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CONDITIONS FOR DESIGNING TRAINING AND PROFESSIONAL ENVIRONMENTS IN THE ERGATIC SYSTEM

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Abstract

The informatization of the modern marine ergatic system is considered as a strategic direction for its further development. Ergatic technological systems are widely discussed due to their non-stop development and implementation in all spheres of life. In spite of this phenomena a human operator continues to be the important participant in them and in this connection consideration of all personal characteristics that can influence the final result of activity are important. In the shipping industry, human factors are recognized as a major source of risk to safe and efficient operations. The paper substantiates that the process of operator training can be successful only if the principles of functioning of ergatic systems are understood at any level. The article substantiates that the immersive educational environment, which is a virtual educational space, is part of the general educational space, therefore, when designing it, it is necessary to rely on the main features of the educational space and take them into account when organizing training at any level of training. The conditions for the organization of immersive training and professional environments have been determined and substantiated. It is shown that the effect of immersiveness is achieved by repeated immersion in certain conditions that imitate real professional activity.

Keywords: Ergatic system, simulator, human factor, immersiveness

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1. Introduction

Despite the technical equipment of the merchant shipping industry, in any ergatic system of its control, it is the person who has the decision-making function, and this function plays a leading role in ensuring the safety of navigation.

The tasks that a person must solve at sea include transportation, escort, control of the movement of offshore objects, the organization and conduct of search operations at sea, and much more. Most of the tasks are solved using organizational and legal methods, considering well-developed decision-making algorithms, as well as through technical methods for collecting information about marine mobile objects and methods of processing them. It is the informatization of modern navigation that is considered as a strategic direction for the development of the industry, where a special place is occupied by the "human factor", recognized as main one in the maritime activity, including performing duties of the crew and overcoming all risks.

The complex task of reducing the physical and information load of ship specialists has been solved for a long time by transferring some of the functions for processing information and controlling technological processes to ergatic control systems with rather complex software, but these issues remain relevant in the maritime transport industry.

2. Problem Statement

2.1. The operator as the decisive subject of the ergatic system

The design of ergatic technological systems has long attracted great interest from both researchers and practitioners. This can be clarified by the constant development of technologies and mandatory participation of a man in it. This is a rather difficult task that requires considering all sides of a human, in any area of production, including shipping.

It is obvious that increasing the efficiency of the maritime industry is associated with its presentation as an ergatic system, that is, the system "man-machine – production environment", and its development is due to the account in the production of psychological, psychophysiological, biomechanical, and other features of the human operator. Ignoring or insufficient attention to these characteristics can result in losses in the regular work at sea and ashore.

According to IMO in resolution A. 947 (2003) resolution “Human factors is a complex multidimensional concept that affects maritime safety, safety and the protection of the marine environment. It encompasses the full range of human activities performed by ship crews, coastal authorities, regulators, recognized organizations, shipyards, legislators, and other relevant parties, all of which must work together to effectively address Human Factors concerns” (p. 2).

Issues affecting the phenomenon of the human factor are considered in various documents adopted by the International Maritime Organization, among which the most significant are: SOLAS Convention; The Seafarers' Training, Certification, and Watchkeeping Convention (STCW), the Maritime Labor Convention, etc. Such attention is explained by the fact of high concern about safety, as it is traditionally

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associated with the likelihood of accidents, where a person, as a rule, is the “weak link” in the technological chain of modern production.

Considering the psychophysiological, psychological, and other characteristics of a person that affect the effectiveness of his activities in the "man-machine" system, it should be remembered that this polysemantic term describes the possibility of human error or illogical decisions in specific situations, as a rule, already perfect and already analyzed, i.e., it is associated, first, with that aspect of this interaction, which is determined precisely by human activity.

Wide implementation of complex systems in all spheres of the merchant industry require special attention to specialists working in it and the level of their training (Kondratiev et al., 2019; Makashina, 2011; Popov, 2019; Sauli, 2017). The professional characteristics of a seafarer encompass the ability to focus, responsibility, managerial and other abilities over a long period of time. The factor of a long stay at sea determined the attention of researchers to such important personal characteristics for the safety of swimming as: vision, hearing, speed of sensorimotor reactions, endurance, vestibular apparatus. Special attention is paid to such a psychological component of the human factor as psychological stability (stress resistance). In this regard, the construction of ergatic systems is a difficult task associated with both the multifactorial nature of the construction and functioning of systems, and with the multifactorial criteria for evaluating the operator's activity.

On the one hand, an increase in the efficiency of organizing modern production is associated with the presentation and development of it as an ergatic system, on the other hand, it is necessary to consider a sharp change in high-tech production, which is the shipping industry, where, along with the widespread introduction of new technologies, the psychophysiological load on the operator also increases, changes the content and nature of his work. The process of training such an operator is also changing, and it can only be successful if the functioning of ergatic systems analysis is provided. Correctly organized interaction of a human operator with technical means in ergatic systems will contribute to communication among participants of the activity. And in this case, neglect of didactics, misunderstanding of its function can lead to decrease of expected results.

3. Research Questions

3.1. The ratio of the ergatic and educational environments

Society, and the shipping industry, are in demand for a new state of education, which gives significantly better results in preparing a person for life and production activities. In this regard, new standards, new programs, and new teaching aids are being introduced. The following categories constantly fall into the spotlight: “educational environment”, “professional environment” and “educational space”. But the essence of these concepts, both in the theory of pedagogy and in other sciences (despite the great interest in them), is interpreted in different ways. Most often, researchers use these concepts intuitively, presenting this phenomenon as an organization or a collection of something needed. The substantiation of the essence of concepts and the disclosure of the laws of their existence is necessary both for understanding and for ordering their structure and composition, connections, etc., i.e., from everything that determines the assimilation of the content of education, but this is the subject of a large study, and the recommended

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volume of the article does not imply a deep analysis of them, therefore we will try to give only a concise overview of existing approaches.

In the work of Marichev (2013) presents an in-depth analysis of the work of scientists exploring the educational space. Here are only those that are relevant to our topic. Educational space is understood as: “a field for psychological and pedagogical interaction”; “A set of state and public mechanisms operating on the basis of complete legal equality, independence, self-government, taking into account regional and local characteristics, but with the obligatory observance of state educational standards that ensure the proper ... level of education, a single educational space”; “A“ place ”existing in society, where many relations and connections are subjectively set, where special activities of different systems are carried out ... for the development of the individual and his socialization”; “A specially organized pedagogical sphere, a structured system of pedagogical factors and conditions for the formation of a personality”; “The totality of all educational and educational institutions, scientific and pedagogical centers, government and public education organizations in different countries, geopolitical regions and on a global scale, their mutual influence and interaction in the conditions of intensive internationalization of various spheres of public life in the modern world”, etc. (Marichev, 2013, p. 216). In the presented definitions, different aspects of the educational space are distinguished: global, regional, state, sectoral, the space of institutions; multicultural, cultural, and informational space for personality development; real, ideal (virtual), etc. But it should be noted that no matter what space is studied or described, practically all researchers associate the features of the educational space they distinguish with educational actions.

We are closest to the approach of Marichev (2013), according to which the educational space has two sides – spatial and educational and is a set of conditions (which are its objects) for the implementation of educational actions. The scientist notes that the educational space is created to produce the product of education, which arises in the student's activity, which consists in transforming its object. The educational space is made up of components of a different nature, acting in an integral set of unified structures, which, in turn, create a unified structure of a higher level of an organization aimed at creating an educational product.

Another concept that is important for this work is “educational environment”. Compared to the "educational space", the environment is a part of it, that is, a purposefully organized area of space and is formed exclusively in accordance with the goals of the pedagogical process, i.e., created artificially.

Considering educational and professional environments we would like to point out that the main goal of the first is to influence actions of the learner to achieve better learning results and the idea of the "professional environment", is associated with carrying out any work activity.

The main objective of this work is the design and description of an immersive learning environment, the presence in which is a dynamic process of including the psychological and psychophysiological systems of a person in the environment of human experience in the process of their construction and development, accompanied by a sense of presence.

Immersive learning environments are in the field of vision of many scientists and practitioners, and most of them view them as learning ergatic environments (Lokuketagoda et al., 2019; Nazir & Jungefeldt, 2017; Sergeev, 2010;). These environments are designed considering such principles of their organization as self-organization, selectivity, immersion, presence, student activity, mutual orientation in the process of

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learning communication, physical immediacy, and subjective (conscious) mediation, interactivity. So, for example, training systems, widely used in the process of practical training of future and active seafarers, mainly reflect the ideas of environmental modeling, and the study of the material and technical part, as a rule, is carried out within the framework of traditional approaches. The cardinal idea here is the ratio of creating professional activity in which the following rule should be observed: the more changeable conditions, the more competent a learning environment is.

As a rule, such learning/education environments are created by means of simulators, among which the following can be distinguished:

- navigation simulator Navi-Trainer Professional 5000 (with 360° visualization) designed for training and certification of officers of the watch, chief mates, captains, and pilots of commercial and fishing vessels with a registered capacity of 500 tons and more;
- a simulator of cargo and ballast operations, which can be used to study the structure of a tanker, the composition of its technical means and systems;
- a simulator of a semi-submersible floating drilling rig, which simulates the equipment of a floating drilling rig, which allows to control the position of the platform and technological processes;
- a crane operations simulator designed to teach how to operate the most common types of modern cranes.

For mastering the basic principles of ship control and operation of ship equipment, for cadets to acquire skills in ship operation in emergencies, operation of ship rescue equipment, survival skills in life-saving equipment, such specialized simulators are used as: “Maneuvering and control of the ship” NAVITRAINER; "Electronic cards"; GMDSS simulators; RLP and ARPA; “Virtual bridge”, etc. The above simulators are not a complete list of equipment used in maritime educational institutions, but they all require additional knowledge and skills of all participants in the educational process, and above all, an instructor. To work effectively in a virtual educational space, a teacher/instructor must be competent both in the field of pedagogy and in the field of information technology.

Application of simulators with different immersion effect lead to different ways of interaction, that allows future specialists to feel more prepared and confident in the transition to a real professional environment. It should also be noted that in the design and properties of tools modeled under given conditions, the student's life experience is used to the maximum. Examples of immersive environments are computer representations of the elements of a simulated virtual environment, which provide an interactivity between the operator and the content of the artificial world.

4. Purpose of the Study

4.1. Conditions for the organization of immersive learning and professional environments

Having defined the basic concepts, we will consider the conditions for the design and functioning of training and professional environments. The bottom line is that educational activities are carried out in the proposed conditions (territory, classroom, training center, etc.), where the participants in educational activities and their funds are located. Funds are provided to both the teacher and the student, i.e., to those

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who are the performer of the leading and decisive activity. The connections between the participants are mutual and the result of this interaction affects the correction of the learning immersive environment.

5. Research Methods

Based on the approach suggested by Marichev (2013), under which "... education itself is an interaction consisting of actions, and actions differ in a variety of features that appear in the structure of their logical connections" (p. 216), we have identified content (subject) and essential-organizational groups. The function of the latter is to group content – to create such groups from them that generate the results of education (knowledge, etc.). In this regard, we set the task to consider the roles of participants in the learning immersive medium and to determine their relations.

6. Findings

Consideration of two groups in learning process including the performance of the leading action by a teacher and a decisive action by a student allows to use all available tools for changing the learner's characteristics according to set aim. (Makashina, 2011; Marichev, 2013). The subject does not exist without the object. The object is a listener, student, etc., who acts in two roles. At first, he manifests himself as an object (even if he is a specialist undergoing retraining) and therefore acts as a condition for the manifestation of a leading action, is a subordinate of the leading subject. To understand the nature of essential organizational actions, let us consider the structure of the educational functional system using the example of immersive learning environments. When constructing it, we based on the approach developed by E.G. Little baby. According to this approach, two essential participants function in educational interaction – the teacher and the student. Each of them has its action center in the consciousness. The teacher transmits to the student information about the current or assigned educational situation and the task (task) that needs to be performed (solved). This information enters the student's consciousness, in which (in memory) the educational information mastered by him is stored and the action (controlling actions) component of the personality is located, which sets in motion the toolkit for changing the objects of education under consideration (Makashina, 2011; Marichev, 2013). The system under consideration consists of two subsystems (systems of the second-order). Each of them has its subject and its object. In the first, the subject is the teacher, and the object is the learner. In the second subsystem, the subject is the learner, and the object is the mastered reality. In the functioning of these systems, the second plays a decisive role, since it is she who provides the essential, necessary product. The first subsystem plays a leading role since it leads the student to actions, the implementation of which gives the desired result. The learner always performs two necessary roles – the object of the leading and the subject, the decisive subsystem. It is the connecting functionality of these subsystems. Without fulfilling the two considered functions, the educational process cannot take place. The student's actions integrate all the circumstances we have considered into a single system of the educational process (Makashina, 2011). The conditions for organizing educational immersive environments presuppose the presence of a training center for performing educational activities; time to complete it; contingent; means of disseminating educational information; potential consumers of the results of the educational process; logistics systems; normative documents of educational activities; sources of

information about the existing experience of educational activities; sources of funding. The conditions for the organization of immersive learning environments include any means of educational activity: the fund of educational and other literature, equipment of educational laboratories, training classes, visual aids, etc. Particular attention is paid to regulatory documents – curricula, programs, textbooks, etc. The specificity of the educational process of the university is in the fact that their regulatory documents provide for some adjustment of the content of education, considering the direction of the university, educational standards, the improvement of production technologies, the development of science and technology, changes in the needs of production, social order, etc.

7. Conclusion

Constant development of the shipping industry and wide implementation of technological achievements in it require highly trained specialists playing a particularly important role in the ergatic system. In this regard, it is necessary to optimize the methods of training specialists for the industry. Consideration of the design conditions for immersive learning and professional environments in an ergatic system allows you to maximize their potential for educational purposes. The creation of immersive learning environments opens new opportunities for future specialists to master the information flow and acquire the necessary knowledge and skills. The study attempts to made to substantiate the conditions for organizing such environments, considering the specifics of the implementation of professional activities in the shipping industry. It is shown that the effect of immersiveness is achieved by repeated immersion in certain conditions that imitate real professional activity. The most productive tool at this stage is simulators. The main criterion for the selection of actions performed on the simulator is the criterion of their compliance with actions in their psychological structure, which are equally performed in educational and real professional activities. It is substantiated that the immersive educational environment, which is a virtual educational space, is part of the general educational space. Therefore, when designing it, it is necessary to rely on the main features of the educational space and take them into account when organizing training at any level of training.

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