

# Benchmarking in online maritime education: tracing the evolution of assessment in electronic educational environments

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**Abstract.** The paper is devoted to the analysis of the evolution process of assessment practices in online maritime education within electronic educational environments (EEEs). It is highlighted that with the increasing popularity of EEEs worldwide, especially amid the COVID-19 pandemic, online education has become a crucial tool for ensuring continued access to learning. It is mentioned that despite the growing importance of e-learning platforms, there remains a gap in understanding best practices, trends, and innovations in assessment methods within this context. A comparison analysis of the most popular e-learning platforms is conducted in the study. The benefits of Moodle while online maritime education are mentioned in the article. The results of the study showed that Moodle has many tools and instruments for future ship engineers who want to study maritime English. The study also found that Moodle offers flexibility, interactivity, and efficiency in evaluating students' learning progress and outcomes with the help of these tools and instruments. This work highlights that while Moodle's assessment tools are effective, teachers can enhance the teaching and learning experience for both themselves and their cadets.

**Keywords:** e-learning · benchmarking · digitalization · assessment · innovative technologies · electronic educational environment

## 1 Introduction

E-learning environments have indeed gained popularity worldwide, mainly due to the COVID-19 pandemic. They provide convenient and accessible platforms for students to continue their education remotely. However, it is essential to note that the adoption and popularity of e-learning can vary from country to country

and be influenced by various factors such as technology infrastructure, internet accessibility, and cultural norms.

In the context of Ukraine, due to the impact of war, it is understandable that electronic educational environments (EEEs) may have faced challenges in implementation. War has disrupted infrastructure, including electricity and telecommunications, making access to online education difficult. Additionally, the prioritisation of resources during times of war is not directed towards building and supporting e-learning platforms. The war has displaced many people, including academic staff and students, and disrupted traditional education systems, making EEEs a vital tool for ensuring continued access to education. People are increasingly seeking flexible learning options that fit their busy schedules and individual needs. EEEs can provide this flexibility through features like asynchronous learning and self-paced courses [11, 28].

Nevertheless, it is encouraging to see efforts being made globally to bridge the educational gap through online platforms. These platforms can help mitigate the impact of different challenging circumstances by providing alternative avenues for learning.

It is important to acknowledge that the trend towards EEEs existed before these events, and they are likely to remain a significant part of the educational landscape even after the pandemic and war are over. EEEs can connect students and educators from all over the world, creating a more diverse and interconnected learning environment. Electronic educational platforms (EEPs) provide access to learning materials anytime and anywhere. Future ship engineers can study at their own pace, whether it is from home, on a voyage, or even while on the go. These environments offer flexibility in terms of scheduling and learning methods. Students can choose when to study and engage with educational content, allowing for personalised learning experiences [14, 23].

EPPs often incorporate a variety of multimedia elements, such as videos, interactive simulations, and multimedia presentations. These resources enhance engagement and help students grasp complex concepts more effectively. Also, online platforms facilitate communication and collaboration among students, allowing them to connect and learn from peers across different geographical locations. They can create posters and projects, work using whiteboards, and be assessed simultaneously. EEEs can adapt to individual student needs. They use algorithms and analytics to track student progress and provide tailored recommendations and resources based on their specific strengths and weaknesses. Online learning often eliminates the need for physical textbooks and reduces other expenses associated with traditional classroom settings, making education more affordable and accessible to a broader range of learners. Overall, EEEs offer a range of advantages that enhance accessibility, flexibility, interactivity, and personalisation in the learning process [1, 19].

Our research aims to identify and analyse best practices in online maritime education assessment. Therefore, this article shows the experience of a Ukrainian maritime HEI, Kherson State Maritime Academy, in this area.

## 2 Analysis of recent research

The issue of benchmarking in education was studied by many scientists, among which are Caeiro et al. [5], Hlukhaniuk et al. [10]. As about maritime sector benchmarking was studied by Godet et al. [9], Osman et al. [20]. Caeiro et al. [5] have critically reflected the existing tools to assess and benchmark Education for Sustainable Development implementation; they also consider these assessment and benchmarking tools to be useful as drivers to higher education institutions (HEIs) in improving their sustainability performance. Their work highlights how benchmarking can catalyse continuous improvement in educational practices and institutional sustainability efforts. Hlukhaniuk et al. [10] have examined Science, Technology, Engineering, the Arts and Mathematics (STEAM) education as a benchmark for innovative training of future teachers. Their research underscores the role of benchmarking in promoting educational innovation, particularly in aligning training programs with contemporary educational needs and industry demands. In the maritime industry, Godet et al. [9] identified the challenges in benchmarking the energy efficiency of ships. Unlike the automotive industry, where driving cycles have been standard in performance evaluation, the maritime sector lacks such formalised benchmarking tools. Their research highlights the complexities and gaps in existing benchmarking practices within maritime transport, pointing to the need for more robust and standardised approaches. Osman et al. [20] conducted a comprehensive benchmarking analysis of the maritime sector, focusing on digitalisation trends. Their comparative study of the Norwegian national market and the global maritime cluster revealed significant insights into the sector's digital transformation. They concluded that the future of the maritime industry lies in its ability to embrace and integrate digital technologies, which will be critical in maintaining competitiveness and sustainability. Despite these advancements, there is a noticeable gap in the research concerning benchmarking in online maritime education, particularly in the assessment of Electronic Educational Environments (EEEs). While many studies have focused on comparing and analysing teaching methods, curriculum structures, and training facilities in traditional maritime education, the shift towards online education necessitates new benchmarking standards. The lack of studies in this area indicates a pressing need for research that addresses the unique challenges and opportunities presented by online education in the maritime sector.

## 3 Methods

The research was conducted on the basis of Kherson State Maritime Academy (KSMA), Kherson (Ukraine). The research proposal was reviewed and approved by the Institutional Review Board of Kherson State Maritime Academy (approval number: 2023-05).

EEE of KSMA was used (Moodle, Maritime English online course). The research team included three academics from KSMA and its structural subdivision – Maritime Applied College, Kherson (Ukraine). Research participants

were first-year cadets of the Marine engineering faculty, abridged program (AP) split into two teaching groups (211AP as a control group and 213AP as an experimental group). The total number of cadets is 63 (males, 20-21 y.o., approximately the same level of English language communicative competence: elementary-intermediate).

Students in control groups who were evaluated by teachers sometimes asked why they received such an evaluation and did not agree with it. Students in experimental groups who were graded through Moodle were able to review their mistakes and retake the survey or quiz to get a higher score.

Prior to the commencement of the study, informed consent was obtained from all participants. The participants were fully informed about the nature of the research, its objectives, and the potential risks and benefits of their involvement.

## 4 Results

By comparing different EEEs and their assessment methods, benchmarking helps institutions and educators understand what works most effectively and efficiently to evaluate student performance in online settings.

The process of benchmarking involves collecting data, gathering information, and studying the assessment techniques employed by various EEPs [3, 12, 18]. It enables educators to recognise successful strategies for evaluating student learning outcomes, improving instructional design, and optimising assessment processes in virtual classrooms. Moreover, benchmarking helps identify emerging assessment technologies, methodologies, and approaches that can enhance the quality of digital learning environments, aims to contribute to the continuous improvement of assessment practices, enabling educators to adapt and refine their teaching methods in line with the changing needs and advancements in the digital education [24, 25].

Various platforms help assess students available worldwide, each with its advantages and disadvantages. The Open edX distance learning platform is a not-for-profit open-source system created and introduced by the Massachusetts Institute of Technology (MIT) and Harvard University. It provides the flexibility to customise the platform's appearance, language, and settings to cater to individual users, making it one of the most user-friendly and robust tools available globally. Open edX comprises two components: the user-facing solution that grants access to courses, and the course creation module utilised by online course developers to build educational content. This platform serves as a valuable resource for both educators and learners in the realm of online education. However, Open edX can be perceived as more complex to set up and customise than Moodle, especially for users with limited technical expertise. That is why It may require more training or technical knowledge to take full advantage of its features and functionalities [13, 26].

Google Meet is a free platform with powerful functionality and integration with Google Classroom. Google Classroom is a free service that organises distance learning and tests knowledge. Allows one to publish tasks via the Inter-

net and evaluate the work of the student. It helps monitor the teacher's work, evaluation, the ability to return work to the student, and confidentiality of evaluation; files sent by students are not stored on users' devices but on Google Drive. It is easy to download materials for the students (textbooks, tasks, photos, and video materials), to provide tasks in the "Tasks" tab, you can group your notes/documents and textbooks by topic, as well as arrange them in a convenient order; students will be able to perform these tasks, and you will have the opportunity to monitor completed tasks and evaluate them; the teacher can leave comments regarding the students' completed homework. However, Google Classroom, while sufficient for basic assessments, may not offer the level of sophisticated evaluation tools. Google Classroom, although it offers some integrations, may not have the same breadth and depth of integrative capabilities as Moodle. Google Classroom, being a proprietary product, does not provide the same degree of community-driven innovation and customizability [17, 22].

Padlet is an online platform that serves as a digital wall where a teacher can share and display various types of content, such as documents, videos, images, and more. It allows multiple participants to collaborate on the same wall, making it ideal for remote learning environments. With Padlet, learners can easily access and study materials remotely. It offers features like organising collaborative work among students, saving their progress, and supporting various document formats. Best of all, the service is free, enabling users to create an unlimited number of pages [8].

Padlet focuses primarily on collaboration and content sharing, lacking the extensive features of a complete LMS. On the other hand, Padlet is more open-ended and often used for brainstorming, sharing ideas, or collaborative projects. It may not provide the same level of organisation and structure required for formal education settings. Padlet does not have built-in assessment features, making it less suitable for formal grading processes or managing complex assessments. Padlet, though useful for collaboration among smaller groups, might be less equipped to handle the organisational needs and scalability requirements of larger classes or institutions. Padlet, though useful for collaboration among smaller groups, might be less equipped to handle the organisational needs and scalability requirements of larger classes or institutions. Since Padlet focuses more on content sharing and collaboration, it may not offer robust analytics features to monitor student performance effectively.

The HUMAN platform serves as a digital assistant for school administrators, enabling them to streamline the complex operations of their institutions and foster collaboration among all stakeholders in the education process. This platform offers various capabilities, including the ability to assign, submit, and review homework assignments, deliver educational materials through photos, videos, tables, and presentations, track students' progress, visualise analytics of student performance, assess and provide online feedback on work, make grades instantly accessible to students, automatically provide feedback on students' understanding of the material, facilitate communication among teaching staff, students, and parents, conduct surveys and knowledge assessments, and share the latest news,

announcements, and relevant information. Furthermore, the HUMAN platform empowers teachers to enhance their professional development by utilising information technology [16]. The HUMAN platform may lack interactive features and limited customisation options, potentially restraining the user's ability to adapt the learning environment to their preferences. It may not have the same breadth of features, potentially limiting its capabilities as a complete learning management system. Offering communication channels may not provide the same level of collaboration tools and features as Moodle.

Edmodo is a popular platform utilised by educators to facilitate virtual instruction. It offers a user-friendly interface, is free, and encompasses essential features that enable teachers to effectively engage with their students remotely. One can generate various forms of student assessments, such as tests, surveys, and assignments, and conveniently administer them through the platform. Additionally, a gradebook feature is available to maintain a record of students' performance. However, Edmodo lacks extensive functionality as it primarily focuses on basic functions. It should be noted that merging created groups within the platform is not possible, which may pose some challenges during the teaching process. Nevertheless, Edmodo has limited customisation options. Edmodo offers a premium model where the basic features are free, but additional functionality comes at a cost. Edmodo, while having a user base, might have a comparatively smaller and less active community for assistance and collaboration. However, Edmodo integrates with various educational tools and platforms [2].

My Class is a digital platform designed to facilitate online classes. It offers a comprehensive collection of pre-made tasks and tests of different difficulty levels. The platform also enables automatic assessment of students' work and grading. Additionally, teachers can create their curriculum using the website. Parents receive weekly progress reports for their children, and only authorised teachers can access student profiles. The service is available for free, with an optional paid subscription called "My+" that provides enhanced features. My Class has limited customisation capabilities; it might be challenging to adapt it to meet the unique needs of different educational institutions or instructors, it has limited integration options, and it might restrict the utilisation of other tools and technologies preferred by educators [15].

Having analysed a lot of digital platforms, we have found that one of the most user-friendly and comprehensive options for Ukrainian teachers is the Moodle platform. It offers a Ukrainian interface, enough instructions, and round-the-clock support from specialists. Ultimately, the choice of distance learning platform is up to the educational institution, and our Kherson State Maritime Academy has chosen Moodle [7].

It is a versatile learning management system that can be used for electronic and distance learning (it is convenient for students who are on a voyage). Its primary focus is on facilitating interaction between teachers and students, although it can also support traditional distance courses and in-person learning. Here, the teacher can create tests and download all information to the lessons (from files, PowerPoint Presentations, pictures/photos to audio and video content).

This platform is the most suitable for training future seafarers because it has many functions. Students can download files, listen to audio recordings, watch videos, participate in discussions, and take tests without switching to other platforms.

Moodle comes with a wide range of assessment options, including advanced quizzes, custom grading methods, and rubrics. These features allow for more precise evaluation and feedback. Moodle provides a structured learning environment with organised courses, modules, and lessons. It allows educators to create a sequential learning experience with clear objectives, resources, and assessments. Moodle is designed to handle large numbers of students and courses efficiently. It offers administrative tools, user management, and scalability options. Moodle provides in-depth learning analytics and reporting tools. These tools enable educators and administrators to track students' progress, identify areas of improvement, and generate detailed reports. Moodle promotes collaborative learning by enabling users to work together on group projects, engage in peer assessments, and participate in collaborative forums. Moodle is highly extensible and can be integrated with various learning tools, content management systems, and student information systems.

The results of the experiment with control (CG – 211 AP) and experimental groups (EG – 213 AP) were analysed by the end of the Maritime English course. All students had their end-of-course assessment, which showed a considerable increase in the high level of communicative competence in EG, while the number of cadets with intermediate levels in both experimental and control groups was nearly the same. Nevertheless, EG had a smaller number of cadets with a low level of communicative competence.

Results of our research show that the teachers of KSMA are primarily satisfied with the chosen LMS—their variable of the level of satisfaction is 8.8/10 (e.g., the automatic assessment option is valued most of all); students' variable of the level of satisfaction is 7.6/10. A questionnaire to study the level of satisfaction with Moodle of all the educational process participants has been designed on Google Forms.

## 5 Discussion

The assessment should be founded on a positive principle, primarily considering a student's accomplishments rather than focusing on their failures. It is crucial to determine the level of academic achievements as education should aim to develop a person's overall competence, which encompasses knowledge, experiences, values, and abilities gained through training, rather than just imparting a set of information, skills, and knowledge. Competence extends beyond mere knowledge and skills and encompasses a range of complex abilities and personal qualities. A comprehensive educational approach involves the aptitude to solve challenges that arise in different real-life scenarios, drawing from one's knowledge.

For assessment, the teacher can use elements such as assignments, tests, lessons, forums, etc.

In Moodle, an Assignment refers to a task or project that is assigned to students by the teacher. It can involve various types of activities, such as uploading files, writing essays, submitting answers, or creating multimedia presentations. When an assignment is created in Moodle, it typically includes instructions, deadlines, and grading criteria. Students can access the assignment details, submit their work electronically, and receive feedback and grades from their teachers through the Moodle platform. Moodle provides a range of features to manage assignments efficiently, including options for setting different submission types, managing due dates, and facilitating the grading process. This helps to streamline the assessment and feedback process for both teachers and students in online or blended learning environments. An example of an Assignment can be found in figure 1. The figure shows the work submitted by the cadet on the Moodle Maritime English course (course name is Smart Control), the file itself (essay about LNG type of ship), the date and time of submission, comments (textual and visual), and grade from the teacher.

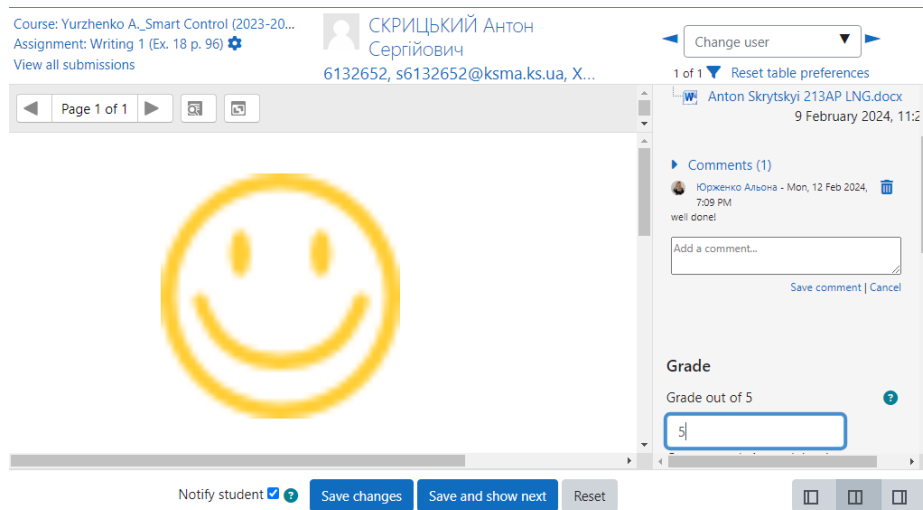


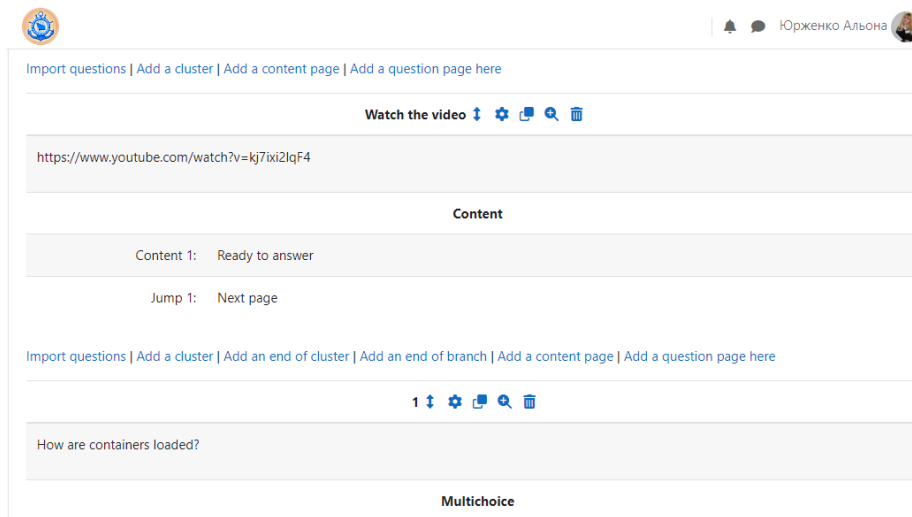
Fig. 1. Moodle's Assignment example.

In Moodle, a Lesson is a specific type of activity that allows educators to create interactive content for their learners. Figure 2 is an example of Lesson's editing section. It shows a list of options the Lesson allows to create; the first page of the Lesson (Watch the video) with a link from YouTube and two content options (Ready to answer/Next page jump); the second-page beginning (Question: How are containers loaded) and Multichoice option to answer it.

Lessons are designed to provide an engaging learning experience by presenting information in a structured and sequential manner. They typically include a series of pages that learners can navigate through, with content such as text,



images, videos, and embedded media. Lessons in Moodle can be customised to adapt to learners' responses, allowing for branching scenarios based on their choices or answers. Educators can create interactive elements like multiple-choice questions, matching exercises, and fill-in-the-blank activities to assess comprehension and reinforce learning. Overall, lessons in Moodle offer a versatile way to deliver content and assess learners' understanding through interactive and adaptive features. The lesson's editing section shows a number of pages which are created during the lesson: content (e.g. text or video), question (e.g. multiple choice or true/false). The system automatically grades the pages with questions as the teacher chooses the correct answers while creating them. Nevertheless, there is also an essay type of question that can be created in a lesson, and this type should be assessed by the teacher manually. Pages with content are not graded [21].



**Fig. 2.** Moodle's Lesson editing section.

In Moodle, a Forum is an interactive online discussion platform where participants can engage in discussions, ask questions, and share information. It allows users to communicate and collaborate asynchronously by posting messages and replying to existing threads [4]. Forums in Moodle can be organised into different categories or topics, and users can subscribe to receive notifications when new posts are made. They are commonly used for course discussions, Questions and Answers sessions, peer support, and collaborative problem-solving. Figure 3 is an example of a Forum. The figure shows the teacher's question (What is being a seafarer like?), Two cadets' answers, options for answering, editing, etc.

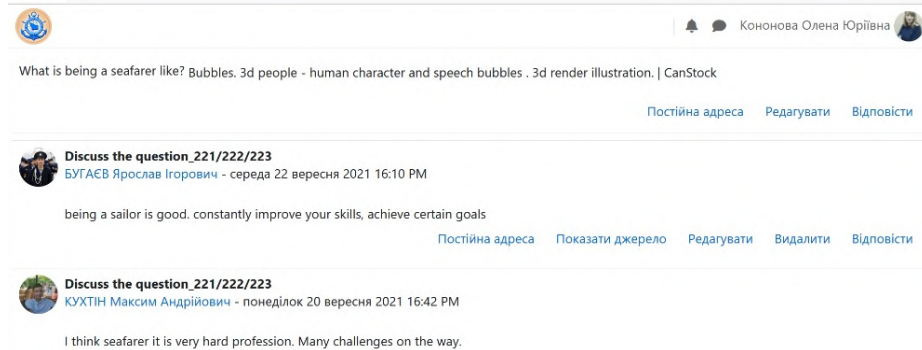


Fig. 3. Example of Forum on LMS Moodle.

Forum is also the task where students can receive grades (e.g., whether their question was interesting or the answer was correct). The forum’s assessment can be done manually by the teacher or other students.

In Moodle, a test refers to an assessment tool that allows instructors to create and deliver quizzes or exams to their students. These tests can include various types of questions such as multiple-choice, true/false, short answer, essay questions, etc. Moodle provides a platform where instructors can design, customise, and manage these assessments. Students can take the tests online, and Moodle can automatically grade certain question types, providing immediate feedback (essay is an exception). It is a versatile feature that helps educators assess and evaluate their students’ understanding of the course material. Figure 4 is an example of a test assessment on LMS Moodle. It shows two cadets’ data: names, ID numbers, emails, institution name (KSMA), state (both works were finished), the time they started and completed the test, amount of time taken, automatic grade and the possibility of checking each question separately whether the answer was correct/partially correct or wrong.

	/ First name / Middle name	ID number	Email address	Institution	State	Started on	Completed	Time taken	Grade/5.00	Q. 1 /0.50	Q. 2 /0.50	Q. /0
<input type="checkbox"/>	BC СИДЯКІН Віктор Костянтинович Review attempt	6271374	s6271374@ksma.ks.ua	ХДМА	Finished	9 October 2023 3:41 PM	9 October 2023 4:44 PM	1 hour 3 mins	4.50	<input checked="" type="checkbox"/> 0.20	<input checked="" type="checkbox"/> 0.50	<input checked="" type="checkbox"/>
<input type="checkbox"/>	AC СКРИЦЬКИЙ Антон Сергійович Review attempt	6132652	s6132652@ksma.ks.ua		Finished	10 October 2023 3:26 PM	10 October 2023 4:42 PM	1 hour 16 mins	4.49	<input checked="" type="checkbox"/> 0.20	<input checked="" type="checkbox"/> 0.50	<input checked="" type="checkbox"/>

Fig. 4. Example of a test’s automatic assessment on LMS Moodle.

In Moodle, grades are used to evaluate and assess students' performance in a course. It is a way to measure their progress and achievement. Moodle allows instructors to set up grading scales, define grade items, and create different types of assessments such as quizzes, assignments, and exams [6]. Moodle automatically scores these activities, and the resulting grades are stored in the gradebook. Additionally, Moodle offers various grading methods like weighted mean, simple weighted mean, and more to calculate final grades based on specific criteria determined by the instructor. Students can view their grades through their Moodle profile or by accessing the gradebook within their course.

While conducting the research, the following challenges were faced: data collection challenges (technical difficulties, low level of digital competence of some teachers); time-consuming comparative analysis; limited research in benchmarking while in the MET field; non-motivated students (e.g., sometimes it's hard to receive feedback), etc.

## 6 Conclusions

Through benchmarking, educational institutions and stakeholders in the maritime industry have been able to identify best practices, establish standards, and measure the effectiveness of online assessment methods. This process has allowed for continuous improvement and innovation in the field.

The evolution of assessment in electronic educational environments has seen a shift from traditional paper-based exams to more dynamic and interactive formats. Online platform Moodle now provides opportunities for real-time feedback, personalised learning, and the integration of multimedia resources. These advancements have not only enhanced the learning experience for maritime students but also improved their ability to acquire practical skills relevant to the industry [27].

Moreover, Moodle benchmarking has facilitated the development of standardised assessment criteria that enable students to be assessed on a level playing field regardless of their geographic location.

We find the obtained results practical in identifying best practices in maritime English, namely the experience of KSMA. The study provided valuable insights for teachers, tutors, maritime HEIs, and stakeholders in the marine industry, promoting effective e-learning and assessment practices that can lead to more qualified maritime professionals.

The prospects for further research can be seen in the analysis of various AI systems used for online maritime English training.

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