAVIGATION: THEORETICAL ASPECT

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Abstract

The relevance is driven by the fact that the ecological crisis both globally and in Ukraine particularly, is characterized by a trend of increase. The war with the Russian Federation, which severely destroys the country's ecosystems, has become a challenge for domestic ecology. We now face significant losses of hundreds of species of animals and plants. This requires replenishment of organizations and institutions, including maritime and water transport, with specialists who have a thorough professional-ecological training. Meanwhile, maritime higher education institutions are still insufficiently focused on activating ecological education for students, on fostering ecologically aware seafarers with developed ecological thinking. The problem of targeted formation of ecological knowledge, skills, and consciousness among future navigation specialists is further actualized by the fact that pedagogical science has not yet substantiated detailed methodological approaches, effective principles, specific conditions, and rules for productive ecological training of future specialists in maritime and inland water transport, nor has it developed effective technologies and methodologies for systemic acquisition of professionally oriented ecological knowledge, skills, and abilities by marine education seekers.

Objective: To substantiate the pedagogical system of targeted formation of ecological competence in future navigation bachelors and to develop its conceptual model.

Methods: To achieve the objective, the study utilized theoretical methods (theoretical analysis of scientific works, study of the requirements of environmental legal documents to clarify the level of problem development and identify directions of scientific exploration; comparison to study scientific approaches to solving the problem; analysis and synthesis to clarify the features of ecological-professional training of navigation bachelors, substantiating the content of their ecological competence formation; modeling to develop the structural-content model of the pedagogical system) and empirical methods (pedagogical observation, discussions, surveys to identify directions, stages, forms, technologies of forming ecological competence in future navigation bachelors).

Results: Based on the analysis of pedagogical theory and educational practice, the peculiarities of professional-ecological training of future navigation bachelors in higher education institutions were clarified; it was determined that ecological competence of future navigation bachelors is a complex scientific object and requires a systemic approach in its research, and the process of its targeted formation should be considered as a pedagogical system; a conceptual model of the system has been developed that combines the conceptual positions of the studied process into a single ideal construct, illustrating the sequence of "movement" from the goal to the expected result.

Conclusions: The substantiated model is a theoretical construct that reflects the conceptual foundations of the systemic formation of ecological competence in future navigation bachelors; the positions embedded in this ideal object regarding the formation of this integrative property of the personality combine the possibilities of intradisciplinary and interdisciplinary directions of ecological education for students with the acquisition of experience by future seafarers in environmental protection, research, ecological-enlightenment, and other activities; the implementation of the developed pedagogical system in a higher education institution will significantly enhance the level of formation of ecological knowledge, ecological thinking, ecological consciousness, and eco-safe behavior among future navigation bachelors.

Keywords: *ecological education, ecological competence, future navigation bachelors, ecological knowledge, ecological worldview, maritime transport, pedagogical system.*

Introduction. We must acknowledge that the environmental crisis in the world is escalating, and in Ukraine, its dynamics are further intensified by military actions on land, as well as in marine and river waters. The war destroys domestic ecosystems, damages rare flora and fauna. More than 80 species of animals are on the verge of extinction: over 10 million individuals have already died due to shelling of zoos and shelters. The negative impact of naval vessels' hydrolocation systems causes the stranding of cetaceans. Significant leaks of fuel and lubricants and the entry of toxic compounds from ammunition and military equipment from sunken ships substantially worsen the ecology of the Azov and Black Seas, estuaries, and wetlands.

It is worth noting that, ultimately, water transport itself is a significant source of environmental and biosphere pollution. Primarily, this refers to pollution from waste generated during the operation of vessels and marine pollution through the discharge of oil, petroleum products, chemicals (ammonium nitrate, superphosphate, bauxite, etc.) during accidents involving barges, tankers, and other cargo ships. Specifically, marine environmental pollution occurs due to: the operation of diesel engines using high-sulfur fuel oil that pollutes the atmosphere with nitrogen oxides, carbon, and other carcinogens; toxic waste from commercial vessels (cruise industry) from burning garbage, including plastic; wastewater from medical facilities, general use areas that may contain harmful viruses, intestinal parasites, etc.; solid waste (glass, paper, ash, plastic, metal drink cans, etc.) that can become marine litter and pose a threat to all life; the discharge of insufficiently treated bilge water; collisions of marine mammals (e.g., whales) with vessels leading to their death and injuries; noise created by ships, disrupting the orientation, communication, and feeding of some marine species, etc. It is not difficult to see that a significant (and possibly decisive) role in marine environment pollution is played by human factors.

Thus, we must recognize that the ecologically safe operation of vessels directly depends on the professional-environmental training of maritime and water transport professionals future officers of the deck command. However, an analysis of the training practices of seafarers in higher education institutions, especially future bachelors of navigation, indicates that the problem of forming ecologically conscious, responsible, active defenders of nature is still insufficiently addressed in maritime universities and

academies. Typically, acquiring ecological knowledge and skills by future bachelors of navigation involves studying in the second or third semester (Bairamova, 2020); National University "Odessa Maritime Academy"; Prospects of training and employment for seafarers) the discipline "Ecology and Environmental Protection," culminating in an examination (from 2 to 6 credits). Unfortunately, in some maritime higher education institutions, such an educational discipline is not included in the educational-professional programs for training bachelors of navigation at all.

Therefore, it can be concluded that in the educational environment of maritime higher education institutions, the development of ecological competence in future bachelors of ship navigation still receives insufficient attention. The problem of targeted formation of ecological knowledge, ecological skills, and ecological consciousness among future maritime professionals is further emphasized by the fact that pedagogical science has not yet substantiated detailed methodological approaches, effective principles, specific conditions, and rules for productive ecological training of future specialists in maritime and inland water transport, nor has it developed effective technologies and methods for systematic acquisition of professionally oriented ecological knowledge, skills, and abilities by maritime education seekers.

Sources. Regulations on the regulation of relations in the field of protection and conservation of natural resources, ensuring ecological safety, principles of environmental protection, use of plant and animal life are specified in the Laws of Ukraine "On Environmental Protection" (1991 with amendments 1993–2022), "On the Natural Reserve Fund of Ukraine" (1992 with amendments 1993–2022), "On Air Protection" (1992 with amendments 1995–2022), "On Radioactive Waste Management" (1995 with amendments 2000–2022), "On Waste" (1998 with amendments 2002–2022), "On Plant World" (1999 with amendments 2009–2022), "On Animal World" (2002 with amendments 2009–2022), "On Environmental Impact Assessment" (2017 with amendments 2019–2022), among other normative legal documents. The content of virtually every analyzed official document includes the issues of the necessity to develop environmental culture among the population, formation of views, beliefs, and knowledge of people regarding the priority of ecological safety requirements, strict adherence to ecological standards, limits on the use of natural

resources in industrial activities. At the same time, it emphasizes the importance of forming ecological competence in students of higher education institutions, preparing them to implement strategies for ecological safety and environmental protection. For example, Article 7 of the Law of Ukraine "On Environmental Protection" (1991) states: "Enhancing the environmental culture of society and professional training of specialists is ensured by general mandatory comprehensive education and training in environmental protection."

It is worth adding that, unfortunately, the bill "Strategy for Sustainable Development of Ukraine until 2030" (2018), which aims to "promote the transition of Ukraine to the principles of sustainable development, legislative and institutional provision of the public management system for sustainable development, improving the quality of life of the population and achieving economic, social, and ecological balance of development of Ukraine," has not yet been adopted. At the same time, the strategy and main directions for the development of Ukraine as a maritime state are declared in the Maritime Doctrine of Ukraine for the period until 2035, which defines: "Among the priority national interests at sea are meeting the needs of society, economy, and state in the use of sea resources, strengthening the position of Ukraine among the leading maritime states, as well as ensuring security by: preventing pollution of the marine environment, conducting effective ecological monitoring; achieving the condition of the marine environment in the territorial waters and the exclusive economic zone of Ukraine, which corresponds to the concept of 'good environmental condition' in the sense of the EU Framework Directive on Marine Strategy, and maintaining such a state in the long term" (Postanova Kabinetu Ministriv Ukrainy, 2009).

The theoretical and methodological basis for addressing the issue of purposeful formation of ecological competence in future bachelor mariners has been defined by the works of scholars such as M. Bilyanska, V. Boholyubov, O. Vernik, S. Deryabo, I. Koreneva, V. Karamushka, L. Kurnyak, L. Lukyanova, O. Mateyuk, O. Palamarchuk, V. Panov, N. Pustovit, S. Rudyshyn, T. Saienko, Y. Shvalb, L. Rudenko, H. Filichuk, S. Shmaliy and others; the theoretical and methodological aspects of professional and ecological training of maritime and inland water transport specialists are highlighted in the works of L. Bazyl, O. Bayramova, O. Hurenkova, L. Herganova, O. Danylenko, V. Dobrovolska, Y. Yezhokina, V. Zhurian, M. Musorina, T. Rulevska, K. Tkachenko, and others. The scientific aspects of personality trait development, substantiated by these

scholars, served as the basis for the justification and development of the system for purposeful formation of ecological competence in future bachelor mariners.

The aim of the research: to substantiate the pedagogical system for the purposeful formation of ecological competence in future bachelor mariners and to develop its conceptual model.

Methods: To achieve the aim of the study, theoretical (theoretical analysis of scientific works, studying the requirements of normative legal documents of ecological nature to determine the level of problem development and identify directions for scientific exploration; comparison – to study scientific approaches to solving the problem; analysis and synthesis – to clarify the features of ecological-professional training of bachelor mariners, substantiating the content of their ecological competence formation; modeling – for developing the structural and content model of the pedagogical system) and empirical (pedagogical observation, conversations, surveys – to determine the directions, stages, forms, technologies of forming ecological competence of future bachelor mariners) methods were used.

Results and discussion. Given that Ukraine is a leader in supplying maritime industry specialists to the global fleet (in 2018, 69,000 jobs (Bayramova, 2020), in 2023 – about 100,000), and a member of the International Maritime Organization (IMO), it is critical for solving the problem of professional and ecological training of bachelor mariners that students know and are able to apply the main norms and rules of international maritime safety and environmental protection. These provisions are highlighted in a number of Conventions adopted by the IMO, including: the International Convention for the Safety of Life at Sea (SOLAS-74/83); the International Maritime Dangerous Goods Code (IMDG-Code); the International Convention for the Prevention of Pollution from Ships (1973).

In turn, the standard of higher education (first (bachelor's) level of higher education; field of knowledge – "27 Transport", specialty – "271 River and Sea Transport"; implemented by the order of the Ministry of Education and Science of Ukraine dated 13.11.2018 No. 1239) (Ministry of Education and Science of Ukraine, 2010) defines that future bachelors of navigation must master the general professional competence "Ability to supervise and control the compliance with national and international legislation in the field of navigation and measures to ensure the protection of human life at sea, protection and conservation of the marine

environment." For bachelors of the specialty "271 Maritime and Inland Water Transport", with the specialization "271.01 Navigation and management of sea vessels (Navigation)", the standard establishes that graduates must demonstrate learning outcomes directly related to the subject of our research, in particular:

- *RN22. Knowledge of methods, measures, and equipment for combating pollution from ships, as well as precautionary measures necessary to prevent pollution of the marine environment and fulfilling the obligations according to the International Convention for the Prevention of Pollution from Ships, as amended;*

- *RN23. Knowledge of international and domestic legal acts regarding the safety of human life at sea and the protection of the marine environment and ensuring their compliance.*

Thus, it is worth defining the essence of the concept of *"ecological competence of a future bachelor of navigation"*. We note that as a result, and at the same time as an indicator of the quality of ecological education, Dzham (2016, p. 105) considers ecological competence, positioning this component of life competence of a person with her ability to make decisions and act in the interests of sustainability and environmental conservation. The scholar is convinced, and we support her position, that "The formation of ecological competence of citizens is one of the most important tasks of education for sustainable development. Ecological competence enables a modern individual to responsibly resolve life situations, subordinating the satisfaction of their needs to the principles of sustainable development. Therefore, ecological education requires special attention. Since balance is the result of harmonizing economic and social development of society and environmental conservation, one of the important trends in the ecological component is the formation in a citizen the ability to make decisions and act in the interests of sustainability and conservation of the environment." As the ability of an individual to actualize the acquired ecological knowledge and experience in real-life environmental situations for making environmentally appropriate decisions is considered ecological competence by Naidonova & Furdui (2018, p. 124). We value the well-founded approaches of these scholars in research, which include: 1) creating conditions for understanding the essence of norms and rules of environmentally appropriate behavior and mastering them; 2) fostering the formation of ecological convictions; 3) developing appropriate emotions related to nature

and its ecological state; 4) developing the ability to make responsible decisions in specific ecological life situations; 5) self-education of the student's personality.

Lobodynska & Mahazynshchykova (2018, p. 168) demonstrate that ecological competence must be acquired by every specialist with higher education; in the conditions of a planetary crisis, this key competence is necessary for every modern person. It is worth agreeing with the scholars' interpretation of ecological competence as the ability of a specialist to interact harmonically with the environment and society "... in all spheres of their life activity." The above statement convinces that future bachelors of navigation must thoroughly master ecological competence, which, following Zhurian (2022), we understand as a complex, integrative personality trait that reflects the motives of ecological activity, possession of ecological knowledge, and naturally-purposeful types of activity, volitional qualities, and values of the personality with an active stance in the field of environmental protection, rational use, and reproduction of natural resources, and provides the ability to perform environmental professional activities in the field of maritime and inland water transport.

The acquisition of knowledge about environmental problems and ways to solve them, the purposeful formation of needs, motives, and habits of environmental activity, the development of ecological thinking, and ecological awareness of future mariners are carried out in the process of ecological education. In this regard, as Bayramova (2020) points out, two approaches to professional-ecological training of future bachelors of navigation are implemented in educational practice: multidisciplinary (using the ecological potential of each discipline in the curriculum, giving an ecological orientation to each component of the educational-professional program) and intradisciplinary (a separate educational component of the curriculum provides for a discipline of ecological content). Here, it is worth listening to Saienko's (2008) suggestion to focus on a combined model of ecological training of specialists in higher education, which combines students' study of the subject "Ecology and environmental protection" with the ecologization of professional-practical disciplines and all types of practice. Our position aligns with the definition of ecological education by Lukianova (2006), who is convinced that this is a new sense and purpose of the modern educational process, a unique means of preserving and developing the environment and continuing human civilization, a process that is in

constant development and, what is extremely important, is the result of reorientation and coordination of various disciplines. Moreover, it is important to consider that the effectiveness of ecological-professional training of seafarers significantly depends on the quality of students' study of environmentally-oriented disciplines ("Occupational Safety," "Life Safety," "Labor Protection in the Industry" etc.).

Ecological education of future bachelors in navigation is a leading direction in acquiring classical ecological knowledge by students, and the greening of the rest of the educational program components enables productive formation of students' perceptions of the "nature-human-society" system. In this case, we do not distinguish ecological education of students (ecological holidays, ecological excursions, debates on ecological topics, ecological trails, etc.) as a separate direction, considering the close integration of processes of education, upbringing, and personal development.

At the same time, it is equally important to involve students in practical activities related to environmental protection, develop robust skills and habits of environmentally friendly behavior, teach future mariners to anticipate the consequences of their actions on nature, and develop personal responsibility for the environmental condition. Rulyevska (2021) voices consonant thoughts in this regard, stating that students' participation in ecological activities (clearing and maintenance of the territory around drinking water sources, landscaping educational institution territories, cleaning water bodies from waste, etc.) ensures the effective combination of ecological knowledge and practical skills, fostering habits of safe ecological behavior. In turn, Bayramova (2020) argues that the formation of ecological awareness, development of ecological ethics, and skills of eco-safe behavior in future mariners should be carried out not only through nature conservation activities but also through experimental, ecological-educational activities, and so forth. This includes students' participation in ecological clubs, groups, ecological agitprop brigades, ecological expeditions, volunteer eco-events, and execution of ecological projects by future mariners.

Along with the formal component of ecological education of mariners, this informal component is also aimed at achieving the primary goal to ensure high levels of professional-ecological training for future bachelors of navigation, capable

of systematically analyzing and competently resolving various ecological situations, and qualified to carry out measures to prevent and eliminate pollution of the environment and the biosphere during vessel operation.

Therefore, we conclude that the ecological competence of future bachelors in navigation is a complex scientific object and requires a systemic approach in its study, and the process of targeted formation of this integrative characteristic of the personality should be considered as a pedagogical system. Recall that the pedagogical system must possess certain characteristics (Luzan, & Pasichnyk, 2023, p. 399-400): the presence of components, parts; diversity each system component has certain unique properties that distinguish it from other components; the presence of structure certain elements, connections, and relationships among them; the presence of integrative, general properties, qualities that no single component possesses; identifiability any component can be conditionally or actually distinguished from the construct; hierarchy; the presence of functional characteristics of the system as a whole and its individual components; the purposiveness of the system; every system is created to achieve a specific goal, so the functions of its components must correspond to the purpose and functions of the whole system; and the inherent communicative properties, which are manifested in two forms in interaction with the external environment and in interaction of this system with systems of a lower or higher order, and others.

Using the recently outlined features and characteristics of the system, the study justifies a hierarchical structure of dialectically interconnected elements (goal, main determinants, tasks, principles, stages, content, methods, forms, tools, diagnostics, expected result). In light of the principle of conceptual minimalism combined with the maximum informativeness of the subject of modeling (Lodatko, 2022), we have developed a conceptual model of the system for forming the ecological competence of future bachelor mariners, the visualization of which is presented in Table 1. As evident from the ideal construct shown in the table, the main determinants (formative and non-formative components of ecological education for future mariners) are directed towards achieving the primary goal of the studied process systematic, purpose-driven formation of ecological competence of future bachelor mariners.

Conceptual Model of the System for Developing Ecological Competence in Future Bachelor's of Ship Navigation

Purpose	Systematic, targeted development of ecological competence in future bachelor's of ship navigation	
Determinants (Directions)	Formal component of ecological education for seafarers	Informal Component of Maritime Environmental Education
Main Tasks	To form classical ecological knowledge and skills in students, develop ecological awareness of seafarers regarding the resolution of ecological situations during the operation of ships	Future seafarers' mastery of environmental conservation, eco-educational activities, and others, development of ecological thinking, worldview, and students' ecological ethics.
Methodological Approaches	Systemic, culturological, competence-based, technological	Activity-based, person-oriented, humanistic
Fundamental Principles	Systematicity, integrativity, scientific basis, interdisciplinarity	Nature correspondence, continuity, ecological responsibility, goodness
Content	Content of the course "Ecology and Environmental Protection" and environmentally oriented disciplines, ecologization of the content of other educational components of the program	Practical environmental conservation actions, research on ecological problems related to water pollution, eco-educational activities, ecological design, and so forth.
Methods	Explanatory-illustrative, reproductive, problem-informational, heuristic, research, gaming, simulation, simulation-gaming, etc.	Practical demonstration, execution of actions, operations, persuasion, suggestion, example, exercises, training, observation, experiments, design, research methods, and others.
Forms	Lectures, seminars, practical classes, design, forms of Internet self-education, participation in olympiads, conferences, ecological contests, etc.	Ecological clubs, teams, "eco-trails," ecological expeditions, volunteer eco-events, ecological events (cleaning of water bodies,), ecological festivals, ecological internet excursions, and so on.
Means	Natural objects, subject-spatial representations of objects: machines, mechanisms, ship systems, ship models, demonstration stands, etc.; educational, methodological, ecological literature, scientific-reference publications; electronic educational resources	
Diagnostics	Criteria, indicators, and levels of ecological competence formation in future bachelor's of ship navigation	
Expected Outcome	Sufficient levels of ecological competence formation in future bachelor's of ship navigation	

The aim of implementing a system for developing ecological competence in future mariners is specified by interconnected tasks of both structurants of ecological education, in particular: (1) to form classical ecological knowledge and skills of students, to develop ecological awareness of mariners regarding the resolution of ecological situations during vessel operation; (2) for future mariners to master the experience of performing environmental protection, ecological education, and other activities, development of ecological thinking, ecological worldview, and ecological ethics of students. For the execution of the forecasted tasks, the conceptual model identifies methodological approaches, main principles, content, methods, forms, and means of forming ecological competence of future mariners.

Conclusion. The justified model is a theoretical construct that reflects the conceptual foundations of systemic formation of ecological competence in future bachelor's degree holders in ship navigation. The provisions laid down in this ideal object regarding the formation of the studied integrative characteristic of personality combine the possibilities of intra-disciplinary and interdisciplinary directions of ecological education for students with the acquisition of experience in environmental protection, ecological education, and other activities by future mariners. The implementation of the developed educational system in a higher education institution will significantly enhance the level of ecological knowledge, ecological thinking, ecological consciousness, and ecologically safe behavior of future bachelors in ship navigation.

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ФОРМУВАННЯ ЕКОЛОГІЧНОЇ КОМПЕТЕНТНОСТІ МАЙБУТНІХ БАКАЛАВРІВ СУДНОВОДІННЯ: ТЕОРЕТИЧНИЙ АСПЕКТ

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Реферат:

Актуальність зумовлюється тим, що екологічна криза у світі та в Україні зокрема, характеризується тенденцією до зростання. Викликами для вітчизняної екології стала війна з РФ, що жорстко нищить екосистеми країни. Нині маємо суттєві втрати сотень видів тварин і рослин. Це потребує поповнення організацій і установ, зокрема морського і водного транспорту, фахівцями з ґрунтовою професійно-екологічною підготовкою. Натомість морські заклади вищої освіти поки-що недостатньо зорієнтовані на активізацію екологічної освіти студентів, на виховання екологічно свідомих, з розвинутим екологічним мисленням моряків. Проблему цілеспрямованого формування екологічних знань, екологічних умінь, екологічної свідомості майбутніх фахівців-судноводіїв актуалізує й те, що педагогічною наукою дотепер не обґрунтовано докладних методологічних підходів, дієвих принципів, конкретних умов і правил продуктивної екологічної підготовки майбутніх фахівців морського і внутрішнього водного транспорту, не розроблено результативних технологій і методик системного опанування здобувачами морської освіти професійно орієнтованими екологічними знаннями, уміннями, навичками.

Мета: обґрунтувати педагогічну систему цілеспрямованого формування екологічної компетентності майбутніх бакалаврів судноводіння та розробити її концептуальну модель.

Методи: для досягнення мети дослідження використано теоретичні (теоретичний аналіз наукових праць, вивчення вимог нормативно-правових документів екологічного характеру – задля з'ясування рівня розробленості проблеми дослідження та визначення напрямів наукових розвідок; порівняння – з метою вивчення наукових підходів щодо розв'язання проблеми; аналіз і синтез – задля з'ясування особливостей еколого-професійної підготовки бакалаврів судноводіння, обґрунтування змісту формування їх екологічної компетентності; моделювання – для розроблення структурно-змістової моделі педагогічної системи) і емпіричні (педагогічне спостереження, бесіди, опитування – для визначення напрямів, етапів, форм, технологій формування екологічної компетентності майбутніх бакалаврів судноводіння).

Результати: на основі аналізу педагогічної теорії і освітньої практики з'ясовано особливості професійно-екологічної підготовки майбутніх бакалаврів судноводіння у закладах вищої освіти; визначено, що екологічна компетентність майбутніх бакалаврів судноводіння є складним науковим об'єктом і потребує системного підходу у його дослідженні, а сам процес цілеспрямованого формування цієї інтегративної властивості особистості вартує розглядати як педагогічну систему; доведено, що основними напрямками формування досліджуваного феномену є формальний і неформальний складники екологічної освіти, які в інтеграції форм, методів, засобів забезпечують системне, цілеспрямоване формування екологічної

компетентності майбутніх бакалаврів судноводіння; розроблена концептуальна модель системи поєднує концептуальні положення досліджуваного процесу в єдиний ідеальний конструкт, унаочнює послідовність «руху» від мети до очікуваного результату.

Висновки: обґрунтована модель є теоретичним конструктом, що відображає концептуальні основи системного формування екологічної компетентності майбутніх бакалаврів судноводіння; закладені у цьому ідеальному об'єкті положення щодо формування досліджуваної інтегративної властивості особистості поєднують можливості внутрішньо дисциплінарного і міждисциплінарного напрямів екологічної освіти студентів з набуттям майбутніми моряками досвіду виконання природоохоронної, науково-дослідницької, еколого-просвітницької та ін. діяльностей; реалізація розробленої педагогічної системи у закладі вищої освіти дозволить суттєво підвищити рівень сформованості екологічних знань, екологічного мислення, екологічної свідомості та екологобезпечної поведінки майбутніх бакалаврів судноводіння.

Ключові слова: *екологічна освіта, екологічна компетентність, майбутні бакалаври судноводіння, екологічні знання, екологічний світогляд, морський транспорт, педагогічна система.*

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