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Gamification in maritime English language assessment in the context of STEM education

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Abstract. Maritime English is one of the key tools in STEM (Science, Technology, Engineering, Mathematics) education of future ship engineers, as it provides access to technical literature and professional communication. The article's goal was to find the ways to use gamification in Maritime English assessment. The research methodology was based on a combination of theoretical analysis of scientific works in the field of pedagogy and linguistic didactics, the study of international standards (in particular, STCW), as well as experimental verification of the effectiveness of implementing gamification in the process of formative assessment. The methods of pedagogical observation, questionnaires and analysis of the results of students' educational activities were used. It was found that gamification, defined as the use of game mechanics in a non-game educational context, contributes to increasing motivation, activating cognitive activity and developing interdisciplinary competencies. Its integration into the assessment of maritime English allows you to simulate professional situations – communication in emergency conditions, preparation of technical reports, and interaction in an international crew. Such tasks develop not only linguistic, but also socio-communicative and cognitive skills important for the profession. The results of the study showed that gamification can transform traditional assessment and make it more flexible, student-centred and responsive to the requirements of the modern maritime industry. The practical significance of the research results lies in the possibility of their use in the maritime education system: in the training courses "English for Professional Purposes" in maritime academies and colleges, during the training and retraining of fleet engineering personnel, as well as in corporate training programmes for shipping companies

Keywords: maritime establishments; personalised space; digital surroundings; LMS MOODLE; e-learning; ship engineers

INTRODUCTION

To obtain quality maritime education and training (MET), English is essential for all future seafarers. Namely, ship engineers need maritime English to communicate with engine room crew, read manuals, fill in necessary documents (e.g., log books, record books, various checklists), and others. English is also essential to implement best practices in the marine industry. Communication and access to global opportunities to master – English allow STEM (Science, Technology, Engineering, Mathematics) students to participate in international conferences, exchange ideas, and work on joint projects. The ability to communicate in maritime English opens the door to global educational resources for seafarers, such as online courses, scientific databases, and learning platforms. This improves the learning process and contributes to developing skills necessary for a successful career in a highly competitive environment.

Different scientists studied the issue of STEM education for future seafarers. Indonesian educators O. Wahyuni & M. Iing (2021) implemented the STEM for the Sea Project in their research, which significantly improved the performance preparing them more effectively for shipboard training. The following key findings were approved by the researchers mentioned above: the STEM for the Sea Project can improve cadets' performance; STEM project-based learning approach can lead cadets to better performance while maritime education and training. Similarly, M.B. Simanjuntak (2024) explored the integration of ethnomathematics and design research into STEM curricula within maritime educational institutions, emphasising the role of contextualised mathematics in enhancing cadets' skills. The problem-solving skills were enhanced by the following methods: linking mathematical principles to the cadets' cultural background and professional environment; showing the practical application in the maritime field.

Maritime robotics as part of STEM programmes at high school level was studied by L. McCue *et al.* (2022; 2023). Their works demonstrated how robotics can foster early interest in maritime technologies and stimulate teamwork, engineering design, and computational thinking among students. They also have developed a successful STEM outreach programme for high school students (grades 9-12) that introduces biologically inspired underwater robotics using lighter-than-air vehicles. The issue of STEM for developing energy literacy in maritime vocational education was examined by D. Wang (2023), who argued that sustainable development goals in shipping cannot be achieved without STEM-based training in energy awareness and environmental responsibility. Engineering cadets' energy literacy was object of his research and he managed to find out the ways how STEM-based instructions can help to develop it.

Other scholars also contributed to this field. W. Walker *et al.* (2025) stressed the broader theoretical foundations of STEM, highlighting its interdisciplinary nature. He has also shared some effective STEM strategies, curricula, and resources to engage students (e.g. lessons that integrate multiple STEM disciplines). M. Chu (2025) pointed to the significance of teamwork, technology, and engineering design methods in maritime-related STEM problem-solving. The scientist was using tech (AI, VR/AR, robotics, IoT, etc.) to solve domain-specific STEM challenges. X. Fazio (2024) suggested that the context-dependent prominence of each STEM discipline can be particularly useful in maritime settings, where engineering and technology often dominate in real-world contexts. His main idea was to use curriculum to promote STEM literacy for decision-making. Recent studies by R. González Vallejo (2024) further emphasised the importance of integrating advanced technologies such as simulations, AR and gamification into maritime education to improve learning outcomes and career readiness. Gamification in complex with AR will definitely promote cooperation, critical thinking, motivation, and meaningful learning. The results of his study included the following: increased creativity, autonomy, digital skills. But the author has also mentioned some drawbacks: risk of overemphasis on numerical assessment vs. actual learning. The last one has created scepticism in some higher education contexts. The purpose of the article was to summarise the ways gamification is used in Maritime English assessment in connection with STEM education.

MATERIALS AND METHODS

The research was conducted using a combination of theoretical and empirical methods in order to explore the potential of gamification as a tool for maritime English language assessment in the context of STEM education. The choice of methods was determined by the interdisciplinary nature of the study, which required both analysis of pedagogical frameworks and examination of practical applications within Maritime Education and Training (MET). The study adopted a quasi-experimental design, integrating gamified elements into formative assessment tasks for cadets of marine engineering programmes. The study sample consisted of 130 second-year cadets (66 cadets in experimental group and 64 cadets in control group) majoring in "Operation of Ship Power Plants". It included applicants from two educational institutions: the Maritime Applied College (MPK) and the Kherson State Maritime Academy (KSMA). The main selection criteria were: second-year study, completion of the English for Special Purposes course (marine engineering), willingness to participate in the experiment, and an appropriate level of English proficiency. The age ranged from 18 to 20 years. The initial level of English proficiency was determined by the results of diagnostic testing and corresponded to levels A2-B1 according to the CEFR. The participants were randomly assigned to groups, and prior to the start of the experiment, there were no significant differences between the groups in terms of their initial level of knowledge, skills, or motivation.

The questionnaire and experimental work were conducted during the 2023-2024 academic year. To create tasks used in future professions, two courses described in

the research: English for Special Purposes at KSMA and Introduction to Maritime English at Lithuanian Maritime Academy (LMA). The experimental group studied according to a modified programme that included the integration of English with professional disciplines, the use of gamification, digital tools (interactive platforms, online tests, virtual simulators) and elements of blended learning. Particular attention was paid to the formation of evaluative competence by introducing parity formative assessment, self-assessment and peer assessment in professionally orientated tasks. The control group worked according to the traditional methodology of teaching English in a professional direction, which was based on lectures and practical classes using printed materials and standard forms of knowledge control (oral survey, written tests, final papers). It did not systematically use interactive technologies, gamified elements or innovative assessment methods. Thus, the key difference was the use of modern pedagogical factors and assessment tools in the experimental group, which allowed to test their impact on the motivation and level of formation of the cadets' English-language professional competence. The data collection tools were complex and combined tests, questionnaires, and pedagogical observations. Pre- and post-testing were used to determine the level of knowledge. The first allowed for assessing the initial level of English proficiency and motivation of the cadets, while the second measured changes after completing gamified tasks (Fig. 1).

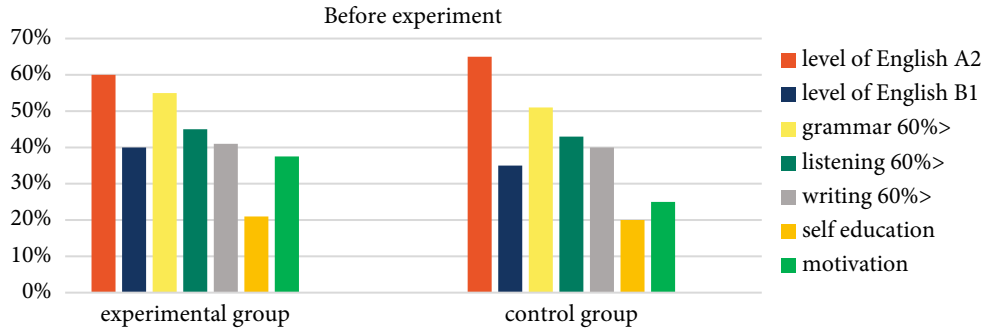

Figure 1. Data before experiment in two groups

Source: developed by the authors

Test tasks included listening to professional dialogues, working with English technical documentation and writing responses to simulated production situations. The questionnaire contained both closed and open questions. Examples are: "Rate on a scale of 1 to 5 how much the game tasks increased your motivation" and "What elements of gamification do you consider the most effective?". Observation protocols were used to record behavioural aspects, taking into account the level of involvement, initiative and ability to perform role-playing tasks in English. Statistical data processing employed both descriptive and inferential methods. For quantitative indicators, mean values and percentage distributions were calculated, enabling the analysis of dynamics in motivation and test performance. To verify the reliability of observed differences, a t-test was applied with a significance threshold set at $p < 0.05$. In parallel, qualitative data collected through open-ended questionnaires and observation protocols were examined using thematic analysis. This approach made it possible to capture the cadets' subjective evaluations and to reveal emerging trends regarding the effectiveness of the applied methods. All procedure carried out in the study adhered to established ethical standards and respected the honour and dignity of all participants. The psychological characteristics of the students, including their age, were duly taken into account. Throughout the experiment, participants' rights were fully safeguarded, and anonymity was maintained in accordance with ethical guidelines for pedagogical research issued by leading professional bodies, such as the American Educational Research Association (2011) and the British Educational Research Association (2018).

RESULTS

STEM education (Science, Technology, Engineering, Mathematics) involves mastering complex technical knowledge, which is often presented in English. Most textbooks, scientific articles, technical documentation, and research materials are written in this language, which makes it an important tool for obtaining a quality education. The same thing is concerning MET. English is the language of international science, allowing students to read modern sources, analyse innovative research communicate, and implement best practices in the marine industry. Communication and access to global opportunities to master English allow STEM students to participate in international conferences, exchange ideas, and work on joint projects. The ability to communicate in English opens the door to global educational resources, such as online courses, scientific databases, and learning platforms. This not only improves the learning process but also contributes to the development of skills necessary for a successful career in a highly competitive environment. English is a key tool in STEM education, as it provides access to technical terminology, which is a common language for scientists and professionals around the world. Learning English allows students to better understand engineering, mathematics,

science and technology concepts, using international textbooks, articles and standards. Teaching English to STEM students faces a few specific challenges. The main problem is the integration of technical terminology into the learning process, as traditional textbooks often do not cover the highly specialised vocabulary required for ship engineering or maritime disciplines. Also, students focused on technical subjects often show less interest in learning the language, which requires the development of motivational techniques and interactive tools. Another challenge is the need to develop interdisciplinary skills, where Maritime English serves as a means of communication for solving complex technical tasks. Assessing English knowledge of STEM students also has its own characteristics. Conventional testing methods do not always allow for an adequate assessment of language proficiency in professional situations (bunkering, replacing pump parts, firefighting, etc). It is important to create tasks that simulate real maritime language, but this requires additional resources and time. In addition, there is the problem of adapting international assessment standards to local curricula, which makes it difficult to compare results at the global level.

Gamification, i.e., the use of game design elements in the educational process, is a tool for engaging students in active learning. It helps create a motivating environment where students feel more interested and satisfied with completing tasks. Thanks to interactive activities, such as competitions, points, achievements, or levels, students are involved in the learning process in a natural way, perceiving it as a game. This is especially effective in teaching technical disciplines, where students often encounter complex concepts and need additional motivation. Gamification helps improve the assimilation of material by actively involving students in solving practical tasks and simulating real-life situations. Game elements allow teachers to create conditions for the gradual development of skills, giving students the opportunity to independently evaluate their achievements and correct their own progress. This approach also stimulates teamwork, critical thinking and adaptation to new challenges, which makes the educational process more effective and focused on real professional needs (Boeru, 2023). Gamification is the introduction of game elements and mechanics into non-game contexts, particularly in education, to increase engagement and motivation (Leon & Peña, 2022). The main elements of gamification are: points (the accrual of points for completing tasks, which stimulates the achievement of set goals); levels (gradual progress with the discovery of new stages or opportunities that reflect the growth of competence); competition (a spirit of rivalry among students or groups, which promotes increased activity); rewards (encouragement in the form of certificates, medals or other symbols of achievement); feedback (immediate feedback on successes or mistakes, which helps to learn faster and correct mistakes). The goal of gamification in the educational process is to increase student motivation for active participation, create an interesting and dynamic environment for the acquisition of knowledge and skills. In the context of assessment, gamification allows you to reduce the stress associated with traditional forms of testing and stimulates students to improve their results through an interactive approach. It also promotes the development of self-reflection, critical thinking, and collaboration skills that are essential in professional activities. As for the advantages of gamification in the educational process, it can be noted that it increases motivation, develops critical thinking and collaboration skills, and focuses attention on achieving specific goals.

Assessment in STEM education has its own unique features that distinguish it from other disciplines. One of the key aspects is the emphasis on professional terminology since the possession of specialised vocabulary is important for understanding technical concepts and effective communication in a professional environment. Assessment tasks often include work with real cases, technical texts, or simulations, which allows students to test their ability to apply terminology in the context of real-life situations. STEM education is focused on solving practical tasks that require the integration of knowledge from several disciplines. It should equip ship engineers with knowledge of the main parts of a two-stroke engine and knowledge of its operational process step by step. Additionally, they should be familiar with the schematics of all diesel engines, including the start and stop points. Assessment should consider not only the correctness of the answer but also the student's ability to apply theoretical knowledge in practice, solve problems, work in a team, and use innovative approaches. Such an interdisciplinary approach requires the creation of tasks that cover several fields of knowledge, for example, combining physics, mathematics and engineering, and also stimulate the development of analytical thinking and creativity. Using Interactive platforms such as Quizizz (Degirmenci, 2021), Kahoot! (Kohnke & Moorhouse, 2022) and Duolingo (Shortt *et al.*, 2023) for Schools are effective tools for creating tests that not only assess knowledge but also make the learning process more interesting. Such platforms allow teachers to organise assessments in a game format, involving students in completing tasks in real time. This makes it possible to quickly receive feedback and adapt the learning process depending on the results. In addition, these tools allow to store statistics of results and assess student progress, which makes the process more structured and focused on achieving specific learning goals.

Interactive learning can include STEM quests which allow students to complete a series of tasks related to different stages of a STEM project (from research to testing). Each stage will be performed in English, which allows participants to simultaneously develop skills in using professional maritime vocabulary. A team competition for solving technical cases can be structured as a group task, where teams must use specialised terminology to analyse and solve practical problems. This format allows students to test both their English language skills and ability to work together and apply professional knowledge. A STEM game, where success depends on correct communication in

English, allows to create a learning environment in which students must actively use language to achieve goals. This can be a game in which students have to solve problems or participate in scientific debates. The use of role-playing games in learning allows one them to assess the level of knowledge and skills of students in real or simulated professional situations. For example, a simulation of a conference where students have to present their research in English, or a scientific council where they discuss new technical solutions, allows to assess their ability to communicate effectively and use professional terminology. Such scenarios help students feel part of a professional community and allow them to develop skills important for their future careers. Thereby, the experience of two maritime higher education institutions, Kherson State Maritime Academy (KSMA), Ukraine, and Lithuanian Maritime Academy (LMA), Lithuania, were studied. Both institutions use LMS MOODLE as a platform to collect all necessary materials for all courses. Figure 2 represents part of a course that reflects real Standard Marine Communication phrases needed on the ship to communicate with other crewmembers, shore, port state, etc.

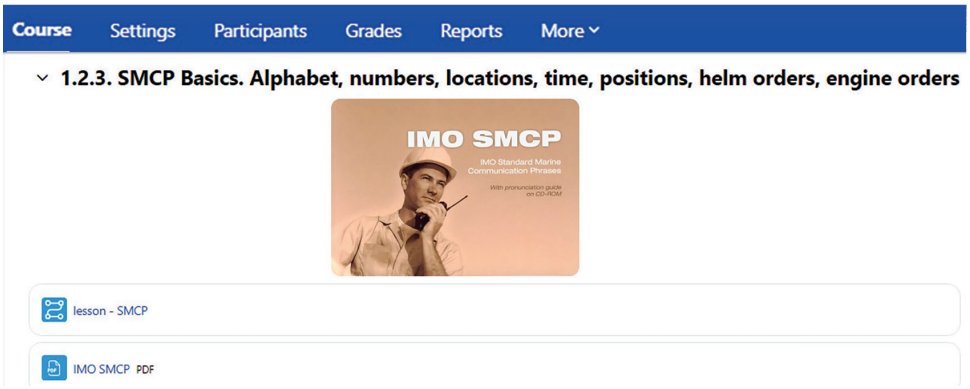

Figure 2. Introduction to Maritime English course
Source: IMO SMCP materials added on LMS MOODLE of LMA (Kudriavtseva & Shvetsova, 2019)

Gamification encourages students to actively participate in the learning process, turning tasks and assessments into interesting and dynamic activities. The use of game elements, such as competitions and points, motivates students to actively interact with the learning material, which improves their involvement and responsibility. KSMA is a temporarily relocated higher education institution in Ukraine. It was relocated to Odesa from Kherson due to martial law. Nowadays educational process is conducted in remote mode. LMS MOODLE, Zoom, corporate mail, repository and other digital tools have become efficient while e-learning. Foreign partners have opened many online resources for KSMA for free (e.g., Ocean Learning Platform (n.d.), a library of the University of Plymouth (n.d.), English4Ukraine). LMS MOODLE provides various gamification elements to be used by teachers in their courses (Kononova & Yurzhenko, 2021). Maritime English teachers use digital badges to encourage cadets to achieve progress. Figure 3 represents MOODLE settings on the list of badges: their names, badge status (available/unavailable), criteria to achieve a badge, number of cadets who have already achieved badges, actions (disable access, edit, copy, delete).

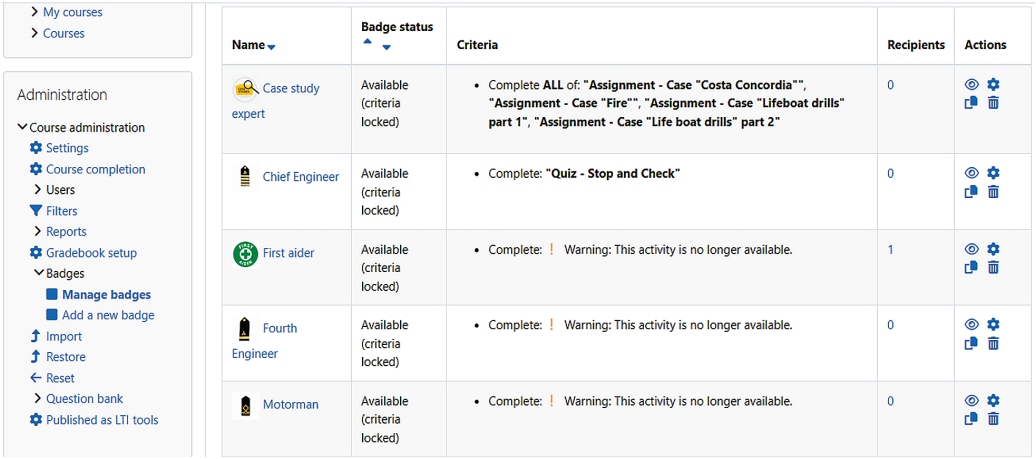

Figure 3. KSMA MOODLE badges (English for special purposes course)
Source: LMS MOODLE of KSMA

The first badge is called Case Study Expert and is given in case the cadet has done three assignments which represent authentical texts with the following news: Costa Concordia disaster, Fire on Maersk container carrier, and Lifeboat drills. All texts are followed with a list of questions (e.g. What was done wrong in the situation described; What had to be done to change the result of a situation; Whose actions were inappropriate). All texts represent real cases and help future ship engineers know what to do in their future profession (Saleem *et al.*, 2022). The other gamification elements used on MOODLE while English for special purposes are the following: levels and missions, maps, Easter eggs, etc. Thanks to gamification, assessment becomes less stressful and more exciting for students. Game mechanics make the assessment process interactive and help to change the perception of tests as a routine and stressful activity to an exciting game in which new results can be achieved. Another example of gamification assessment is leaderboards which can be created on LMS MOODLE (Yurzhenko *et al.*, 2022). LMA activities to receive a credit contain the following: Presentation of self-study practice, tests and exercises. To collect cadets' presentations on the LMS MOODLE assignment activity module was added to the "Introduction to Maritime English" course (Leon & Peña, 2022). It contained complete activity instructions, an additional file with a PowerPoint presentation template, availability dates (soft and hard deadliness), maximum grade, and two feedback types (comments and files). In such a way, using the Assignment cadet uploaded his presentation and had a chance to receive the teacher's comments and correct mistakes until the soft deadline before the online defence using Google Meet (hard deadline). All MOODLE activities with grades can be added as leaderboards using blocks (items added to the side inside the block drawer of MOODLE course). The example of leader boards (Upload presentation activity) can be seen in Figure 4.

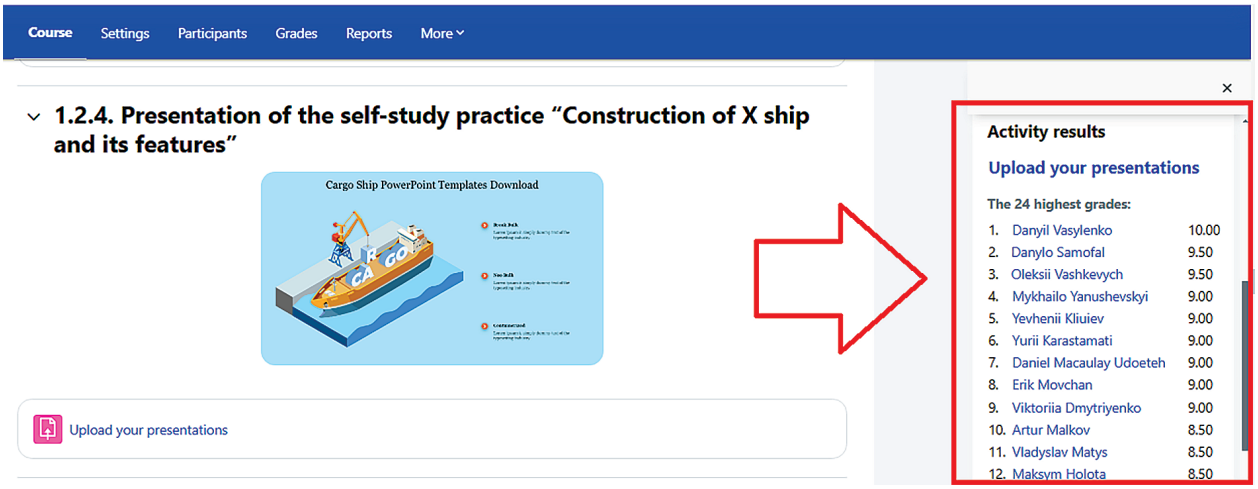

Figure 4. LMA's example of leader board

Source: LMS MOODLE of LMA

The findings of this study confirm that the integration of gamification into Maritime English language assessment contributes significantly to higher levels of motivation, engagement, and improved performance among cadets. Compared with traditional assessment formats, cadets demonstrated greater willingness to participate in tasks, more active collaboration during team-based exercises, and stronger retention of technical vocabulary (Fig. 5).

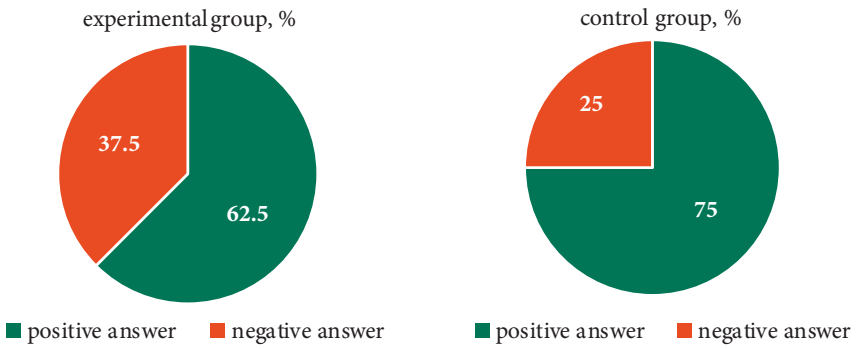

Figure 5. Survey result

Source: developed by the authors

These results show that gamification is not only a way to diversify learning, but also a tool that strengthens the link between language acquisition and professional training in maritime contexts. One of the most important contributions of gamification is the stimulation of creativity in problem-solving. Traditional assessment methods often limit students to following standard instructions or reproducing fixed answers. Such an approach does not always encourage flexibility or adaptability. By contrast, gamified assessment tasks challenge cadets to explore alternative solutions, test different options, and find original approaches to professional problems. This type of thinking is crucial in maritime practice, where unexpected situations frequently occur and require quick, inventive responses. Through simulation-based games and scenario tasks, cadets learn to approach technical and communicative challenges in a flexible and confident way.

Gamification also supports the growth of autonomy in learning. In a gamified environment, cadets have opportunities to choose their own paths, strategies, and learning speeds. This independence reflects the professional reality on board a ship, where engineers are often responsible for making operational decisions and solving problems without constant external guidance. The ability to monitor personal progress through levels, points, or achievements fosters a sense of ownership and responsibility. As a result, cadets not only complete tasks but also learn how to manage their own learning process, which is an essential skill for lifelong professional development. Another valuable effect is the creation of sustainable motivation. Maintaining interest in language learning is often a challenge, especially when technical training competes for students' time and attention. Gamification provides visible rewards, clear feedback, and opportunities for healthy competition, which sustain enthusiasm even during intensive study periods. Awards, leaderboards, and progress charts give cadets a tangible sense of achievement and recognition. This helps to maintain engagement across the semester and supports long-term commitment to improving English for professional purposes. The survey results further confirm this tendency (Table 1).

Table 1. Comparative table of results

Indicators	Experimental group, %		Control group, %	
	Before	After	Before	After
A2 level	60	35	65	55
B1 level	40	65	35	45
Grammar	55	88	51	52
Listening	45	90	42	55
Writing	41	89	40	50
Self-education	21	77	21	22
Motivation	37,5	78	25	32

Source: developed by the authors

In response to the question about motivation to learn English, 37.5% of the participants in the experimental group gave a positive answer, whereas only 25% of the control group responded in the same way. However, after the experiment the level of motivation to learn English increased significantly: 78% of the cadets in the experimental group reported high motivation, compared to only 32% in the control group. Before the experiment, both groups had similar results. The level of English remained mostly at the A2 level (60-65%), some of the cadets reached B1 (35-40%). The indicators of grammar, listening and writing fluctuated within 40-55%. Motivation and independent learning were at a low level (about 20%). As can be seen from the Table 1, after the experiment, the results of the experimental group increased in almost all categories. The B1 level rose to 65%, while the A2 level decreased to 35%, which indicates a gradual shift of the participants to a higher level of language proficiency. More than 85-90% of the cadets completed tasks in grammar, listening and writing, which is 30-40% higher than before the experiment. The indicators of self-education (up to 77%) and motivation (up to 78%) increased especially noticeably, which indicates the formation of a stable interest in learning. In the control group, the changes were much less pronounced. Although the number of cadets with a B1 level increased slightly (from 35% to 45%), and the share of those who demonstrated success in grammar, listening and writing rose to 50-55%, the level of self-education and motivation remained almost unchanged (20-30%).

During the experiment, qualitative changes in the behaviour and learning activity of the cadets were confirmed. If at the initial stage only a small part of the students showed initiative in discussions or role-playing games, then after the introduction of gamification elements, the number of voluntary responses and active speeches increased significantly. The cadets began to participate in group tasks more often, offered their own solutions, showed willingness to perform additional interactive exercises and initiate discussions in English. Such behavioural manifestations indicate the formation of stable internal motivation and positive learning dynamics. The results obtained are closely related to the research

methods used, which ensures their empirical validity. The testing data confirmed the increase in the level of foreign language competence, the questionnaire showed an increase in motivation and satisfaction with learning, and pedagogical observations reflected changes in the behaviour and involvement of the cadets. Thus, the combination of quantitative and qualitative methods allowed not only to record progress in results, but also to explain the mechanisms of its achievement, which gives the research a comprehensive and evidentiary nature. Thus, the experiment proved the effectiveness of using gamification: it contributed to improving the level of English, expanding communicative and professional skills, and forming greater motivation and readiness for self-education. The control group, which studied using traditional methods, did not demonstrate a similar qualitative leap.

Despite these advantages, gamification also faces certain challenges. Technical limitations, such as the availability of reliable devices or stable internet connections, can reduce the effectiveness of online games and simulations. Organisational issues must also be considered: integrating gamified tasks into the curriculum requires careful planning to ensure they complement, rather than distract from, the main learning objectives. There are also methodological concerns. Not every student responds positively to gamification. Some may find the competitive format stressful, while others may not immediately recognise its value for professional growth. This means that instructors must strike a balance between the engaging elements of game design and the fundamental educational goals of the course. Gamification itself is based on the intentional use of mechanisms originally developed for games – such as scores, levels, badges, challenges, and rewards – in settings that are not games. Its aim is to transform learning environments that might otherwise appear routine or rigid into dynamic spaces that are interactive, motivating, and enjoyable. By turning assessments into engaging experiences, cadets become more active participants, rather than passive recipients, of the learning process. This change in methodology is particularly important in the maritime industry, where students must combine a wide body of theoretical knowledge with practical skills. Traditional tests can measure vocabulary or grammar, but they rarely capture the complex interaction between communication, technical knowledge, and decision-making that is essential in real shipboard operations. Gamified assessments, on the other hand, allow cadets to practice these interactions in conditions that replicate professional scenarios. For example, a game might simulate a communication drill during an emergency, requiring cadets to use both technical terminology and quick problem-solving skills under pressure.

Gamification also makes learning more student-centred. Instead of passively receiving knowledge, cadets engage in interactive quizzes, role-based simulations, and tasks that provide immediate feedback. This interactivity helps maintain focus over long periods, while the constant feedback loop encourages students to correct mistakes and improve performance on the spot. Importantly, the sense of competition and teamwork fostered by gamified exercises mirrors the real-life environment of ship crews, where collaboration and communication are critical for safety and efficiency. In summary, the integration of gamification into Maritime English assessment is not a superficial attempt to make learning entertaining. Rather, it is a thoughtful pedagogical approach that combines the motivational power of games with the rigour of professional training. Gamification fosters creativity, autonomy, sustained motivation, and collaborative learning. It helps cadets build confidence in using English in professional contexts, supports the transfer of knowledge from theory to practice, and prepares them for the communicative and technical demands of maritime work. While challenges remain – such as technical access, curriculum design, and student diversity – the evidence from this study demonstrates that gamification can play a transformative role in Maritime Education and Training, especially within STEM-focused programmemes.

Results show substantial gains in the experimental group across language attainment (grammar, listening, writing), self-regulated learning and motivation, with only marginal change in the control group. These findings align with a growing body of recent research indicating that gamified and game-supported approaches can boost engagement, achievement and assessment performance in STEM-orientated language learning settings. Studies in Maritime English specifically echo the outcomes. C. Christodoulou Rafits *et al.* (2024) reported that introducing gamification mechanics in Maritime English LMS courses (badges, points, missions, leaderboards) increased motivation and supported the formation of communicative competence among future ship engineers; this directly parallels post-test improvements and the large rise in self-education/motivation indicators in the experimental group. Similar conclusions were reached in a companion article that details concrete gamified activities for Maritime English m-learning in Moodle, again pointing to positive shifts in engagement – consistent with questionnaire data (Kayisoglu *et al.* 2022).

Beyond the maritime domain, recent syntheses in STEM education corroborate the efficacy of games and gamification for learning and assessment. S.R. Mohd Rosedi (2024). concluded that gamification in STEM reliably increases student motivation and improves STEM abilities and related soft skills; data showed strong gains in motivation and collaborative performance during simulations in the experimental group are in line with these claims. Likewise, V. Ponnusamy & F. Manzil (2025) highlighted improvements in performance and engagement, reinforcing the notion that well-designed game elements could translate into measurable assessment gains – again mirroring grammar/listening/writing ≥60% growth. When specific classroom tools used in the intervention are considered, their alignment with recent evidence becomes evident. In the case of game-based quizzing, J. Wooten (2022)

reported that Kahoot! enhances motivation and contributes to improved academic performance in engineering and computing education. These findings correspond to the post-test advantages observed and the positive attitudes of students toward gamified quizzes. For lexical development, I. Mykytka (2023) study showed Quizlet significantly enhances vocabulary learning; writing and listening improvements likely benefitted from these vocabulary effects, and learners reported high satisfaction with spaced, game-like drills. I.S. Verdú *et al.* (2024) demonstrated that audience-response systems such as Wooclap, when applied formatively, increase motivation and achievement while enabling deeper debriefings. This function corresponds to their role within the formative assessment cycles, where they supported processes of self- and peer-evaluation. The context of the learning management system represents a decisive factor in shaping educational outcomes. Research T.E. Kim *et al.* (2021) on gamified Moodle environments consistently demonstrated their capacity to strengthen learner motivation, increase persistence, and encourage active participation. These results align with the survey data showing measurable motivational gains and the sustained engagement recorded throughout the semester. In the specific domain of maritime education, analytical scholarship underscores the central role of simulation-based training and its integration into the curriculum. The present design reflected this trend by embedding gamified scenarios and simulator-like tasks into the assessment process, thereby bridging theoretical instruction with practice-orientated learning experiences.

Nevertheless, findings across the literature are not uniformly positive. M. Sailer & L. Homner (2020) cautioned that gamification may generate unintended side effects, such as shallow participation or a focus on extrinsic rewards. To mitigate these risks, game elements were deliberately aligned with clear assessment criteria, each quiz was accompanied by structured debriefing and systematic error analysis, and motivational tools such as badges and leader boards were used to reinforce progress in mastering the material, rather than speed or superficial competition. Post-test data provided evidence of statistically significant improvements in core competencies, while qualitative observations confirmed the adoption of deeper learning strategies. These results indicate that the design avoided the common pitfalls highlighted in earlier investigations. A distinctive feature of this study lies in the integration of assessment for learning and assessment of learning. Whereas many prior investigations in language and STEM education concentrate on discrete skills or short-term outcomes, the present intervention combined formative cycles – facilitated through tools such as Wooclap, Kahoot, and Quizlet – with summative evaluation in the form of post-tests. This methodological integration enabled the demonstration of transfer from gamified practice to summative performance, thereby extending the evidence base in a dimension rarely quantified in previous research.

CONCLUSIONS

The results of the study showed that the use of gamification in the assessment process significantly influenced the formation of foreign language professional competence of future specialists in technical specialities. In particular, in the experimental group, the number of cadets who demonstrated a high level of proficiency in English-language technical terminology increased from 28% at the beginning of the experiment to 61% after its completion. In the control group, the same indicator increased only from 30% to 38%. In addition, observations during classes confirmed the increase in voluntary participation of cadets in discussions, more active use of digital tools and greater willingness to take on the role of leader in group tasks. A particularly important result was the improvement in the mastery of technical terminology in the fields of engineering and marine technologies. Cadets demonstrated not only better memory for specialised terms, but also greater confidence in using them during simulations of professional situations, such as role-playing games on ship safety or simulations of emergency protocols. The majority of cadets in the experimental group were able to complete the tasks of keeping a logbook and preparing English-language reports without significant errors, while in the control group, this figure was 23% lower.

Interactive assessment tasks contributed to the development of teamwork, communication skills and critical thinking. Cadets noted that working with Kahoot, Quizizz, and Wooclap motivated them to navigate technical information faster, find solutions to simulated problem situations and interact with each other more effectively. This is confirmed by the survey data: 72% of the participants in the experimental group admitted that their confidence in working with English-language professional materials had increased significantly thanks to gamified assessment forms, while only 41% of the respondents in the control group gave a similar answer. The generalised results confirmed the conclusions of international studies that gamification increases student satisfaction, reduces class absences, and improves academic achievement in various disciplines. Gamification has the potential to transform assessment practices, making them more flexible, student-centred and aligned with modern educational goals. Further research should focus on the long-term impact of gamification on the development of professional competence, as well as on testing adaptive models that integrate artificial intelligence and virtual reality into assessment environments.

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Гейміфікація під час оцінювання в морській англійській мові в контексті STEM-освіти

Анотація. Морська англійська мова є одним з ключових інструментів у навчанні майбутніх суднових інженерів за напрямом STEM (наука, технологія, інженерія, математика), оскільки вона забезпечує доступ до технічної літератури та професійного спілкування. Мета статті – знайти способи використання гейміфікації в оцінюванні рівня володіння морською англійською мовою. Методологія дослідження базувалася на поєднанні теоретичного аналізу наукових праць у галузі педагогіки та лінгвістичної дидактики, вивченні міжнародних стандартів (зокрема, STCW), а також експериментальній перевірці ефективності впровадження гейміфікації в процесі формувального оцінювання. Використовувалися методи педагогічного спостереження, анкетування та аналізу результатів навчальної діяльності студентів. Було встановлено, що гейміфікація, яка визначається як використання ігрових механізмів у неігровому освітньому контексті, сприяє підвищенню мотивації, активізації пізнавальної діяльності та розвитку міжпредметних компетентностей. Його інтеграція в оцінювання морської англійської мови дозволила моделювати професійні ситуації – спілкування в екстрених умовах, підготовку технічних звітів, взаємодію в міжнародному екіпажі. Такі завдання розвивають не тільки мовні, а й соціокомунікативні та когнітивні навички, важливі для професії. Результати дослідження показали, що гейміфікація може трансформувати традиційне оцінювання та зробити його більш гнучким, орієнтованим на студентів і чутливим до вимог сучасної морської галузі. Практичне значення результатів дослідження полягає в можливості їх використання в системі морської освіти: на навчальних курсах «Англійська мова для професійних цілей» у морських академіях і коледжах, під час навчання та перепідготовки інженерно-технічного персоналу флоту, а також у корпоративних навчальних програмах для судноплавних компаній

Ключові слова: морські навчальні заклади; персоналізований простір; цифрове оточення; LMS MOODLE; електронне навчання; суднові інженери