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Development of professional competence of future specialists in the operation of shipboard technical systems and complexes using LMS MOODLE

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Abstract. Modern digital learning tools have become an integral part of maritime education and training (MET). Modernisation of MET with digital tools requires the development of new skills for maritime professionals (e.g., specialists in the management of shipboard technical systems and complexes). The purpose of the present study was to analyse the role of digital learning platforms, specifically, learning management systems (LMS), modular object-oriented dynamic learning environments (MOODLE), and online ESP courses. The study described the LMS MOODLE tools used in ESP online courses for future specialists in the management of shipboard technical systems and complexes to develop their professional competence. The study analysed the possibilities of the digital educational environment for the development of professional skills and competences of students of maritime educational institutions. The advantages of integrating e-learning into the training of ship's mechanics were determined, specifically through flexibility in access to materials, adaptability of the educational process, and the possibility of forming individual learning paths. It was concluded that the LMS MOODLE significantly contributes to the development of professional competence of maritime specialists in e-learning. This ensures a comprehensive approach to MET and allows future specialists in the management of shipboard technical systems and complexes to take an active part in e-learning. As a result, students acquire theoretical knowledge with practical skills necessary for further work on board. The practical value

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of this study lies in its possible application of LMS MOODLE by teachers in teaching ESP in maritime higher education institutions

Keywords: maritime institutions; marine professionals; digitalisation; maritime English; e-learning

INTRODUCTION

The need to develop the professional competence of future shipboard technical systems management specialists using the MOODLE LMS is driven by the necessity of adapting maritime education to modern technological requirements. The development of innovative information technologies and globalisation are changing the requirements for training specialists who must possess not only theoretical knowledge but also practical skills for the effective management of complex ship systems. The use of MOODLE allows integrating modern distance learning methods, which contributes to the individualisation of education, the development of self-education skills, the necessary professional competences, such as analytical thinking, and skills in working with technical programmes. This makes learning more interactive and effective, meeting the requirements of the modern labour market.

Global standardisation in the maritime industry has become uniform globally. Every seafarer must be well-qualified not only to graduate from a maritime institution but also to get certificates, pass interviews at crewing agencies, take English language tests, etc. English tests vary depending on the shipping companies' requirements. Examples are as follows: Marlins, TEST of Maritime English for Seafarers, SMCP-Based Tests (Official website of the International..., n.d.). The crewing agencies use these tests to check future worker's ability to speak in English. Professional tests are developed according to international maritime standards (e.g., STCW – Sailors' Training and Certification and Watchkeeping).

The professional competence of future seafarers has been explored by many researchers, each of whom has made a valuable contribution to the disclosure of various aspects of this issue. Overall, their research indicates the significance of developing not only technical knowledge, but also socio-communicative skills, which are key in the maritime profession. All these studies confirm the effectiveness of the use of digital technologies in the training of seafarers. They provide flexibility of training, improve access to training materials, and create an interactive environment for the development of professional skills. S. Ghosh *et al.* (2024) investigated the characteristics of skills and competence frameworks through a systematic literature review. The researchers also examined the STCW Code for seafarer training. As a result, the researchers proposed their variant of essential characteristics of the frameworks which need to be imbibed in the Code to maintain its relevance. A group of Ukrainian researchers investigated the professional competence of specialists in the maritime industry, particularly the role of soft skills in it. The researchers re-

viewed the use of soft skills in the professional competence of maritime specialists and determined the value of these soft skills for the work of seafarers (Zheliaskov *et al.*, 2024). O.L. Moroz (2024) studied the professionally oriented communicative competence of seafarers. The researcher offered some practical solutions that helped teachers to minimise the challenges of online Maritime English course teaching.

Y. Tymoshchuk (2019) studied the essence of a foreign seafarer's professional competence using the example of learning professional English. The researcher proved the value of foreign communicative approach in forming a comprehensively developed seaman, ready to perform their professional activities on board. E. Sumartono (2024) investigated the impact of digital platforms on the effectiveness of training future seafarers. The findings of the study revealed that digital transformation has fundamentally changed the way seafarers work, study, and interact. J. Li *et al.* (2024) analysed the adaptation of electronic technologies in maritime education, particularly the use of artificial intelligence to personalise the educational process. The principal subject of their study was digital literacy. As the result, the seafarers' digital literacy was found to be at a moderate level.

E. Ceylani *et al.* (2022) ranked critical competences for future seafarers within the scope of digital transformation. The researchers concluded that cognitive skills are expected to be the most significant competencies of maritime professionals in the context of digitalisation. M.I.A. Aziz & W.Z. Zakaria (2022) focused on Malaysian seafarers in their study. Their findings suggested Malaysian seafarers' readiness to adopt digital innovations at the workplace. However, all the studies mentioned did not address the competence of specialists in the operation of shipboard technical systems and complexes and thus their findings have limited generalisability. That is why the purpose of the present study was to describe the development of the professional competence of future specialists in the operation of shipboard technical systems and complexes using LMS MOODLE.

MATERIALS AND METHODS

This study was conducted at the Kherson State Maritime Academy (KSMA), Odesa, Ukraine. KSMA trains the following maritime professionals: ship navigators, electrical engineers, and specialists in the operation of shipboard technical systems and complexes. The study involved three stages of pedagogical experiment: preliminary, content, and analytical. First-year cadets of Marine Engineering Faculty were chosen as a subject of research during the preliminary stage of experiment. The survey of their professional

competency was developed on LMS MOODLE (Questionnaire resource) during September 2024 to collect the data from cadets. The preliminary survey placed on LMS MOODLE ESP online course is presented in Figure 1 below.

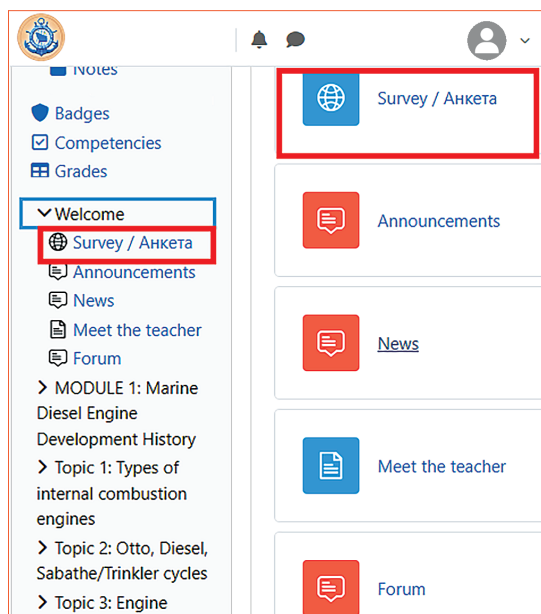


Figure 1. Preliminary survey on LMS MOODLE
Source: ESP online course on LMS MOODLE of KSMA

The survey included 13 questions (as an initial diagnostic tool) and was conducted by 61 cadets (mostly 18-year-old males). The survey results did not affect the cadets' distribution into groups and English subgroups. Cadets were randomly distributed into two main groups using alphabetical order, ensuring an unbiased distribution: 211AP group (1st (15 cadets) and 2nd (16 cadets) subgroups) and 212AP group (1st (15 cadets) and 2nd (15 cadets) subgroups). Most of participants, who generally possessed a basic level of professional competence, began the experiment on equal terms.

The content stage of the experiment was conducted during one semester of the 2024/2025 academic year – from October 2024 to January. During this period, new educational and methodological materials were developed specifically for LMS MOODLE to enhance the professional competence of future specialists in the operation of ship-board technical systems and complexes. These materials incorporate innovative tools and instruments such as the H5P module for interactive content, gamification elements to boost engagement, and assignments for continuous assessment. Each tool was strategically selected to promote active learning, foster critical thinking, and simulate real-world problem-solving scenarios relevant to maritime operations.

The final diagnosis, conducted during the analytical stage of the experiment, provided a comprehensive assessment of the implemented methods. This evaluation compared the performance of cadets in the experimental groups – who used the newly developed materials – with

that of control groups following conventional instructional methods. Various metrics were employed, including the quality of assignments submitted, improvements in professional competencies, and overall engagement with the course content. The comparative analysis aimed to validate the effectiveness of the modernised approach in fostering both communicative and professional skills. The study followed all ethical standards of the Declaration of Helsinki (2013), anonymity was preserved during the experiment, and no rights were violated. The data was taken from LMS MOODLE of KSMA (ESP online course).

RESULTS AND DISCUSSION

LMS MOODLE at KSMA serves as a comprehensive digital hub that encompasses online courses for all subjects taught at the institution and its structural subdivisions (e.g., Maritime Applied College). This integrated platform not only centralises the curriculum but also supports a flexible, anytime-anywhere learning environment. Within this framework, the ESP course was specifically developed to enhance cadets' communicative and professional competences by leveraging a diverse range of interactive and collaborative tools. The ESP course is structured to address both language skills and professional knowledge by incorporating a variety of MOODLE activities and resources. Quiz and Survey: these tools enable continuous evaluation of student's progress, enabling instructors to assess understanding and provide prompt, personalised feedback. Questionnaire facilitates self-assessment and helps gauge prior knowledge and learning outcomes. Book, Lesson, and Page serve as organised repositories for comprehensive learning materials, guiding students through structured content and facilitating self-paced study. Wiki and Glossary: encourage collaborative content creation and serve as valuable reference tools, particularly for mastering technical vocabulary and maritime-specific terminologies.

Assignments were used in each module of the ESP online course, which contributed to the integration of theoretical knowledge with practical skills. Parts of the student textbook (Kudryavtseva *et al.*, 2018) served as detailed instructions for working on the Assignments, which enabled students to navigate the tasks and complete them independently. These assignments were assigned as homework during the semester for future specialists in ship engineering systems and complex operations, ensuring systematic repetition and consolidation of the studied material (Bekteshi *et al.*, 2021). Using this platform, teachers could collect completed tasks, provide detailed comments on each assignment, and evaluate them, which created effective feedback. This enabled cadets to receive recommendations for improving the quality of work, correcting mistakes and, if necessary, re-submit tasks to improve their skills. This approach stimulated the development of self-control, critical thinking, and responsibility for their learning (Tsimplis, 2020). A particularly significant aspect is the ability to resubmit assignments. This enables students to view mistakes not as failures but as part of the learning process and

develop individual improvement strategies, which is crucial for the development of professional competence (Konratenko *et al.*, 2021). The feedback received motivates students to improve themselves and contributes to the creation of a positive learning environment where everyone is free to experiment and develop. Teachers could analyse the progress of each student, track errors, and promptly adjust the learning process, ensuring an individual approach to each cadet (Kurban, 2018).

Assignments (Fig. 2) are a useful tool for the development of both communicative and professional com-

petencies, as they contribute to the active engagement of students in the learning process, the development of analytical abilities, and the ability to work effectively in a team (Lytvynova, 2015). The tasks integrate theoretical training with practical activities, which allows future specialists not only to master the material but also to adapt it to the real conditions of professional activity in the field of ship engineering systems and the operation of complexes. Thus, the tasks serve not only as a means of testing knowledge but also stimulate continuous professional growth and cadets' self-development (Mezentseva, 2020).

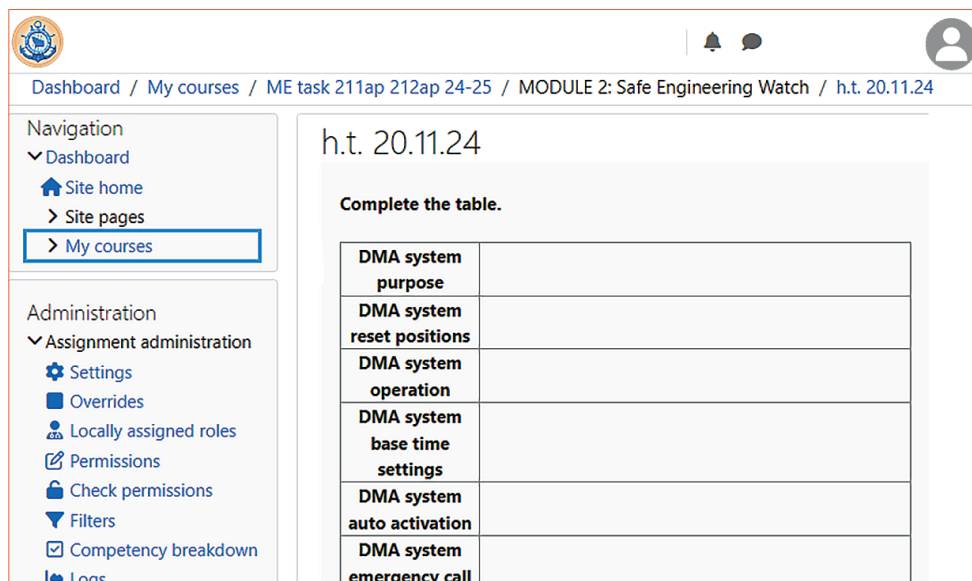


Figure 2. Example of Assignment on LMS MOODLE

Source: ESP online course on LMS MOODLE of KSMA

Module Book (Fig. 3) is also used as a useful tool for teachers in ESP classes. This module can be used to present new vocabulary at the Presentation stage of the lesson. Module Book allows the creation of various digital pages with such elements as text, pictures, gifs, videos, audio, links, and H5P (Mohan, 2018). By integrating multimedia elements teachers can create a dynamic learning environment that addresses various learning styles and keeps students motivated. For example, including interactive quizzes or drag-and-drop exercises on a book page can reinforce new vocabulary, ensuring that students are actively engaged with the content rather than passively reading it (Rasool & Dawood, 2021). Book can contain a list of the names of book pages (Table of contents), Book description, ID number, language to be forced (e.g., English), Restricted access which is really useful for home tasks, activity completion option, tags, and competencies (in case online courses contain competency framework created by MOODLE administrator). In addition to its role in introducing new material, the Module Book is extremely versatile. Teachers can use it to curate supplementary resources, create thematic sections, or even develop self-study materials that align with the course competency

framework. By tagging content and linking it to specific competencies, teachers can track student progress and ensure that each student is achieving the desired outcomes (Schaffzin, 2016). The flexibility of the Book module supports a holistic approach to learning, combining presentation, practice, and application phases (Semerikov *et al.*, 2020). This not only improves students' understanding of new vocabulary but also integrates these terms into a broader communicative context, thereby enhancing both linguistic proficiency and professional competence in ESP (Sherman *et al.*, 2020).

The Chat and Forum modules are two activities that are mostly used to develop students' writing skills (Fig. 4), considering the restrictions on full offline classrooms during martial law in Ukraine (Striuk & Semerikov, 2020). The only sufficient difference between them is that the Forum module creates asynchronous discussions while the Chat module creates synchronous ones. The synchronous nature of the Chat module encourages immediate dialogue between students, enabling them to quickly clarify doubts and share ideas, which is especially valuable when in-person classes are not possible (Valko *et al.*, 2021). In contrast, the asynchronous forum module enables students to take

time to formulate thoughtful responses, encouraging deeper reflection on topics and facilitating richer discussion (Yakhontova, 2003). Chats are text-based but in Forums students can add pictures, GIFs, videos, H5P components, which helps illustrate complex concepts and makes the learning process more engaging for diverse learning styles. Both Chats and Forums sessions are saved and can be made available for everyone unless the course tutor has made a restriction (e.g., for distinct groups or subgroups). Due to the impossibility of conducting fully offline classes during martial law in Ukraine, KSMA A. Volkova (2021) found

Chat and Forum modules useful for group discussions, especially for future specialists in operating shipboard technical systems and complexes to exchange their experience on various topics while studying ESP (Zaitseva et al., 2022). Saved discussion recordings allow instructors to monitor student engagement and assess written communication skills over time (Zinchenko et al., 2022). These recordings can also serve as a basis for providing detailed feedback, helping students identify areas for improvement and encouraging the continued development of professional writing and critical thinking skills (Sakib et al., 2021).

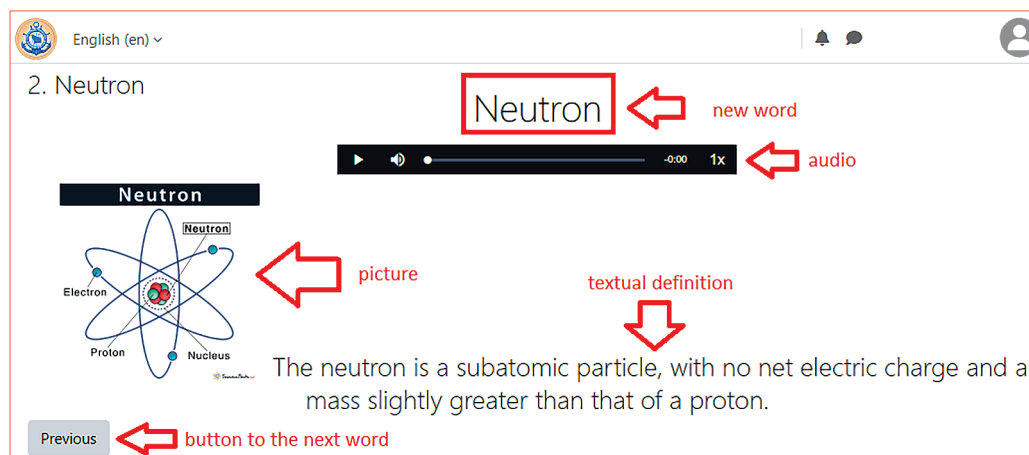


Figure 3. Book on the topic “Electricity in the Engine room”

Source: Maritime English course on LMS MOODLE of KSMA

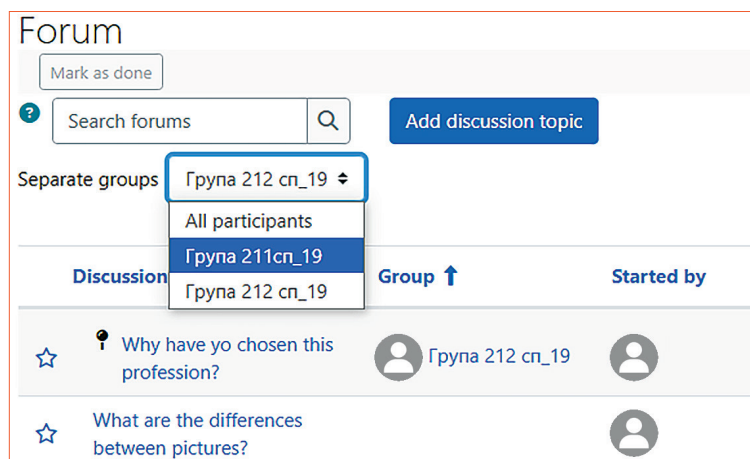


Figure 4. Forum of ESP course in LMS MOODLE

Source: ESP course on LMS MOODLE of KSMA

The flexibility of these modules means that they can be seamlessly integrated with other MOODLE activities and assessment tools, providing a comprehensive environment for the development of language and technical skills (Pidpala, 2017; Tyron et al., 2020). Using SCORM and HotPot allows integrating interactive modules, simulations, and dynamic content that accurately simulate real professional situations and encourage independent analysis of situations, decision-making, and experimentation, which

is critical in the training of specialists (Liashenko, 2024). SCORM packages allow creating adaptive training programmes, where each student can work on practical tasks that match their level of training. This approach enables a detailed assessment of individual progress, which helps to identify strengths and areas for improvement. HotPot allows developing interactive exercises, tests, and tasks with gamification elements that stimulate active engagement of students (Fig. 5).

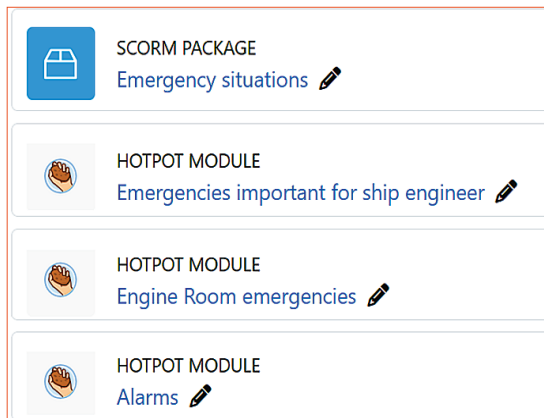


Figure 5. SCORM and HotPot of ESP course in LMS MOODLE

Source: ESP course on LMS MOODLE of KSMA

The Recosha Meet platform opens wide opportunities for organising virtual meetings, facilitating real-time collaboration. This tool enables teachers and students to conduct online conferences, seminars, and interactive classes, which maintains continuity of communication even in remote mode. Virtual meetings using Recosha Meet contribute to the development of communication skills, allow quickly solving problem situations and exchanging experience in real time. This is particularly relevant in the context of modern challenges, when conventional teaching methods must be adapted to the online environment. The integration of Recosha Meet into the educational process forms an effective platform for collaboration, which increases the overall level of professional training of future specialists (Fig. 6).

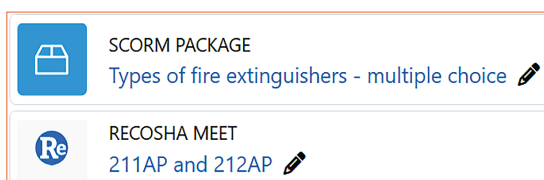


Figure 6. The Recosha Meet platform of ESP course in LMS MOODLE

Source: ESP course on LMS MOODLE of KSMA

The analytical phase of the study collected, synthesised, and evaluated comprehensive data to assess the effectiveness of the newly implemented methods and tools within the ESP course. This phase served as a link between the experimental activities and the final diagnosis of the learners' competences. During this phase, a series of practical tasks and performance assessments were conducted for both the experimental and control groups. These assessments provided measurable data on the learners' progress in both communicative and professional skills (Shintial *et al.*, 2024; Bahno & Serhiichuk, 2024). In addition to the numerical data, qualitative data was collected from both learners and instructors. This feedback highlighted the ease of use of the

Moodle tools and provided insights into areas that required further improvement.

The analytical phase involved a systematic comparison between the group that experienced the new, integrated Moodle activities, and the control group that followed conventional teaching methods. This comparison was essential to identify a modernised approach to learning outcomes. By analysing both qualitative and quantitative data, instructors could assess improvements in critical areas such as language proficiency, decision-making skills, and the ability to apply theoretical knowledge to practical maritime scenarios. The analytical phase confirmed the effectiveness of integrating advanced tools such as H5P, SCORM packages, and interactive collaboration platforms (e.g., Recosha Meet) into the curriculum. Informed curriculum development: the insights gained in this phase laid the foundation for future adjustments and improvements to the course design, ensuring that the curriculum stays responsive to the changing needs of maritime education. Long-term competency development: by correlating the use of innovative learning tools with improved performance indicators, the analysis highlighted the potential for sustained professional growth and better preparedness for real-world maritime challenges. The analytical phase was thus a critical component of the experiment, not only providing a detailed assessment of current pedagogical interventions but also informing strategic decisions for the development of future curricula. Through robust data collection, comparative analysis, statistical and qualitative assessments, this phase ensured that the methods implemented were effective and scalable for enhancing the professional skills of the future maritime professional.

The integration of these diverse tools within the ESP course enables a multi-dimensional approach to learning. Cadets benefit from the combination of theoretical content, interactive multimedia, and collaborative activities. This approach not only enhances their language proficiency but also equips them with the practical skills required for managing ship technical systems and complex operations (Gucma, *et al.*, 2023). Overall, the LMS MOODLE platform at KSMA, with its extensive suite of activities and resources, plays a pivotal role in modernising education. It provides a dynamic, interactive, and student-centred learning environment that effectively supports the professional and communicative development of future maritime specialists. Since most students in both groups (211AP and 212AP) undergo internships on board ships and are on board for extended periods, the significance of using a modern LMS system is particularly relevant. In this mode of study, students face a series of challenges, including the variability of conditions on board and limited access to stationary educational resources. The LMS provides continuous access to online courses, which is critical to maintaining a prominent level of professional training for future specialists. One of the key advantages of the LMS is its mobility and the ability to access it from any device, regardless of the student's location. Whether it is a computer, tablet,

or smartphone, the system allows easily entering online courses in each subject, which is crucial for students who often change their location along with the ship. This creates a flexible learning environment that can adapt to constantly changing conditions.

The centralised access to learning materials provided by the LMS enables students to quickly find the necessary information, view lectures, complete homework assignments, and take part in interactive discussions. All learning resources are stored in one place, which greatly simplifies the organisation of the learning process and provides a systematic approach to studying the material. Finally, the LMS creates opportunities for operational communication between students and teachers. By integrating online communication and collaboration tools, even when working remotely on board, teachers can provide prompt feedback, hold consultations, and organise virtual meetings. This contributes to the continuous learning process and maintains a strong level of professional training of students, despite the challenges associated with the conditions of practice on board.

Thus, the professional competence of future seafarers is multicomponent and includes both technical knowledge and soft skills (social and communicative), as well as adaptation to the digital learning environment. The achieved results call for integration of two approaches: implementation of soft skills as part of professional competence with emphasis on communication skills, teamwork, and decision-making skills in challenging conditions which are essential for seafarers; implementation of digital technologies in the educational process for the organisation of adaptability, interactivity, and individualisation of training. Implementation of innovations such as LMS MOODLE, virtual simulators, and augmented reality offers an opportunity to create an efficient environment for training future specialists.

CONCLUSIONS

This study found that the LMS MOODLE platform helps students to not only actively learn theoretical

material but also to develop practical skills necessary for making operational decisions in real shipping conditions. Interactive modules, remote tests, and forums contribute to the exchange of experience between students and teachers, which enables prompt adjustment of the educational process and the introduction of innovative methods. It was concluded that the LMS MOODLE significantly contributes to the development of the professional competence of maritime specialists during e-learning. This provides a comprehensive approach to MET and allows future specialists in managing shipboard technical systems and complexes to take an active part in e-learning. The integration of this platform into the educational process helped to optimise the structure of educational programmes, which further contributed to the individualisation of approaches to each student and increases their motivation.

Furthermore, the usage of the LMS MOODLE contributes to the development of critical thinking and analytical abilities, which are crucial for the effective solution of practical tasks. The system allows creating simulations and model various scenarios that meet the modern requirements of professional activity on a ship. This creates conditions for continuous professional growth and improves the quality of training of future specialists. Finally, the implementation of e-learning using LMS MOODLE corresponds to modern trends in education and opens new prospects for the development of highly qualified maritime specialists capable of effectively managing shipboard technical systems and complexes in the conditions of dynamic development of the industry. Further research will analyse the effectiveness of digital technologies in increasing the level of professional communication of cadets in English in the context of globalisation of the maritime industry.

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CONFLICT OF INTEREST

The authors of this study declare no conflict of interest.

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Формування професійної компетентності майбутніх фахівців управління судновими технічними системами і комплексами засобами LMS MOODLE

Анотація. Сучасні цифрові засоби навчання стали невід'ємною частиною морської освіти та підготовки (МЕТ). Модернізація МЕТ за допомогою цифрових інструментів вимагає формування нових навичок у морських фахівців (наприклад, у фахівців управління судновими технічними системами і комплексами). Метою цього дослідження було провести аналіз ролі цифрових навчальних платформ, зокрема системи управління навчанням (LMS), модульного об'єктно-орієнтованого динамічного навчального середовища (MOODLE) та онлайн-курсів англійської мови за професійним спрямуванням (ESP). У статті описуються інструменти LMS MOODLE, які використовуються в онлайн-курсах ESP для майбутніх фахівців управління судновими технічними системами і комплексами для формування їх професійної компетентності. Проаналізовано можливості цифрового освітнього середовища для розвитку професійних навичок та компетентностей здобувачів морських навчальних закладів. Визначено переваги інтеграції електронного навчання у підготовку суднових механіків, зокрема через гнучкість у доступі до матеріалів, адаптивність навчального процесу та можливість формування індивідуальних траєкторій навчання. Зроблено висновок, що LMS MOODLE суттєво сприяє формуванню професійної компетентності морських фахівців під час електронного навчання. Це забезпечує комплексний підхід до МЕТ і дозволяє майбутнім фахівцям управління судновими технічними системами і комплексами брати активну участь в електронному навчанні. В результаті студенти отримують теоретичні знання з практичними навичками, необхідними для подальшої роботи на борту судна. Практична цінність цього дослідження полягає в його можливому застосуванні викладачами LMS MOODLE у викладанні ESP у морських закладах вищої освіти

Ключові слова: морські заклади освіти; морські фахівці; діджиталізація; морська англійська; електронне навчання