

Problems of improving the ergatic learning environment

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Abstract. Currently, there is a great interest in the influence of environmental content on the efficiency of education. New technologies and their introduction into the learning process allow creating new content and new conditions for this process. However, against the background of modern achievements, the engineering and psychological, pedagogical and ergonomic components of effective ergatic environments based on traditional methodology are not sufficiently developed. Despite the accumulated experience in designing human-machine-artificial environment systems, it should be admitted that many issues still remain unclear. Such issues include the problem of organizing ergatic learning environments. The organization of ergatic learning environments and their widespread introduction into the educational space involves the use of simulators to make the learning process not only more exciting, but also contributes to the feeling of presence, which, ultimately, will allow students accumulating the subjective experience necessary to perform their professional activities. The creation and widespread introduction of ergatic learning environments into the learning process enriches the content of educational information and regulates the actions of students to master it. The assimilation of information in ergatic learning environments is determined not only by the volume and content of information, but also by the form of their pedagogical support. The feasibility of regular advanced training courses for those teachers who work directly on simulators is justified. The main issues to be analyzed and considered are highlighted, including: organizational support (organization of learning and teaching); methodical support (selection of education content) and technical support (ability to work on a specific simulator). It was shown that the efficiency of the utilized technology is determined not only by high-quality equipment, but also by the preparation of all participants in the educational process: students, teachers, instructors, etc. Taking into account the principles of ergatic learning environments and observing the conditions of their functioning allows improving the ergatic learning environment and the educational process as a whole.

1 Introduction

Today, there are many definitions of the ergatic system, and their essence comes down to the interaction of a person (operator) and a machine that process information in order to perform labor activity. The main idea of existing approaches is that a person's professional activity within the ergatic system is represented by a variety of subject-object relationships caused by the profession (human-technology, human-technology-environment, etc.), where a person acts not only as an accomplice and performer of normative labor functions, but also as the creator and converter of the ergatic system [1].

The rapid development of technologies, the introduction of artificial intelligence, the use of virtual reality and digitalization in general change not only human functions, but also all modern production. This also applies to the marine industry [2, 3, 4]. We do not set the task of considering all levels of this system. Moreover, we are absolutely convinced that one author cannot simply analyze it. Therefore, let us consider only one of its components – an ergatic learning environment

designed to train a specialist able to interact in a complex marine ergatic system.

2 Materials and Methods

In accordance with the above tasks, we used a set of the following mutually complementary research methods:

- theoretical, including the analysis and synthesis of material accumulated in science; systemic, environmental, technological and situational-functional approaches;
- empirical, involving the expert assessment, as well as the generalization of pedagogical experience.

Reliance on these research methods made it possible not only to conduct a comprehensive analysis of the problem, but also to form an individual vision for solving it.

3 Results and Discussion

Highlighting the essence of the ergatic learning environment, we need to understand the very phenomenon of the learning environment and the

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relations between its components. Educational environments were analyzed from different positions, and points of view, in the studies of various objects and subjects related not only to pedagogy. An analysis of the specific characteristics identified by the authors showed their wide variety, the reason for which lies in many different approaches to their selection. On the one hand, this makes it difficult to understand the main idea of developing an educational environment and the possibilities of using it to improve the quality of education. On the other hand, the use of the concept of "environment" by different sciences helps to reflect the unity of diverse objects and explain their essence [5, 6, 7].

The ergatic learning environment is considered as a set of conditions to perform educational activities, where the main relationship is a human-machine relationship, in our case, a human-simulator relationship. The conditions for this activity can be divided into external (components of the learning environment) and internal (education process itself). The specified set of conditions is created directly by academic actions and is used for their fulfillment [1].

The ergatic learning environment does not appear, does not exist, and does not function on its own, and only its competent construction will help determine the result of the learning process. The ergatic learning environment relies on the understanding of its complex structure, the relationships of its components and their purpose. It should be borne in mind that the main and only purpose of the components is to provide opportunities for learning actions. Therefore, both its structure and its content are determined by the purpose and objectives of the learning process. To achieve the optimality of the ergatic learning environment, it is necessary to ensure the adequacy of its components to the conditions for the functioning of the learning process. At the same time, it is important to take into account that these conditions are not static and change depending on a number of external and internal factors, but, nevertheless, they must be quite resistant to changes and correspond to their main purpose – the implementation of learning actions. In this regard, it seems appropriate to highlight the methodological principles of the ergatic learning environment.

1. Since in pedagogical theory and practice there are different approaches to determine the ergatic learning environment, the main principle of its formation should be the clarification of its essence.

Each learning environment has its own conditions, which are specified depending on the goals. And no matter what the goals are, it always remains subject-oriented.

The ergatic learning environment is a purposefully organized section of the educational space, which is a component of the ergatic system and includes relationships involving the activity of a student in the process of educational communication, the inclusion of psychophysiological and other human systems in relations with the technical environment of the ergatic system, as well as the conditions for performing educational actions due to specific pedagogical goals [1].

2. The next methodological principle of the ergatic learning environment can be the effectiveness of conditions that depend primarily on the tasks of education and are necessary for its productive functioning. In this regard, it is advisable to update the ergatic learning environment after each change in educational tasks. The most optimal approach here can be situational and functional, which consists in conducting a student through several training situations and in including him in the functional system operating in this situation, in which he acquires the necessary competencies while performing adequate educational actions [5, 6, 7, 8]. The use of a situational and functional approach allows creating conditions for the formation of the necessary knowledge and skills.
3. Another methodological principle of organizing the ergatic learning environment is to clarify the laws of its structure, which should provide components of activity. Here it is important to consider the mental and physical state of a student; a comprehensive presentation of the components of the content of education reflecting the future professional field and covering the maximum possible areas of activity of a specialist, etc.

Based on the above, we can highlight the basic principles of the ergatic learning environment:

- composition and content of the objects of the ergatic learning environment should be directed to educational actions that ensure the implementation of educational programs;
- proposed educational actions should be adequate to the learning content;
- educational activities in the ergatic learning environment shall be harmonized;
- conditions that allow achieving the set educational goals to establish mutual compliance with the current state of the educational situation and considering the current results of functional actions.

All the principles are not only interconnected and mutually agreed, but also complement each other.

As a rule, the productive functioning of the ergatic learning environment requires certain conditions. Its design usually relies on a digital platform, which is a complex software and hardware information and training complex that forms the necessary knowledge and skills. Today, the choice of such platforms is quite wide, therefore, as a rule, it is determined by the financial capabilities of a particular educational organization. Such a platform should include a standard set: control server; automated workplace of the trainee; automated instructor seat; multimedia demonstration system; peripherals; set of network and switching equipment.

In one of the earlier published works, the author of the paper considered quite fully the conditions for the design and functioning of training and professional environments. It was justified that educational activities are performed in the proposed conditions (territory, class, simulator center, etc.) with the participants in

educational activities and their means. All the reserves are provided to both the teacher and the student, i.e., to the executor of leading and decisive activities [1]. If the first group includes the conditions for performing the actions of the teacher using the full range of possible methods, forms and means of training, then the second group includes the conditions for performing the actions of the student. The latter group involves the fulfillment and, ultimately, achievement of the goals set by the teacher based on the methods, forms and means proposed by him.

A logical question here – what relations prevail in the subject-subject or subject-object learning process? We rely on a situational-functional approach to the learning process, according to which the functional system of the educational process includes a compound weave of the subject of object relations [5, 6, 7, 8]. In each elementary action, certain subjects and objects are related to each other. They are present in every action. Despite the fact that the participants in different actions perform different roles, any participant in the educational process and the teacher, instructor or student in some actions acts as a subject, in others – an object, and their subject and object roles in the actions performed differ. In other words, their roles in the functional systems of the educational process are divided into leading and decisive. The leading subject of the general functional system is the teacher and at that moment the student is the object of his actions. When a student makes a decision himself or makes a conclusion, he is the subject of decisive events. In other words, a student always performs two roles – the object of the leading and the subject of the decisive subsystems, while acting as their (subsystems) connecting functionality. The fulfillment of these functions is the educational process aimed at the emergence and development of new knowledge [5, 6, 7, 8]. The conscious construction of these double connections and the constant change of roles during training imply the possibility of activating the connection of theory with practice, the actual use of pedagogical experience.

For a more complete understanding of the nature of essential organizational actions, let us consider the structure of the educational functional system using the example of ergatic learning environments.

Specific conditions of their organization and functioning include various simulators, software, logistics systems, regulatory documents of educational activities; sources of information about the existing experience of educational activities, sources of funding and much more that is necessary for the implementation of the process. But all of the above is not enough if there is no teacher, instructor or mentor who has the necessary didactic training and is able to perform actions of combining various conditions in strict accordance with the laws of didactics. In this regard, the issue of training and retraining a teacher to work in ergatic learning environments is quite relevant.

Teachers and instructors working on simulators, i.e., in ergatic educational environments, are guided by the information model of learning, which includes both sources of information (textbooks, modeling software,

databases, and knowledge of the subject area, reference and information, and expert systems), and active participants in the educational process itself, i.e., a teacher introducing new teaching methods, and a student receiving information and interpreting it in the form of their knowledge and skills in the process of performing tasks on simulators.

It is also an undeniable fact that the requirements for the level of training of a teacher who acts as an intermediary between a future specialist and the merchant shipping industry, who owns an educational program of actions and uses modern simulators to form a given quality, are also increasing.

Simulator training, which ensures the practice of actions in different situations, is often the only possible way when it comes to the dangers associated with accidents and loss of life. The psychological readiness of marine specialists affects their ability to withstand extreme external influences, quickly and competently respond to changes in the situation to survive.

An extreme situation in the professional activity of a navigator is a combination of rapidly changing circumstances and sailing conditions that pose a threat to the safety of the crew, ship, and the environment. These conditions, as a rule, have the property of novelty for the navigator and require him to demonstrate his competence to the maximum to decide to minimize damage. In this regard, the regular performance of tasks on simulators in ergatic educational environments allows not only increases the productivity of modeling any professional situation but also achieves such a level of professionally important qualities that will further affect the student's subjective position.

Specific requirements for the training and means of training of marine specialists are clearly defined by the International Convention on the Training and Certification of Sailors and Watchkeeping as amended in 2010 [9]. This Convention allows the use of simulators as a means of training and assessing the competence of crew members of ships on an equal basis with ship equipment. This made it possible to use simulators to conduct various types of training in order to acquire skills to perform the basic functions, and today their introduction into the educational process has become not only desirable, but also mandatory.

Different types of simulators are used to prepare and verify the competence of marine specialists within the framework of the requirements of this Convention. Their choice depends on the ability to either fully or partially meet the requirements of the Convention, in particular, to replace the internship on board a real vessel. Simulators are also used to conduct classes in certain disciplines or individual operations in the preparation of ordinary personnel and basic training of cadets, and to assess competencies in advanced training courses for officers of ship crews.

The widespread use of simulators in the educational process is explained primarily by the fact that simulators allow reproducing the environment, including water space, coastline, navigation fences, moving ships, etc. Real representation of all weather conditions, the effects of visibility and illumination, procedures related to

mooring, towing, search and rescue, special operations, make the simulator into an effective training tool.

In marine education, training is conducted using two types of simulators, which are based on a different principle of operation: computer simulators based on mathematical modeling and the use of advanced information and computer technologies and model simulators using full-scale models made on a certain scale and used in real water areas.

The proposed approach allows significantly intensifies the educational process. The organizers of the educational process in general and ergatic educational environments, in particular, must create conditions conducive to the implementation of a practice-oriented approach to learning, taking into account the possibility of using constantly developing information technologies.

Moreover, the scientific and methodological support of the educational process in ergatic educational environments should be focused on the students' free and responsible choice of their educational trajectories. Their organization should be aimed at the implementation of the goals set, and the formation of the skills of future specialists to work in any, including extreme conditions.

It is also important to keep in mind that the organization of an ergatic quasi-professional environment requires the structuring of educational information at different levels, the systematization of the process of presenting information, and the special organization of interactive communication.

4 Conclusion

Despite the wide interest in the use of simulators in the educational process, the task of choosing the optimal composition of simulators for training specialists continues to be relevant, which is explained by the continuous development of technologies and the search for ways to achieve the quality of training.

No matter how unique the simulator is, for its effective use, appropriate training of a teacher or instructor is required, the requirements for which are also determined by the Convention on the Training and Certification of Sailors and Watchkeeping. The requirements involve a special IMO 6.10 Model Course or a similar course; work experience for 6 months as a simulator instructor (for an examiner); experience as an examiner's shadow trainee, for at least 3 sessions supervised by an experienced professional. In the Russian Federation, the requirements for the experience and qualifications of the examiner are established in a maritime educational institution, with the exception of training and simulation centers, for which there are "Recommendations for organizing the activities of training and simulation centers and their examination" approved by Rosmorrechflot. But all this is not enough if the teacher or instructor does not have didactic knowledge and does not take into account the experience and needs of students, the experience of industry production, while adhering to the subject curriculum. In this regard, it is necessary to emphasize that marine education needs integrated approaches to new training

methods that combine both unique technical means and the readiness of the teacher to work with these means. It is in this case that such an ergatic environment can be called educational.

Regardless of the specific subject area, the issue of designing ergatic learning environments is a very complex multifaceted and interdisciplinary task. Its solution requires the fulfillment of other subtasks, including the following:

- development of principles of ergatic learning environments;
- substantiation of conditions of qualitative functioning of ergatic learning environments;
- consideration of external and internal factors affecting the organization of ergatic learning environments;
- pedagogical support of ergatic learning environments;
- selection of means (real equipment; simulator systems; computer tools and related software; computer learning systems, etc.).

To solve the tasks set, a contingent is needed that has the appropriate personal qualities and professional competencies. At the same time, the activities of specific departments and services of the educational institution should be integrated into the educational process as much as possible, and the employees of these departments themselves should understand not only the essential characteristics of the maritime industry for which they train specialists. but also, the prospects for its (industry) development. Despite the widespread use of simulators in the training of future specialists, there are currently no universal or uniform training models in ergatic learning environments, but highlighting the main parameters and streamlining them will help make the training process more qualitative and productive.

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