CASE STUDY

Integration of whiteboard use in maritime education and training to enhance environmental awareness of cadets

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Abstract: The paper is devoted to analysing the use of whiteboards in maritime education and training of cadets of the ship engineering department. This research highlights the benefits of incorporating interactive whiteboards into maritime education and provides practical recommendations for educators aiming to enhance environmental awareness among future maritime professionals. Whiteboards provide a promising way to bridge the gap between theoretical knowledge and practical application. This ensures cadets are equipped with the essential skills and awareness needed to navigate the challenges of a rapidly evolving maritime industry while prioritising environmental sustainability. The findings demonstrate a significant improvement in cadets' understanding of environmental concepts and their ability to apply sustainable practices in real-world maritime scenarios. Cadets expressed higher levels of engagement and motivation when learning through interactive whiteboards, citing the dynamic and immersive nature of the technology as a contributing factor. Moreover, faculty members reported enhanced teaching capabilities and the ability to address individual learning needs effectively. This work highlights the potential of using whiteboards (e.g. Whiteboard.fi, Miro) to enhance environmental awareness. It suggests further research to explore its effectiveness in other educational contexts.

Keywords: digitalization, maritime professionals, M-learning, MOODLE, whiteboard

1 Introduction

The maritime sector is crucial in facilitating global trade and transportation. Consequently, there is a growing demand for adequately trained cadets with expertise in navigation and maritime operations and a solid commitment to environmental awareness. Environmental awareness or consciousness of future seafarers involves a deep understanding and conscientious consideration of maritime activities' impact on the marine environment. Seamen with environmental awareness recognise the significance of preserving marine ecosystems, reducing pollution, and adopting sustainable practices to mitigate adverse effects on the seas, oceans and surrounding areas.

Environmental awareness can be formed using e-learning (electronic learning) (Lavidas et al., 2022; Sarwari & Adnan, 2024). E-learning's flexibility is especially beneficial for cadets of maritime institutions with busy schedules, namely long-term shipboard training (Dahal & Manandhar, 2024; Lytvynova et al., 2021; Jurayev, 2023). An essential issue of e-learning while using various video conference platforms is whiteboard functionality. Traditional whiteboards are highly effective visual communication and collaboration tools, allowing instructors to sketch diagrams, solve equations, and brainstorm ideas in real time (Dahal et al., 2022; Troulinaki, 2023). However, many video conferencing platforms offer limited whiteboard features compared to a physical whiteboard. This can hinder the educational experience in subjects like maritime education and training (MET), where visual aids are crucial. The research objectives are to analyse the use of whiteboards in maritime education and training (MET) of future ship engineers (Sharabidze, 2017) and provide practical recommendations for tutors to enhance cadets' environmental awareness. These recommendations could focus on maximising existing whiteboard features within the platform or exploring alternative methods to enhance visual communication and collaboration in an e-learning environment.

2 Scientific literature review

The COVID-19 period made many scientists look for different ways of creating and using whiteboards while e-learning (Ipek et al., 2023; Karakose et al., 2023). The following researchers

made a significant contribution to studying this issue, among them are the following: Kevin Fuchs, Pazilova Nasibaxon Muhammadqosimovna, Usmonova Dona Satvoldiyevna, Rafieva Bunafsha Rustamovna, Yinghui Shi, Huiyun Yang, Jingman Zhang, Shimeng Wang, Harrison Hao Yang, Theerasak Rojanarata, Giuseppe Ritella and Nadia Sansone.

Kevin Fuchs proved the positive impact of virtual whiteboards on the level of students' engagement while learning. Although the research did not show any drawbacks of e-learning, it revealed a correlation between the level of engagement and the year of study, which is the primary implication of the study (Fuchs, 2021). Pazilova Nasibaxon Muhammadqosimovna and Usmonova Dona Satvoldiyevna also mentioned no disadvantages to whiteboard use. Their research deals with the importance of using interactive whiteboards in e-learning, and it focuses mainly on the benefits that interactive whiteboards can bring teachers and students (Muhammadqosimovna & Satvoldiyevna, 2022). Rafieva Bunafsha Rustamovna describes the following advantages of whiteboards: the work of tutors becomes creative and fascinating; the learning efficiency of students increases; and there is a rise in the labour productivity of students (Rustamovna, 2021).

Yinghui Shi, Huiyun Yang, Jingman Zhang, Shimeng Wang and Harrison Hao Yang made a meta-analysis of the effects of interactive whiteboard-based classroom instruction on students' cognitive learning outcomes. They concluded that whiteboard-based classroom instructions help students improve their cognitive learning and found it more effective when instructors integrate active or collaborative pedagogical approaches (Shi et al., 2019). Theerasak Rojanarata reported using an online whiteboard to produce a collaborative and interactive report in laboratory learning. The scientist highlighted that the students gain digital and teamwork skills from learning with the whiteboard. The researcher concluded that online whiteboards can engage students in collaborative learning, active learning and formative assessment (Rojanarata, 2020).

Two scientists' studies (Giuseppe Ritella and Nadia Sansone) describe a collaborative knowledge creation task using whiteboards. Their research showed the usage of interactive whiteboards within a collaborative media design task at the university. It concluded that the potentiality of interactive whiteboards strictly depends on the nature of the learning task (Ritella & Sansone, 2020). Studies have yet to be conducted on using whiteboards to form or increase students' environmental awareness. The following researchers studied this issue: Peter Brecka, Monika Valentova, Ivana Turekova, and Cecília M. Antao.

The interactive whiteboards were chosen as one of the digital technologies in environmental education (Brecka et al., 2022). This case study showed the use of whiteboards in a digital support model of environmental education and its positive impact. Cecília M. Antao presents another case study. The study lists the most significant benefits of using interactive whiteboards in environmental education: promoting environmental awareness and collaborative work, increased test achievement, and increased willingness to study. No disadvantages were listed in the research (Antao, 2019).

The following scientists studied the issue of whiteboards' use in the maritime sector: Alcino Ferreira, Stacey D. Scott, Antoine Allavena, Katherine Cerar, Glenn Franck, Mark Hazen, Ted Shuter, and Chris Colliver. Alcino Ferreira has described rapid learning tools (e.g., interactive whiteboards) that learners can use to facilitate the memorisation of lexical items. The researcher listed many e-tools with links describing them and their advantages (Ferreira, 2015). The research investigating tabletop interfaces to support collaborative decision-making in maritime operations showed interactive whiteboard solutions and found the interaction possibilities significantly helpful. However, the researchers ultimately concluded that a tabletop system might provide better opportunities for improved interaction and collaboration among flood experts (Scott et al., 2010). There was no research on using whiteboards during MET to enhance the environmental awareness of cadets in the ship engineering department.

3   Research methods

A total number of cadets is 87 (males, 16-17 y.o., 1-3 years of study at the ship engineering department) from Maritime Applied College and Kherson State Maritime Academy, Ukraine, took part in this research. The cadets were asked to work online and offline using the Miro and Whiteboard.fi (Sandorova & Betak, 2021; Piccirillo et al., 2022). The interaction between the participants was carried out as a class, in groups, in pairs and individually on Miro, which was implemented in the Zoom video conference platform. The individual work was carried out on Whiteboards.fi website.

Scientific research involved systematic investigation, analysis, and interpretation of data to test hypotheses that cadets will increase their environmental awareness in case of usage of

whiteboards while MET, namely the Maritime English course (module "Marine Environment", topics: International Convention for the Prevention of Pollution from Ships; Shipboard Oil Pollution Emergency Plan; Exhaust gas onboard utilisation; IMO/SECA Regulations; Scrubber system (Korach et al., 1984). The knowledge survey was conducted twice before (Figure 1) and after the experiment. The students were surveyed about working independently and in a group, and their knowledge of maritime environmental issues and regulations was measured using a whiteboard.

Using Whiteboard Miro

■ using Whiteboard Miro ■ work individually ■ work in group
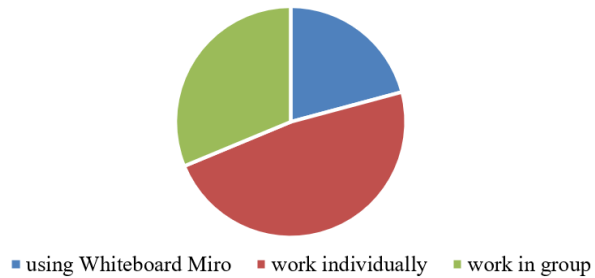
Figure 1   Using the Whiteboard Miro before the experience

As Figure 1 shows, cadets only sometimes use the whiteboard and prefer to work individually rather than in groups.

4   Results

While studying the topics listed above during Maritime English practical lessons conducted on the Zoom video conference platform interactive whiteboard, Miro was also with an experimental group (43 cadets). During the whiteboard lessons, teachers use the platform's whiteboard to illustrate environmental terminology, sketch pollution scenarios, or brainstorm solutions to maritime environmental challenges.

Miro is an online whiteboard platform enabling groups to collaborate in real-time. It provides a digital canvas for users to create, share, and collaborate on various types of content (e.g., diagrams, mind maps, and flowcharts). Miro is designed to facilitate distance collaboration, making it particularly useful for e-learning (Figure 2).
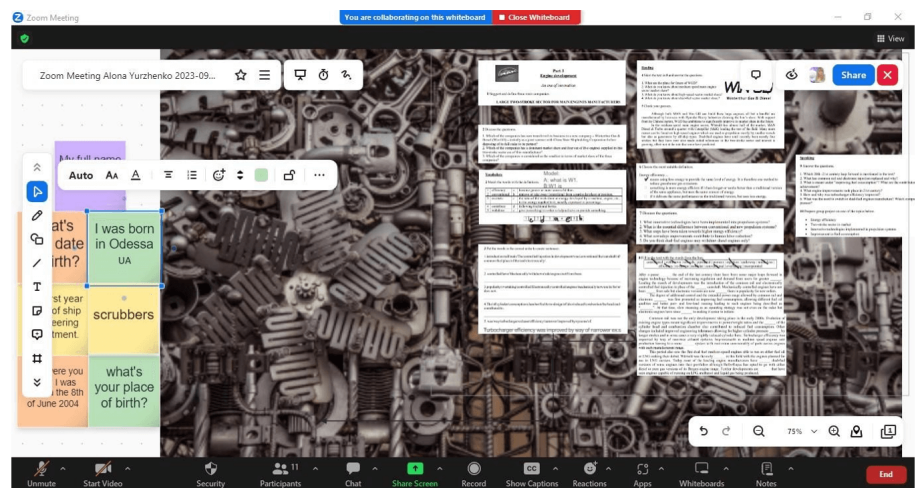

**Figure 2**   Maritime English lesson conducted in the Zoom on the Miro whiteboard Maritime

English practical lesson consists of the following stages: Starter (Interview Questions); Lead-In; Vocabulary; Checking up the meaning; Pre-reading; While-reading; Post-reading; Speaking; Home task. The starter is represented in stickers, which the Miro platform allows you to create. The tutor creates stickers with questions in advance, and cadets, at the beginning of the lesson, choose one or more and answer them, first in written form to practice writing skills and then in oral form to practice speaking.

A teacher adds necessary tasks from the Student's Book (SB) (Bezlutska et al., 2020; Bevzenko et al., 2020), the lesson's topic, and additional instructions. The next activity from SB is Lead-In, which involves students more and sets them up on the lesson's topic. This stage can include additional resources: external links to learningapps.org activities, videos, figures, Mentimeter-based tasks, etc. (Barzii et al., 2020; Yurzhenko, 2019; Hockly & Dudeney, 2017; Mickiene & Valioniene, 2021).

Vocabulary activity is done to study new lexical units (words, word combinations). The whiteboard allows you to write on it using a pen or highlighter, use an eraser if needed, draw lines of different thicknesses and colours, and even use smart drawings. Students do the task individually and then check it with the teacher one by one using a pen or text function to check the meaning of the new lexical units (Sihmantepe et al., 2023; Abduh et al., 2022) after that group repeats the words altogether, individually, in groups (e.g. according to age, hair colour).

All reading activities are done using the abovementioned tools or with additional external resources. After the speaking activity, the teacher will write the homework on the whiteboard. It depends on when a teacher needs a whiteboard during the lesson (e.g. in case of incorrect spelling, the teacher uses a pen or adds correct spelling from an external website on the whiteboard) (Strinyuk & Lanin, 2022). By the end of the lesson, the group can correct their mistakes, and the whiteboard is also used like an ordinary board (Sukomardojo & Ratnaningsih, 2022; Spivakovsky et al., 2022).

In case individual whiteboard work is needed, Whiteboard.fi is used. This platform proposes a free trial; anyone can start a session for two hours or less. Tutors create virtual classrooms to share a real-time whiteboard space with their students (Tinmaz et al., 2022). Each student gets their whiteboard within the virtual space (Figure 3).
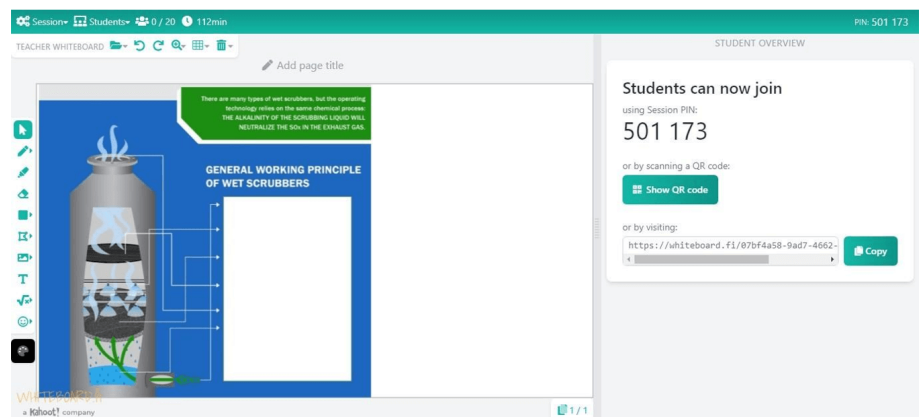
Figure 3   Individual task on Whiteboard.fi, topic "Open loop scrubber system"

The example in the picture represents the Whiteboard.fi website, where each student has his digital whiteboard, providing him with a personal space to work on assignments devoted to the studying of open loop scrubber systems, which is used as a type of exhaust gas cleaning system used on ships, particularly in the maritime industry, to reduce the emissions of sulfur oxides (SOx) from the exhaust gases of marine engines (Peng et al., 2022).

Whiteboard.fi offers a variety of drawing tools, shapes, and colours, allowing users to work. Teachers control the virtual classroom, allowing them to monitor and manage student activities, provide feedback, and guide the class collectively or individually (Audrin & Audrin, 2022; Limbong et al., 2022).

5   Discussion

By the end of our pedagogical experiment, an experimental group of cadets could answer the questions in a survey on LMS MOODLE of education institutions. The results of the survey have shown the following advantages of the Miro platform while Zoom video conference lessons of Maritime English: visual collaboration useful for illustrating maritime concepts, drawing diagrams, or annotating specific elements related to Maritime English (Cabero-Almenara et al., 2023); interactive exercises or games (Vidakis et al., 2019) on the whiteboard which encourage student engagement and participation during Zoom sessions; real-time feedback on students' work; sharing and annotation of documents directly on the whiteboard; a structured and well-

paced Maritime English lesson; mind maps to explore and expand maritime-related English vocabulary; session recording (Kergel, 2023; Sari & Sari, 2022). Although Miro whiteboard has many advantages, it also has some disadvantages: text editing features are less robust than dedicated word processing software, Miro's performance may be affected by slow or unstable internet connections, and the mobile app has limitations. Whiteboard.fi advantages include a range of drawing tools, the platform's accessibility through web browsers, eliminating the need for additional software installations, and teachers' ability to assess students' work quickly.

Integrating whiteboard use into online Maritime English instruction leads to more significant gains in cadets' environmental knowledge and understanding than traditional lecture-style delivery. By comparing the gains in environmental awareness between the two groups, the research determined that whiteboard use in Maritime English contributes to improved learning outcomes while using video conferencing platforms for effective environmental education. (Figure 4)

Using the Whiteboard Miro

■ using Miro   ■ work individually   ■ work in group
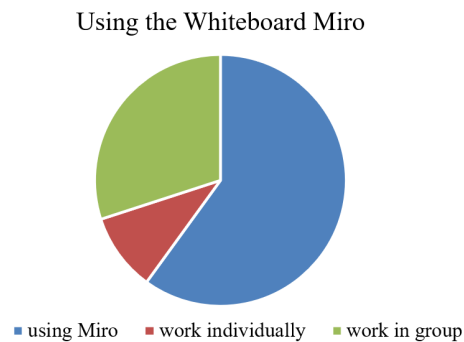
Figure 4   The results of the survey after the experiment

As the diagram illustrates, the adoption of the Miro whiteboard among students has seen a significant rise. This shift has fostered a more collaborative learning environment, with students increasingly working in groups rather than individually. The whiteboard's capabilities fuel this teamwork. Miro's interface encourages students to study and practice together, actively utilising the platform to find information, brainstorm ideas, and visually represent their project concepts. This collaborative approach can lead to a deeper understanding of the material and improved problem-solving skills compared to individual work. Furthermore, the ease of sharing and iterating ideas within Miro contributes to a more engaged and productive learning experience for students.

Students while tackling a complex maritime engineering problem. Use the whiteboard to sketch diagrams, share calculations, and brainstorm potential solutions, drawing upon knowledge of physics, materials science, and environmental regulations. Through this process, students learn to actively listen to diverse perspectives, respectfully debate ideas, and synthesise their contributions into a cohesive solution. This collaborative problem-solving, facilitated by the whiteboard, not only leads them to a well-rounded answer but also teaches them the importance of effective communication, critical thinking, and the reality that there is often no single "right" decision, but rather, the best solution emerges from a collaborative effort. These skills are invaluable for future careers where teamwork and effective communication are paramount, such as on a ship's bridge, where a crew must work seamlessly to ensure safe and efficient navigation.

However, Whiteboard.fi has some disadvantages, among which are the following: it relies on a stable internet connection, and it has some limitations when it comes to integrating multimedia elements such as images, videos, or external files (Mihelj et al., 2019; Hrnic, 2022). Although we find both platforms useful for enhancing cadets' environmental awareness, maritime English lessons must ensure that all ship engineers know and comply with the regulations to ensure the ship's operations are environmentally sustainable.

6   Conclusions

Whiteboards, especially Miro and Whiteboard.fi, offer a promising avenue for bridging the gap between theoretical knowledge and practical application in MET of future ship engineers. The focus on environmental sustainability is crucial for seafarers as ships are significant sources of air pollutants, including sulfur oxides (SOx), nitrogen oxides (NOx), and particulate matter. Being environmentally aware enables ship engineers to implement technologies and practices that reduce emissions, such as using cleaner fuels, optimising engine performance, and employing

exhaust gas cleaning systems (scrubbers).

Students can develop a valuable skill set that transcends the classroom by integrating knowledge from various disciplines and working in teams in diverse situations using a whiteboard as a central idea hub. This collaborative approach fosters teamwork, a critical ability in many professions, including maritime operations.

The Whiteboard.fi and Miro allow you to work on the same whiteboard simultaneously, making it easy for groups to collaborate in real-time. The whiteboards are great tools for visualising ideas and mapping out workflows, making it easier for cadets to brainstorm and communicate effectively, regardless of location. They teach cadets to collaborate as one crew, which is essential to practice while studying and enhance creativity and productivity among group members. We see future research prospects in investigating other whiteboard tools (e.g., Education) to enhance the climate change awareness of future seafarers.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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