

Information and Digital Competence of Future Naval Officers: Building a Development Model in the Context of Non-Formal Education

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Annotation. Traditional education does not sufficiently consider the rapid development of technology, and students are not ready to use the new information systems that already exist in the profession. Therefore, it is necessary to continuously improve professional training and information&digital competence development. The study aims to develop a model for developing the future naval officers' information&digital competence in the context of non-formal education. We used content analysis of scientific publications to identify existing scientific and pedagogical research that emphasizes the models of training specialists; the method of generalization to substantiate the research problem; structural and logical analysis to identify the components of the model; a method of idealization for constructing an ideal model for the development of the future naval officers' information&digital competence in the conditions of non-formal education. We presented a description of the model, which contains blocks (target, methodological, organizational-content, diagnostic) and the components "organizational and pedagogical conditions" and "result". The model is focused on solving problems (developing values and aspirations for professional development in IT, expanding the system of specialized knowledge in IT, deepening basic and specialized IT skills, and developing the personal qualities of future naval officers). Verification of the effectiveness of the developed model will be carried out based on a diagnostic device, which is our further scientific research.

Keywords: information and digital competence, future naval officers, development model, non-formal education, IT, professional education.

Інформаційно-цифрова компетентність майбутніх морських офіцерів: побудова моделі розвитку в умовах неформальної освіти

Анотація. Традиційне навчання недостатньо враховує стрімкий розвиток технологій, і студенти виявляються не готовими до використання нових інформаційних систем, які вже існують у професії. Тому необхідно постійно вдосконалювати як професійну підготовку, так і розвиток інформаційно-цифрової компетентності. Метою дослідження є розроблення моделі розвитку ІЦК майбутніх морських офіцерів в умовах неформальної освіти. Ми використали контент-аналіз наукових публікацій для виявлення наявних науково-педагогічних розвідок, які у виразнюють моделі підготовки фахівців; метод узагальнення для обґрунтування проблеми дослідження; структурно-

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логічний аналіз для виокремлення компонентів моделі; метод ідеалізації для побудови ідеальної моделі розвитку ІЦК майбутніх морських офіцерів в умовах неформальної освіти. Ми представили опис моделі, яка містить блоки (цільовий, методологічний, організаційно-змістовий, діагностичний) та складові «організаційно-педагогічні умови» й «результат». Модель орієнтована на вирішення завдань (розвиток цінностей і прагнення до професійного розвитку в галузі застосування ІТ, розширення системи спеціалізованих знань у галузі ІТ, поглиблення базових і спеціалізованих ІТ-навичок, розвиток особистісних якостей майбутніх офіцерів ВМФ.). Перевірка ефективності розробленої моделі буде здійснюватися на основі діагностичного апарату, що є нашим подальшим науковим пошуком.

Ключові слова: інформаційно-цифрова компетентність, майбутніх морські офіцери, модель розвитку, неформальна освіта, ІТ, професійна освіта.

Introduction

Statement of the problem. Traditional approaches to learning tend to prioritize theoretical knowledge over practical application, potentially leading to a gap between what is taught and the realities of professional life. In addition, traditional training may not fully consider the rapid development of technology, leaving students ill-prepared to use new information systems that have already been implemented in the profession. Therefore, it needs constant improvement as the professional training of a specialist, as well as the development of the specialist's information&digital competence (IDC). This applies to all sectors of the economy, including the maritime industry, and therefore the problem of training naval officers to create a stronger foundation for developing their IDC becomes urgent.

Analysis of current research. The general scientific concepts of "model" and "modeling" are important and complex tools for pedagogy, since they have peculiarities, the nature of which is based on the vagueness, the vagueness of pedagogical concepts [1]. The term "model" encompasses many aspects, ranging from the structure of the educational process to the methods that ensure the effective acquisition of knowledge and skills. The analysis of scientific works on modeling educational systems has shown that for a certain action to be considered modeling, the presence of several components is required: the purpose of modeling; the object of modeling, the model itself; features that the model should have depending on the nature of the object of modeling [2]. Modeling is understood as "an indirect method of cognition, which involves the study of an object based on its copy (model), and a model is a really existing or mentally imaginary system that replaces the original system in the cognitive process and is in relations of similarity, identity, and uniformity with it" [3].

The characterization of "models" allows us to see its different aspects. For example, the article by L. Gerganov and I. Lipenkov emphasizes the importance of organizational and pedagogical conditions for training future marine engineers, which can be considered a component of the professional training model. The authors point out the need to form individual educational trajectories, which indicates an adaptive approach to applying models in the educational process [4].

Generally, the vocational training model includes the main elements and concepts that determine its structure and functioning. S. Khusainova and other authors offer an adaptive psychological and pedagogical support model, which contributes to developing students' professional competencies. This model provides mechanisms for professional and personal development that can be applied in the training of future naval officers [5]. In particular, the model of professional training of future naval officers should consider the specifics of maritime activities, including technical knowledge, management skills, teamwork, and the ability to make decisions in stressful situations. An important aspect of modeling is the development of recommendations that can contribute to improving educational processes within the framework of implementing various models. Thus, the development of information technology

competencies is, as noted in [6], important for the performance of tasks in the maritime industry, and therefore, the model of ensuring the effectiveness of training through the introduction of training for teachers, where training will allow teachers to master new methods of teaching and assessment, is substantiated.

We consider it expedient to analyze the research of Ukrainian scientists on the development of models for the professional training of future maritime specialists. I. Sokol [7] developed and theoretically substantiated a model for the formation of professional competence of future navigators. He proposed three conditions for building a model of professional training: to control the quality of professional development of future navigators by monitoring the educational process and its results in marine astronomy; apply a differentiated approach to the professional development of future navigators in the study of marine astronomy; implement an interdisciplinary approach to professional development; to implement an interdisciplinary approach to the professional training of future navigators in the process of studying marine astronomy. Although this model has all the relevant structural elements, such as the structure of competencies and the conditions for the effectiveness of the research process, it cannot be fully used to model the professional training of future maritime specialists. The model aims at the formation of professional competencies of future seafarers and does not take into account the non-formal education of cadets.

The study of pedagogical conditions for implementing the andragogical approach in the vocational training of marine transport workers, conducted by N. Chernenko [8] made it possible to simulate the training process. In the structure of the author's model, the target, normative, theoretical-methodological, organizational-content, and diagnostic-effective blocks are allocated, which are interconnected by several coherent elements, which makes it possible to comprehensively consider the process under study from the point of view of andragogy, competence, system, and activity approaches to the formation of professionally important qualities in future specialists. In our opinion, the developed model, aimed at forming professionally important qualities, is based on the disciplines of the general professional cycle and does not consider the conditions of non-formal education.

Based on the results of the V. Chernyavsky study of the principles of teaching physics to future specialists in maritime and river transport [9], a model of training specialists in maritime and river transport is presented, which includes fluency in general scientific and professional knowledge, the ability to adequately apply professional means, the ability to translate knowledge and skills into action, to coordinate these actions with the goals and conditions of professional activity, readiness for multifaceted activities; formation and maturity of professionally important qualities, awareness of the personal significance of professional action, choice of profession, ability to communicate at the subject-object and subject-subject level, the ability to identify and take into account the personal characteristics of the subject of communication, the ability to create a favorable psychological climate in the team; environmental literacy, the ability to create a positive climate for aquatic ecosystems in one's country and in the world. The analysis of this model also shows the absence of a non-formal component of education in the professional training of cadets.

L.V. Lipshitz proved the effectiveness of the "model of formation of socio-cultural competence of future navigators of international voyages in studying social and humanitarian disciplines" [10]. The author's model contains the following blocks: target; theoretical and methodological; content; technological; evaluative and effective. The author of the model proves that the effectiveness of the model depends on the observance of pedagogical conditions: "obtaining knowledge about the individual, society, culture and mastering the norms of interpersonal and intercultural communication from the initial stage of education to independent activity" [10]. The model analysis gives grounds to talk again about the lack of its orientation towards non-formal education.

A study of the problem of the formation of professional competence of future ship engineers [11] gives an idea of the methodical system of formation of professional competence using the integration of natural and general technical disciplines. This model also does not take into account non-formal educational training.

The modeling of professional training of future specialists is devoted to the works of many Ukrainian ([12] etc.) and foreign researchers [13; 14]. The analysis of their studies shows the absence of any universal model for training specialists in the maritime industry or the formation of a certain type of personal qualities in them (skills, competencies, culture, etc.). Therefore, the *study aims* to develop the model of developing IDC of future naval officers in the context of non-formal education.

Research methods

We used content analysis of scientific publications to identify existing scientific and pedagogical research that emphasizes the models of training specialists; the method of generalization to substantiate the research problem; structural and logical analysis to identify the components of the model; method of idealization for building an ideal model of developing the IDC of Future Naval Officers in the conditions of non-formal education.

Results

When developing a model for developing the IDC of future naval officers in the conditions of non-formal education, we followed the principles of model construction, namely the principle of objective correspondence, the principle of objective simplification, and the principle of experimental implementation. The model of development of the IDC of future naval officers in the conditions of non-formal education is based on: the organization of training of future naval officers based on a competency-based approach and in the conditions of non-formal education; methodological approaches to modeling the process of professional training of naval officers.

The development of the model was preceded by an analysis of the problem of formation and development of the IDC of future naval officers in the scientific works of domestic and foreign authors, generalization of models of training of maritime specialists in different conditions of the educational process, systematization of approaches to the educational process in institutions where military training is provided, as well as substantiation of organizational and pedagogical conditions for such training.

The model of development of the IDC of future naval officers in the conditions of non-formal education visualizes the features of the educational process and, thanks to the diagnostic block, makes it possible to check it. The model provides for the integrity of professional training by integrating formal and non-formal education, considering the organizational and pedagogical conditions for developing the IDC of future naval officers in non-formal education. The model corresponds to the real characteristics of the educational environment of specialists in the maritime industry and reproduces the process of such development "ideally".

The model for developing the IDC of future naval officers in the conditions of non-formal education was created according to a logical scheme (Fig. 1).

The scientific guidelines for creating the models were researched in the academic environment by the works [8; 11; 15; 16; 17; 18; 19; 20; 21 etc.]. The model integrates several substructures (blocks): target, methodological, organizational-content, diagnostic) and the components "organizational and pedagogical conditions" and "result".

Target The block of the model emphasizes the orientation of the model towards the development of the IDC of future naval officers in the conditions of non-formal education, which is based on the request of Ukrainian society to specialists in the maritime industry of Ukraine and the requirements of [22] to the training of marine specialists, as well as on the need for human self-development throughout life. The emphasis on this block is because modern vocational education attaches great importance to the continuous formation of students'

knowledge and the ability to apply it in practice. In this regard, a special role is given to non-formal education, which enables a person to develop himself.

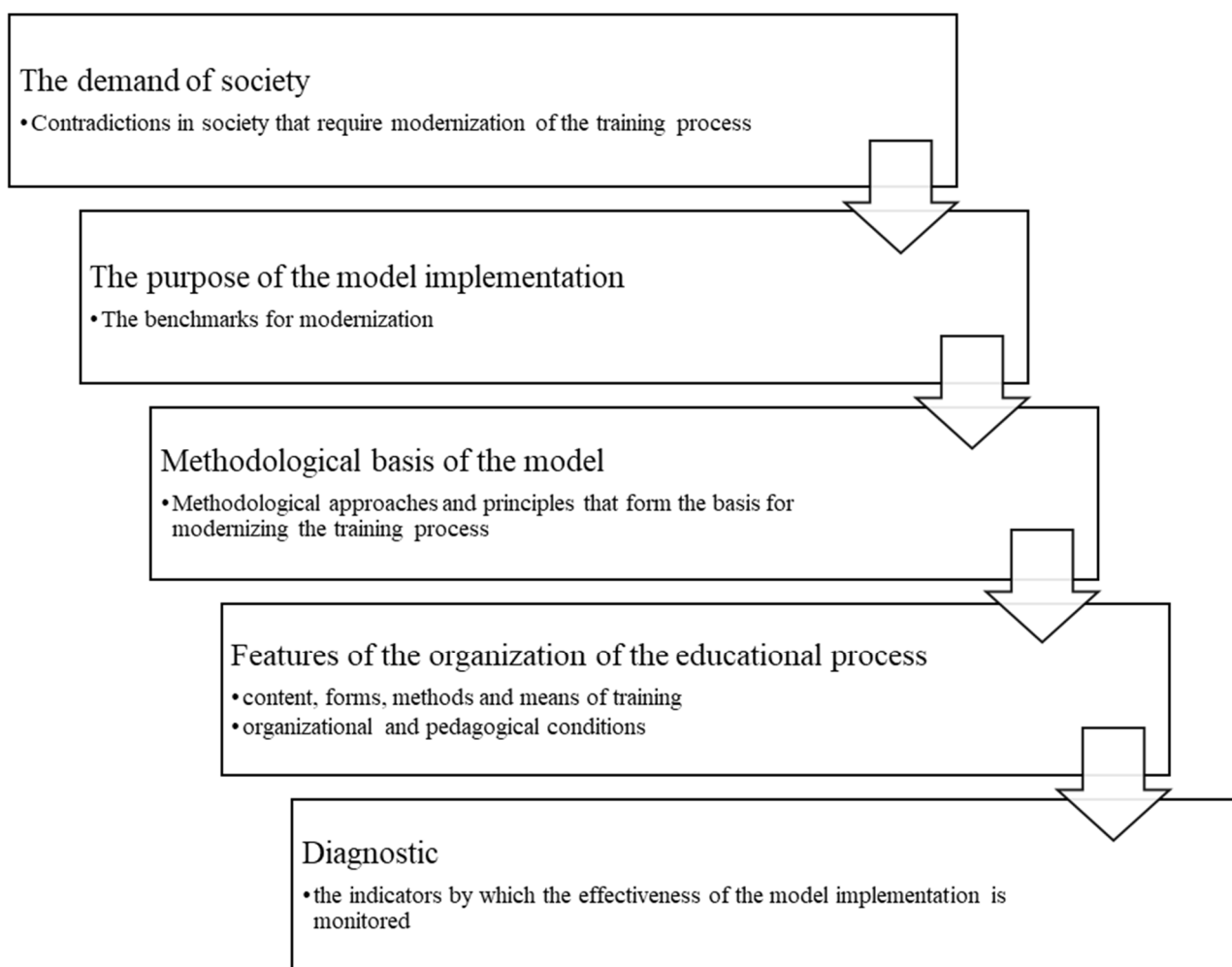


Fig. 1. Logical scheme of development model

One of the main characteristics of the training process is the goal, which in the simulated process is considered as an image of the planned result – the development of the IDC of future naval officers. Therefore, the purpose of the model implementation is to develop the IDC of future naval officers as a necessary component of their professional competence through changes in the organization of the educational process. Such development is envisaged in the context of non-formal education, which is integrated with formal vocational training.

To achieve the goal will be facilitated by a comprehensive solution to several tasks:

- 1) development of values and aspirations for professional development in the field of DH application in professional activities;
- 2) expansion of the IT knowledge system (about information and information processes, methods of its processing for solving professional problems);
- 3) deepening basic and special IC skills (to process information in various forms of its receipt, the ability to apply general-purpose digital technologies and specialized software for professional purposes);
- 4) development of personal qualities of future naval officers (leadership qualities, responsibility, critical thinking, determination, etc.).

The methodological block integrates methodological approaches (systemic, informational, digital, axiological, competence, BYOD-approach, and "Self-made-man" approaches) and principles of organizing the development of the IDC of future naval officers in

non-formal education (the principle of binary, the principle of cumulateness, the principle of continuity, the elective principle, the principle of connection between training and professional activity).

The organizational and content block takes into account the features of specialties 271 "River and Sea Transport" (bachelor's level) in the specializations "Navigation and Management of Sea Vessels", "Management of Ship Technical Systems and Complexes", "Operation of Ship Electrical Equipment and Automation", "254 Support of Troops (Forces)" and "255 Weapons and Military Equipment", which is presented in various regulatory documents: Standard of Higher Education, educational and professional programs, as well as the possibility of implementing an individual educational trajectory provided for in the Law of Ukraine On Prophetic Education. The purpose of this block is to form/develop students' system of knowledge and skills for professional activities, which, among other things, involves gaining experience in applying theoretical knowledge in the field of IT in practice, to form the ability to use various methods and means of acquiring knowledge and skills for the successful implementation of professional activities in the maritime industry. Industry; to develop the leadership qualities of a future naval officer, to expand his general horizons for further self-improvement. That involves a unique structure of professional training due to the peculiarities of non-formal education, which, in most cases, comes down to self-training for future naval officers. The organization of naval officers' training within the framework of the model is conditioned by certain stages, forms, methods, and means of professional training of future naval officers.

The forms of training for developing the IDC of future naval officers in the conditions of non-formal education were individual (in most cases, implemented within the framework of a particular educational trajectory) and collective (when cadets are involved in activities of various types outside of formal education). Implementing non-formal education also provided a mobile form of individual learning. Events (such as seminars or popular science lectures) involved using forms of e-learning (webinars, video lectures).

The methods of training future naval officers to develop their IDC in non-formal education were verbal, visual (story, conversation, demonstrations), and practical (training on simulators, operation and maintenance of professional equipment, specialized software, etc.). Implementing non-formal education required interactive teaching methods within the chosen online course (in particular, immersive methods, games, and case methods).

The model we developed for the development of the IDC of future naval officers in the conditions of non-formal education provided for the use of training tools (electronic educational resources, audiovisual (popular videos about IT and their use in the maritime industry) and visual plane tools (maps, illustrations, magnetic boards), digital tools (mobile phones, specialized software, including devices (compass, barometer, etc.)), virtual simulators, training equipment).

Separate components of the model of developing the IDC of future naval officers in the conditions of non-formal education are "organizational and pedagogical conditions" and "results." Successful implementation of the model aimed at the development of the IDC of future naval officers requires compliance with the following conditions: encouragement of self-development through the passage of massive online courses in the IT direction; popularization of training on the development of information and digital literacy; the use of practice-oriented tasks with insufficient data, which require the use of IT to solve them. Another component of the model, "Result," is a positive dynamic in the levels of development of the IDC of future naval officers, and it is the final step in implementing the model. Still, it provides for a preliminary assessment of the described impacts.

To determine the effectiveness of the model, it is necessary to have a diagnostic apparatus that includes objective indicators and methods for their evaluation to record the development of the IDC of future naval officers. The diagnostic block of the model of development of the IDC

of future naval officers in the conditions of non-formal education expresses the criteria and indicators of the development of the IDC of future naval officers. Quantitative assessment of indicators makes it possible to track changes in the development of the IDC of future naval officers. Such indicators were: "presence of motives", "values for self-development", "knowledge about IT in general and in the industry", and "ability to use IT to solve professional problems". Listed The indicators fully cover the components of the IDC, which we have identified in Section 1, and make it possible to qualitatively and quantitatively characterize the three levels of development of the IDC of naval officers: low, medium, and high.

The result of the model implementation in a certain way characterizes the solution of problems and the achievement of the desired goal (target block). Considering the effectiveness from the point of view of the goals and objectives of the process of ensuring the effectiveness of the organizational and pedagogical conditions for the development of the IDC of future naval officers, attention should be paid to the access of cadets to online resources and the recommendations provided by teachers or practitioners to the choice of courses for the development of the IDC of future naval officers.

Conclusions

Thus, modeling the process of development of the IDC of future naval officers in the conditions of non-formal education makes it possible to theoretically imagine how it is possible to contribute to the development of the IDC of future naval officers. The model developed by us consists of blocks (target, methodological, organizational-content, diagnostic) and components "organizational and pedagogical conditions" and "result" and is aimed at performing several tasks (development of values and aspirations for professional development in the field of DH application in professional activities; expansion of the IT knowledge system; deepening of basic and special IC skills; development of personal qualities of future naval officers).

The developed model is based on methodological approaches (system, informational, digital, axiological, competence, BYOD-approach, and "Self-made-man" approaches) and principles of organization of development of the IDC of future naval officers in the conditions of non-formal education (binary, cumulative, continuity, electiveness, connection between training and professional activity). The implementation of the model is step-by-step: (1) motivational; 2) conceptual and analytical; 3) procedural; 4) comparative-evaluative) and is based on the content of training, which is formed on the individual requests of future naval officers and compliance with organizational and pedagogical conditions, which for their implementation require forms (individual and collective), methods (verbal and visual, practical, interactive) and means (electronic educational resources, audiovisual (popular videos about IT and their use in the maritime industry) and visual plane means (maps, illustrations, magnetic boards), digital means (mobile phones, specialized software, including devices (compass, barometer, etc.)), virtual simulators, educational equipment) training. The result of the model is considered to be a positive trend in the levels of development of the IDC of future naval officers, which is determined based on the developed diagnostic apparatus (criteria and indicators of the IDC of future naval officers).

Further research requires practical verification of the developed model for efficiency.

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