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PROSPECTS FOR MODERN MARITIME EDUCATION AND TRAINING PRACTICES IN TERMS OF DISTANCE LEARNING

ПЕРСПЕКТИВИ СУЧАСНОЇ ПРАКТИКИ МОРСЬКОЇ ОСВІТИ І ПІДГОТОВКИ В УМОВАХ ДИСТАНЦІЙНОГО НАВЧАННЯ

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ABSTRACT

This paper considers the problem of maritime education and training of navigators in the context of modern distance learning conditions. The constant expansion of the world fleet in order to maintain productivity at a high level entails increased requirements for the qualifications and training of seafarers. In particular, for a correct assessment of the situation, the necessary condition is a combination of deep knowledge of the equipment operation and its practical significance, with proper bridge team management. According to statistics from open sources, the predominant cause of accidents sets on operators' actions or decisions. Thus, the technical skills and behavioural aspects of the navigation team have to be reviewed from an educational perspective. Concurrently, training efficiency can be increased by taking into account the limiting factors of the present day, which decrease the performance of classic methods of education. Curriculum priorities should be based on maritime accident data, and training methods should use modern technical means, expanding the boundaries of existing practices. On the other hand, in order to ensure complex preparation for navigational operations, it is useful to carry out training sessions with all parties involved. In addition, attention should be paid not only to the qualifications of merchant ships crews but also to the appropriate training of pilots and tug captains, since ignorance of the causes of loss of tug controllability and stability by any party may lead to an accident. Existing papers on classical and innovative tools and equipment used in MET (Maritime Education and Training) were analyzed, including the use of VR in the maritime education sector. A complex study of the problem includes a preliminary analysis of accidents, a review of modern methods used in MET, their limitations, and observations of educational practice at the National University "Odessa Maritime Academy", including a questionnaire. The paper proposes possible prospects for the development and quality improvement of maritime education for navigators from the perspective of modern reality.

Keywords: maritime education and training, maritime resource management, virtual reality, simulators, multi-vessel, distance learning, autonomous ships, human factor.

РЕФЕРАТ

У роботі розглядається проблема морської освіти та підготовки судноводіїв у контексті сучасних умов дистанційного навчання. Постійне розширення світового флоту з метою підтримки високого рівня продуктивності тягне за собою підвищення вимог до кваліфікації та підготовки моряків. Зокрема, для правильної оцінки ситуації необхідною умовою є поєднання глибоких знань роботи обладнання та його практичної значущості з правильним керуванням командою містка. За статистикою з відкритих джерел, основною причиною аварій є дії чи рішення операторів. Таким чином, технічні навички та поведінкові аспекти навігаційної команди мають бути переглянуті з точки зору освіти. Водночас ефективність навчання можливо підвищити, враховуючи лімітуючи фактори сучасності, які

знижують ефективність класичних методів освіти. Пріоритети навчальної програми повинні базуватися на реальних даних морських аварій, а методи навчання повинні використовувати сучасні технічні засоби, розширюючи межі існуючої практики. З іншого боку, для забезпечення комплексної підготовки до навігаційних операцій корисно проводити тренування з усіма залученими сторонами. Слід звертати увагу не тільки на кваліфікацію екіпажів торгових суден, а й на відповідну підготовку лоцманів і капітанів буксирів, оскільки незнання будь-якою стороною причин втрати керованості та остійності буксира може призвести до аварії. Було проаналізовано існуючі документи про класичні та інноваційні інструменти та обладнання, що використовуються в MET (Maritime Education and Training), з оглядом на використання VR у секторі морської освіти. Комплексне дослідження проблеми включає попередній аналіз аварій, огляд сучасних методів, що використовуються в MET, їх обмежень, спостереження за навчальною практикою у Національному Університеті «Одеська Морська Академія» та проведення опитування поміж курсантів. У роботі запропоновано можливі перспективи розвитку та підвищення якості морської освіти для судноводіїв в сучасних умовах.

Ключові слова: морська освіта та підготовка, управління морськими ресурсами, віртуальна реальність, симулятори, взаємодія суден, дистанційне навчання, автономні судна, людський фактор.

Defining the general matter and its connection to important scientific or practical objectives

The intense trend of shipping growth together with the constant development of technology, on the one hand, puts forward a demand for relevant progress in the qualification level of maritime workers. Globalization of maritime transport, on the other hand, affects the volume of cargo transported, which affects not only the total amount of the world fleet but also the capacity of new buildings. In May 2022, as an example, ULCS “Ever Alot” with a capacity of 24,004 TEU was launched in Shanghai, which is the first of the six sister ships planned to be released. The analysis of marine accidents involving container vessels has been published in [1]. According to the UNCTAD Review of maritime transport [2], in 2020, due to the COVID-19 pandemic, the disruption of the economy affected supply, demand and logistics, which resulted in the maritime trade decrease by 3.8%. However, in 2021, global merchandise trade sustained a drastic increase of 4.3%, which implied additional port congestion as well as a reduction of service reliability. The same year, the global commercial fleet grew by 3%, with a global fleet of 99,800 ships, forcing the employment demand to increase in the maritime sector. Thus, in order to keep a high-performance level in the maritime industry, seafarers must constantly comply with growth in requirements and regulations in the context of training and certification of seafarers. To ensure the safety of ship operations in a global and multicultural environment, maritime professions must be constantly regulated at the global level in accordance with relevant international agreements. According to EMSA statistics from 2014 to 2020, 55% of maritime accidents stated such as to be occurred in inland waters, especially in port areas. From the manoeuvring point of view, inland waters are frequently the most critical stages of the passage and in such areas as rivers, harbours, canals, etc., local regulations provide compulsory pilotage and tug services. However, among service vessels, 26% of the casualties involved tugs, whereas 58.4% of the accidents were of navigational nature, i.e. capsizing, contact, grounding, stranding, or collision in multi-vessel operation. Based on the investigation analysis, it was stated that 89.5% of incidents were related to the erroneous actions of operators. In terms of human factors, "safety recommendations" and "actions taken" were mainly addressed to the training, skills, and experience of all the parties involved (50.8%) [3]. Consequently, the technical skills and behavioural aspects of the navigation team require improvement. At the same time, the necessary condition for increasing the effectiveness of training is to have a reference to the limiting factors of present days, such as short breaks between contracts of employment, quarantine restrictions, the unstable political situation in different countries, and other burdens, which seafarers are facing to while being on leave. These circumstances, as a rule, prevent the performance of classroom learning at sufficient volume.

Thus, modern methods of teaching and learning, as well as the equipment used, should be reviewed, taking into account the priority of the curriculum, which should be based on the most common causes of marine accidents and incidents. Moreover, several marine accidents in multi-vessel operations involving tugs emphasize the importance of practical training for common navigational operations such as escort, towing and pushing. In this perspective, attention should be drawn not only to the qualification of merchant ships' crew but also to the relevant training of pilots and tug masters.

Previous researches analysis and definition of new trends in problem solution

With the development of computer technology, artificial intelligence and new learning concepts, maritime education and training have gradually approached the threshold of fundamental changes, which are gaining more and more popularity and turnover. Despite the fact that modern inventions offer various options for the use of certain tools, recent researches demonstrate an evolving trend of uncertainty regarding the formation of an innovative approach to learning. Thus, for example, the following works [5, 8, 9] are devoted to the analysis of the use of AI in assessing the effectiveness of learning and in promoting teaching methods. Although the general idea, together with calculated weight coefficients presented to describe the possible scheme of education, it should be stated that it is limited only to the provided input data. Another group of studies [6, 8, 10, 11, 13] has taken a broad view of the current state of MET (Maritime Education and Training), emphasizing the importance of keeping the curriculum up to date with current issues in the world to help learners adapt to change and innovation, without systematizing the main learning objectives to be followed. The literature review presented in [14, 15, 16] led the authors to the conclusion that the field of maritime education and training in relation to unmanned vessels is at the early development stage. In particular, new requirements for the skills and competencies of seafarers should be established and regulated. STCW, for example, has not sustained changes in terms of autonomous shipping innovations. Meanwhile, the paper [13] study proposed the main professional qualities to be developed in terms of approaching the age of autonomous shipping. Maritime simulators are commonly used in MET and regulated by STCW Convention Regulation I/12 “Use of simulators” and Section A-I/12 “Standards governing the use of simulators”, B-I/12 “Guidance regarding the use of simulators of the STCW Code” [4]. Thus, several studies can be listed, performing the experimental data on the efficiency of specific simulation equipment. For instance, work [17] aimed to examine the reliability and validity of a proposed computer-aided performance assessment (CAPA) tool for pilotage assessment, using the Analytical Hierarchy Process and Bayesian Network to standardize the performance indicators. The authors highlighted the necessity of further research and development of maritime simulator assessment methods. The research [18] investigated the effect of ocean currents in simulator training of docking operations by comparing two groups: one trained with homogenous currents and the other with heterogeneous currents. The study supports the importance of incremental complexity and indicates that if students are exposed to complex scenarios at the early stage, overall performance was lower compared to incremental scenarios. Paper [19] is dedicated to the comparison of various full mission simulator training in Europe, in order to identify compliance with the IMO model course 6.10 *Train the simulator trainer and assessor*. However, the limitation of the research is the neglect of the fact that real situations at sea in most cases differ from the course-based scenarios. The study [20] presents three scenarios based on actual incidents that solve problems not usually familiar to students: the gradient of authority, the desire for harmony in the group, and antagonism between specialities. Based on a real case, it is possible to facilitate the demonstration of specific problems and situations that may arise and lead to an accident. The convenient tool to be used for education and training is the fast-time simulations, such as the SAMMON software for “Simulation Augmented Manoeuvring Design, Monitoring & Conning”, described in [21] in the context of Stern-First-Method in Ship Handling. Such tools can be useful to plan training sessions and evaluate the progress of trainees upon completion. In work [22], the author, based on his own experience, explains the most significant factors in relation to the teacher that affect the overall learning outcome, such as the self-education of the tutor, the instructor’s approach to andragogy, authentic assessment and study significance. This work deeply considers most of the primary aspects to be taken into account in planning and

conducting training and assessment. An alternative to full-mission simulators is virtual and augmented reality systems, which are also being introduced into the maritime education sector. For example, the following works present the usage of mentioned technologies in the maritime sector. Research [23] focused on the analysis of such topics as navigation and navigation aids, spatial knowledge training and trends in VR. The utility and flexibility of head-mounted devices and advanced immersive systems were described in terms of providing a wide range of capabilities and applications in marine simulators in the research [24]. The general utility of cloud-based methods in conditions of distance learning is analyzed in paper [25], highlighting the need for a deeper assessment of the effectiveness of such training types. Another research [27] devoted to the evaluation of the fidelity influence on the training outcome, summarized that despite realistic experience in VR, efficient training can be conducted in combination with dialogue between trainee and teacher. Regarding the challenges imposed through VR use, those are sufficiently described in [26], as well as presenting SLR (Systematic Literature Review) on VR. Suggestions for the MET adjustments were listed in [28], based on the constraints implied by COVID-19 on the performance of maritime training. In summary, taking into account the current reformative stage of MET, the following unresolved issues can be highlighted, which can be a source of inspiration for further research: reconstruction of qualification requirements with regard to MASS (Marine Autonomous Surface Ships) implementation; adaptive learning options to maintain the continuous quality improvement of education; the smart combination of various training methods aiming to increase productivity in the minimum time.

The research objective

The goals of the article include the following: analysis of existing problems in MET, assessment of the cadets` perception in regard to the education in NU "OMA" by conducting the survey, comparison of questionnaire answers with actual observations, i.e. assessment results during the education period. Basing on the processed data, to determine the general trend in the learning and form conclusions on the prospects to improve the quality of MET.

Presenting the main material of a research with a full grounding of received scientific results

1. Navigation officers' training framework. Weak sides of MET.

Based on the literature review in the sector of maritime education, as well as on the reference to the study [1] devoted to identifying the main factors causing marine accident occurrence, it can be emphasized that the qualification of seafarers shall be improved. This statement refers not only to the initial stage of certification but also to the constant self-development of professionals. When it comes to bridge team training, the most common training method used is a full-mission bridge simulator. In order to develop a realistic scenario, it is appropriate to involve all participants engaged in inland navigation, i.e. master, watch officer, helmsman, lookout, pilot, tug crew, VTS communications and surrounding vessels. As for the training of pilots, due to the specifics of their work, the following conditions and circumstances should be taken into account: pilots have to deal several times a day with different ships, crews, nationalities, times of day, workload and other external factors. It is natural that each ship creates its own working environment, as well as a set of standard procedures. Such factor as the cooperation of different nationalities, with different levels of English proficiency, mentality, religion, etc. is also important when considering realistic training. Given the fact that the professional decision of the pilot is a recommendation, it might not agree with the intentions of the OOW and captain. Thus, the pilot must always be competent enough to quickly assess the situation and available resources in the current circumstances and conditions in order to adjust his working style to obtain a positive result. For this purpose, it is necessary to develop qualities such as flexibility and adaptability, which is contrary to the development of standardized procedures. The International Association of Marine Pilots, for instance, provides a theoretical Bridge Resource Management course for pilots without practical training on simulators [29]. On the other hand, a deep study of the

advantages of training marine pilots on simulators was carried out, demonstrating a higher efficiency of the method, in contrast to purely theoretical training [30]. To improve the quality of learning outcomes, it is necessary to form various specific tasks so as not to exhaust the possibilities of memory [31]. Learning based on realistic emergency scenarios can increase the stress level of the trainee, which contributes to the memorization of the corresponding action and situation [32].

In the prevailing number of cases, one of the weak points of the current BRM training is the lack of real interaction between all parties involved, including the dynamics of the vessels. However, such a scenario could improve the quality of training of the bridge team members, pilots and tug masters. A study of the main risk factors affecting the operation of tugs in the port of Kaohsiung showed that tug operators are prone to errors in judgment, work fatigue and lack of skills [33]. According to the analysis [34], the skill level of ship captains and port pilots affects the optimization of port tugs' operations. The concept of a multi-ship interaction simulator [35] was proposed, covering the issue of modelling the stability of a tug, including a simulation study, although the author emphasized that one of the main disadvantages is the high cost of a full-mission simulator. The controllability and stability of tugs during operations with a towed object are critical characteristics that must be taken into account in conjunction with piloting or towing tasks. Recent research [36, 37, 39] presents mathematical modelling of the vessel dynamics during an interaction between a container ship and an ASD (Azimuth Stern Drive) tug, taking into account the stability specifications and including relevant numerical simulations. In general, the following accidents may occur during towing [38]: girting, collision or contact, parting of a towline, grounding of the tug or the tow, main propulsion power, electrical power, steering or critical control systems failure, man overboard, etc. Despite the safety instructions during tug crew training, according to marine investigation reports the girting situation continues to be a concern [40- 44]. Towing training simulators, for example, are provided by Wärtsilä, NAUTIS (VSTEP) and Kongsberg, and are primarily intended for the training of tug captains.

2. Assessment of the effectiveness of education and training in NU "OMA".

Nowadays, MET system mostly tends to provide high-quality learning opportunities with the involvement of modern remote methods of education. In order to form a statistical field for assessing the dynamics of the educational component in the context of the transition to distance learning at NU "OMA", the attendance and academic performance indicators of 2020-2021 and 2021-2022 academic years have been compared.

Data for the survey was collected among cadets of the 2nd and 3rd courses of the navigation faculty. The annual change (in per cent) of the selected indicators during the period of planned learning sessions is shown in fig. 1. Analysing the nature of the trend line, the following could be noted:

1) The beginning of the 2022 academic year is characterized by a decrease in both indicators compared to the previous year. The expected reason for this could be the transition to on-site education during this period after getting used to the distance learning format at the end of the previous year.

2) From November 21 to February 22, the figures increased significantly: in January attendance value increased to 16.7%, whereas the performance parameter up to 14.3%.

3) Due to the military actions in Ukraine, which commenced at the end of February 2022, indicators for March and April 22 reflect a negative trend.

4) The commencement of the current year, despite the continuation of hostilities on the territory of Ukraine, is characterized by a relative increase in academic performance compared to spring values. However, attendance dropped significantly due to the fact, that a large number of students went for practice and/or temporarily left the country. At the same time, many cadets outside of Ukraine continue to take part in the educational process.

In general, estimating the trend till March 2022 leads to the conclusion that the second year of the distance learning format has paid off in terms of improved overall academic performance within the current study. It should be noted that the study is limited to 6 groups of students, so the accuracy

and adequacy could be improved by assessing the parameters of the larger group of cadets.

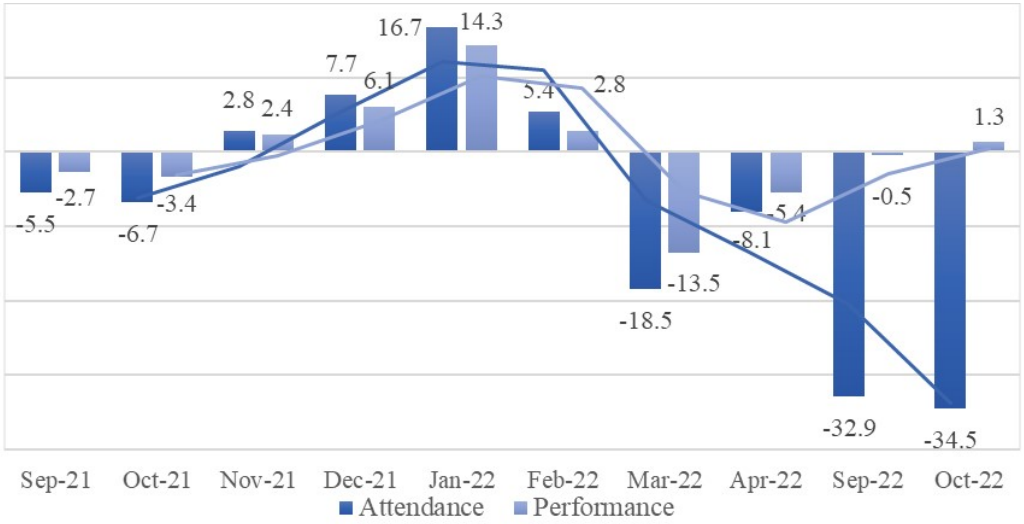

Figure 1. Percentage annual distribution of the attendance and performance parameters 2021-2022 years

In order to evaluate the effectiveness of training, it is not enough to be limited by one-sided judgment only. A necessary condition for achieving progress in this context is the interaction between the teacher and students. In order to collect data on the cadets' opinions regarding existing forms of education, an anonymous survey was conducted, in which 60 students of NU "OMA" took part. The survey resulting values are presented in the form of diagrams (fig. 2-4) and table 1.

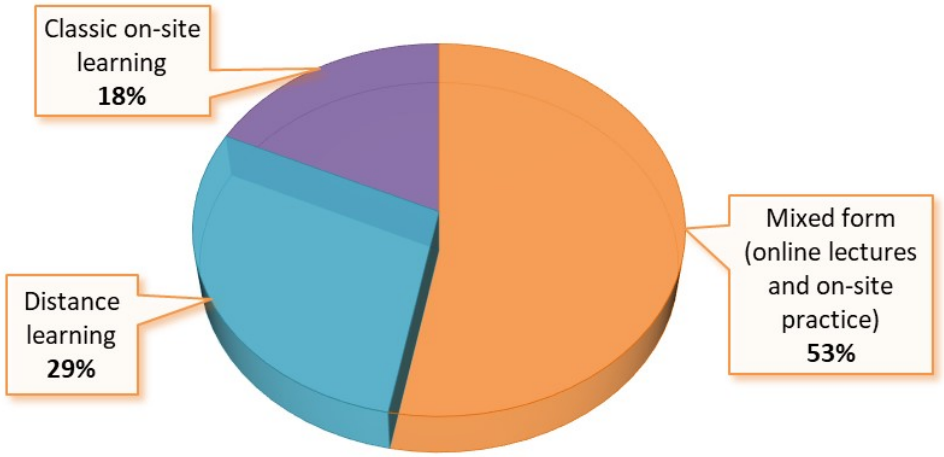

Figure 2. The preferred form of education (distribution of the survey results)

In the context of developing an optimal educational system, the focus should be set on the effectiveness evaluation of distance learning, in comparison with the classical one and vice versa. During the survey, this task was exposed to the students, allowing them to independently prioritize their choices based on their own experience. The distribution of survey results is presented in fig. 2. The preferred form of educational process appeared to be a mixed format with the possibility of on-site practice and lectures in a remote format. However, to complete the review with some valid statements, the questionnaire offered a list of potential advantages and disadvantages. The summarized responses are presented below in tabular form (Table 1). It should be noted that option "other" was also involved, to express an individual opinion, which included the following remarks:

- Negative aspect: the disorganization of teachers in relation to the volume of assignments for independent work, as well as the timing of their delivery.
- Neutral opinion: for students striving for knowledge, the format of training does not affect their results.
- Positive aspect: the ability to travel and continue learning.

Table 1. Collected survey data on the advantages and disadvantages of distance learning with a percentage distribution of the choices.

Advantages of distance learning		
No.	Statement	%
1.	More flexible schedule and time savings.	29.2
2.	A relaxed atmosphere, minimizing stress factors.	26.4
3.	Access to the tutor via the Internet at any time, so that issues can be resolved remotely.	18
4.	Availability of additional resources during the exam.	12.5
5.	Independent work allows students to concentrate and, therefore, a larger amount of material can be memorized and understood.	6.9
6.	Lack of real social contacts.	4.2
7.	Other.	2.8
Disadvantages of distance learning		
No.	Statement	%
1.	Unstable internet connection.	26.8
2.	Lack of means or tools required to study the specific discipline.	19.7
3.	Unrealistic conditions affect the quality of education.	15.5
4.	A relaxed atmosphere causes a decrease in the responsibility of the student.	15.5
5.	Lack of real social contacts.	11.3
6.	Inability to get adequate advice from a mentor when needed.	7
7.	Other.	4.2

When evaluating a number of statements on the positive and negative aspects of distance learning, it is necessary to balance their weight. Thus, several options were intentionally opposed to each other, such as the lack of real social contacts, the relaxed atmosphere, and the teacher's availability for consultation. With regard to the examples given, the following should be emphasized:

- Lack of social contacts was considered a disadvantage (+7.1 %).
- A relaxed atmosphere at home during education was appraised close to a positive point of view, minimizing stress factors (+10.9 %), opposite to the expected negative effect on responsibility level.
- The availability and feedback from teachers showed a positive result (+11 %).

Generally, from this part of the questionnaire, the main advantage of the remote form of learning, as per the cadets' points of view, could be recapped as "Flexible schedule, time-savings, stress avoidance, teacher's support". At the same time, key disadvantages should also prompt actions to minimize their impact, namely: unstable Internet connection and lack of tools and means necessary for studying a particular discipline. In addition to the collected data on the general cadets' opinions regarding the forms of education, an assessment of the education's efficiency level at NU "OMA" has been performed, similarly based on students' perceptions (fig. 3).

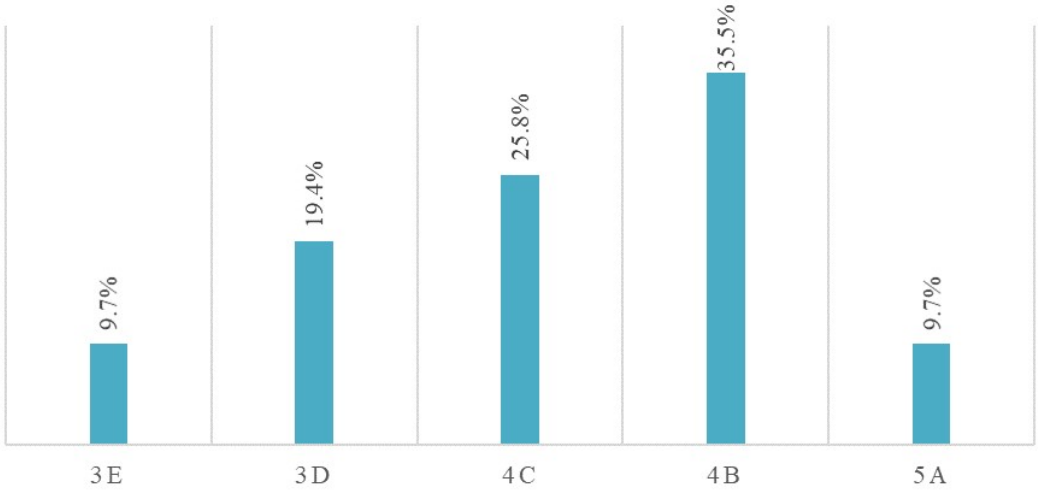

Figure 3. Efficiency evaluation of the current form of education in NU "OMA" (distribution of the survey results)

As can be seen from the values in fig. 3, a predominant number of the survey participants rated the efficiency level of the current form of education in NU "OMA" as 4B and 4C, which exceeded the expected results based on real observations during the classes. In the context of this work, observations are understood as an experimental assessment and control over the behaviour, academic performance, and mood of students, depending on the form of education, as well as on the methods of presenting the material. Based on the correlation between observational and survey results, the following conclusions can be drawn:

1) Distance learning is preferable for the group of NU OMA cadets who participated in the survey.

2) Students are likely to receive more support from teachers remotely.

3) The availability of materials for self-education is a key factor both for online and offline formats of learning.

4) In the course of distance learning, the student can demonstrate such qualities as responsibility and productivity, without comparing himself with others, and also through avoiding additional stress factors.

5) Classroom activities are limited in time, both in terms of material presentation and in terms of interaction with students, so the combination of the above points 2-4 with an allowance for a more flexible schedule shows a positive trend, provided a long period of observation in a distance learning environment.

6) Despite the positive aspects, such problems as an unstable Internet connection and the unavailability of specific tools required for performing practical exercises in some disciplines remain relevant and should be addressed.

The key intermediate goal of the study was to form the concept of effective education and training. Thus, drawing a logical line, the cadets were asked to characterize their vision of possible promising implementations in the education system that contribute to the formation of a positive vector of efficiency and quality of education. The results of processing the received responses are summarized schematically in Figure 4.

Taking into account the modern conditions of distance learning in Ukraine with the participation of students who are abroad, it is possible to substantiate two prevailing points in this matter: VR access to simulation trainings, which can be available from any location; and increased amount of the practical lessons, including simulation trainings. It can be noted that the cadets were divided into two subgroups, however, pursuing one goal, namely, to increase the number of practical exercises, in particular, with the use of simulators. It is a natural wish to devote more time to practical exercises and training sessions on simulators, since the profession of a navigator, as a rule, can be

fully mastered only in real or as close to real conditions as possible. Many theoretical explanations cannot replace the self-experience received on the ship. This statement is confirmed by the votes' results of the cadets being already aware of the above necessary condition at this stage and would like to gain more experience in a safe environment within the period of education in the university and under the teacher`s guidance.

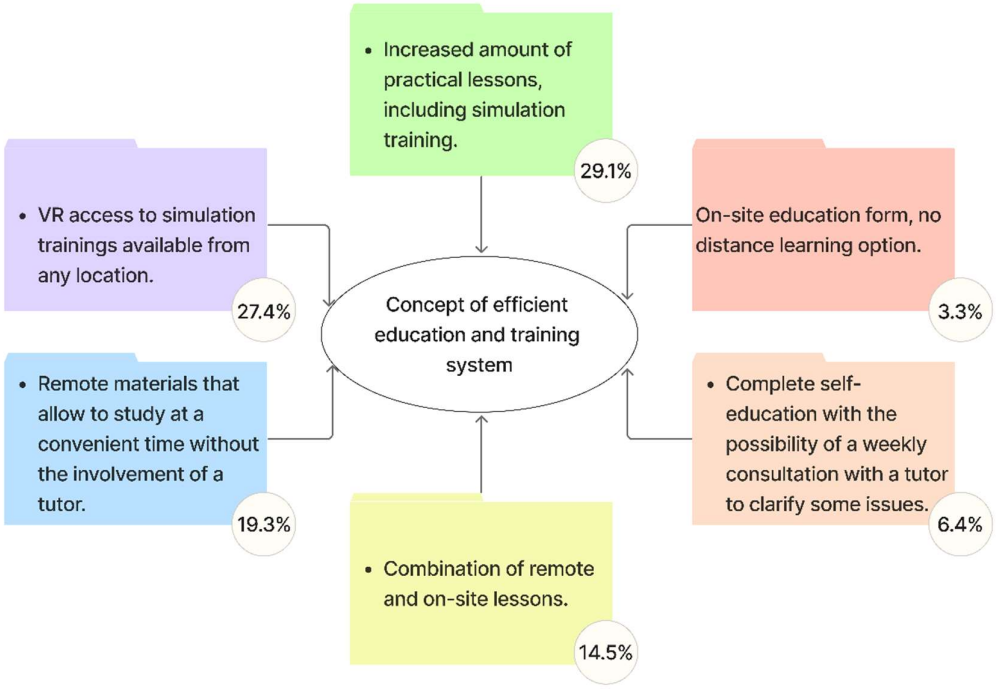

Figure 4. The features that can be introduced into the education system to improve efficiency from the point of view of cadets (distribution of survey results)

Another option, which took third place among answers received, is the transfer of all theoretical explanations to the format of round-the-clock remote access. It is understood that the program could be presented in the form of video lessons, tasks and examples available for self-study. Taking into account the previously mentioned preference of the cadets to support the distance format of lectures, it is possible to model the following prospect of the educational process organization at NU "OMA". By limiting the workload to the planned number of hours, it would be possible to merge the lecture load with the allocated for self-education. In other words, all the lecture material could be worked out by the students on their own, with a certain frequency of consultations with the teacher. With regard to laboratory work, the scheme could be the same, however, most of the material should be considered from the perspective of application on the equipment available at the university in order to involve cadets in practical activities and, thus, to increase their level of interest and actual development of the necessary qualifications. However, in the proposed simplified system, in order to monitor and control the self-organization of students, at the initial stage of implementation, it is necessary to regulate the load in order to teach cadets to reasonably distribute time and effort. To do this, it would be convenient to consider a smart learning platform capable of correcting the student's actions in order to achieve the greatest success in their studies. Such a platform requires more data for developing the correct and necessary parameters for its operation and will be considered in the future.

As for the VR set, which allows connecting to the exercise from anywhere, it should be emphasized that the main limitation is the availability of appropriate equipment for all cadets. However, in case such an option is considered only as a private option for those students who cannot take part in the actual practice of the exercise on the simulator, then the proposal can be considered acceptable. It should be noted that although VR systems provide a realistic experience in the educational field of the maritime industry, simulating movement in VR space can lead to motion

sickness symptoms such as nausea, headache, fatigue etc. The reason for this is the lack of real movements' registration by the muscles of the body so that the mutual perception formed by sight and hearing runs counter to the actual state of the organism. According to [45], visual-vestibular conflict depends on the type of content – static or dynamic. Comparative analysis of the processed research data showed that this is the main factor influencing the symptoms of VR disease. In the field of studying the possibilities of reducing unpleasant impact, methods based on the induction of the user's gaze based on visual guidance have also been proposed [46].

Summing up this section, it would be appropriate to note that all assumptions are subject to verification on a larger number of interviewed cadets. It is also planned to conduct a study among teachers to correlate the vision of the parties involved in the educational process and, subsequently, evaluate possible options for the formation of an optimal concept for an effective education and training system.

Conclusions and further research prospects

This study examines the problem of maritime education and training of navigators in the context of modern distance learning conditions. According to the results of statistical analysis, it was found that more than half of maritime accidents are of a navigational nature and mainly occur in inland waters. Recommendations arising from investigations of such incidents mainly relate to the level of training, practical skills and experience of the employees involved. It is emphasized that one of the weak points of modern simulation training is the lack of real interaction between the crews of ships during joint navigation operations, including the communication between the parties and the mutual dynamics of vessels, namely when in operation with tugboats.

In addition, this work presents the results of observations of the educational practice at the National University "Odessa Maritime Academy" and a relevant survey involving cadets. Possible prospects for the development and improvement of the maritime education system's quality for navigators at NU "OMA" are formulated with regard to external conditions influencing learning performance. The main resulting trends can be summarized as follows:

1) Distance learning is preferable for the group of NU OMA cadets who participated in the survey.

2) Students are likely to receive more support from teachers remotely.

3) The availability of materials for self-education is a key factor both for online and offline formats of learning.

4) In the course of distance learning, the student can demonstrate such qualities as responsibility and productivity, without comparing himself with others, and also through avoiding additional stress factors.

5) On the other hand, the level of discipline might also be increased by attending classes at university to force students to adhere to the timetable.

6) Classroom activities are limited in time, both in terms of material presentation and in terms of interaction with students, so the combination of the above points 2-4 with an allowance for a more flexible schedule shows a positive trend, provided a long period of observation in a distance learning environment.

7) Despite the positive aspects, such problems, as an unstable Internet connection and the unavailability of specific tools required for performing practical exercises in some disciplines, remain relevant and should be addressed.

8) Due to the quite common fact that many cadets are abroad during their studies, it is an interesting option for them to use VR set for accessing the exercises on simulators as well as the practical lessons.

As a result, the concept of a smart distance learning platform was proposed. Many issues should be addressed in order to develop such a platform. For this purpose, further constant monitoring and evaluation of the current education system are expected to be maintained in regard to the formation of an optimal concept for an effective education and training system.

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