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DIGITAL BENCHMARKING TOOLS FOR ASSESSMENT IN MARITIME ENGLISH TRAINING

ЦИФРОВІ ІНСТРУМЕНТИ БЕНЧМАРКІНГУ ДЛЯ ОЦІНЮВАННЯ В НАВЧАННІ З МОРСЬКОЇ АНГЛІЙСЬКОЇ МОВИ

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ABSTRACT

Purpose. *The purpose of this study is to provide a theoretical justification and experimental verification of the effectiveness of using digital benchmarking tools in the assessment system of English-language training for future marine engineers (ship mechanics). The research focuses on improving the quality of assessment by integrating benchmarking principles with digital technologies and aligning evaluation practices with modern educational and professional requirements.*

Methodology. *The research methodology is based on a combination of theoretical and empirical methods. Theoretical methods include analysis, synthesis, and generalisation of scientific and methodological literature on assessment, benchmarking, and digitalisation in education. Empirical methods involve pre- and post-testing to measure the level of English-language professional competence,*

Мета. *Метою дослідження є теоретичне обґрунтування та експериментальна перевірка ефективності використання інструментів цифрового бенчмаркінгу в системі оцінювання англомовної підготовки майбутніх морських інженерів (суднових механіків). Дослідження зосереджено на покращенні якості оцінювання шляхом інтеграції принципів бенчмаркінгу з цифровими технологіями та узгодження практик оцінювання із сучасними освітніми та професійними вимогами.*

Методологія. *Методологія дослідження базується на поєднанні теоретичних та емпіричних методів. Теоретичні методи включають аналіз, синтез та узагальнення науково-методичної літератури з оцінювання, бенчмаркінгу та цифровізації в освіті. Емпіричні методи включають попереднє та повторне тестування для вимірювання рівня професійної компетентності курсантів з*

questionnaires to identify cadets' motivation and attitudes, pedagogical observation to monitor engagement and participation, and analysis of data obtained from the Moodle learning management system. The study was conducted among cadets of a maritime educational institution within a digitally supported learning environment, where benchmarking tools and formative assessment strategies, including self- and peer-assessment, were systematically implemented.

Results. *The findings demonstrate a positive dynamic in the development of cadets' English-language professional competence following the implementation of digital benchmarking tools. The results indicate increased learning activity, improved academic performance, and higher levels of motivation. Additionally, cadets showed a better understanding of assessment criteria and greater ability to monitor their own progress. The integration of self-assessment and peer-assessment contributed to the development of reflective skills, critical thinking, and learner autonomy. Data from the LMS analytics confirmed consistent engagement with course activities and progressive improvement in performance indicators.*

Conclusions. *The study confirms that digital benchmarking tools are an effective means of enhancing the quality of assessment in Maritime English training for future marine engineers. Their use ensures greater objectivity, transparency, and alignment of assessment with learning outcomes, while also supporting the development of cadets' evaluative competence. The integration of digital technologies into assessment practices promotes a learner-centred approach and continuous feedback. Future research should focus on expanding the use of advanced digital and AI-based tools, as well as exploring adaptive assessment models and broader implementation across different educational contexts.*

Keywords: *assessment, benchmarking, digital tools, digitalisation, formative assessment, marine engineers, Maritime English training.*

англійської мови, анкетування для виявлення їх мотивації та ставлення, педагогічне спостереження для контролю залученості та участі, а також аналіз даних, отриманих із системи управління навчанням Moodle. Дослідження проводилося серед курсантів морського навчального закладу в цифровому навчальному середовищі, де систематично впроваджувалися інструменти бенчмаркінгу та стратегії формувального оцінювання, включаючи самооцінювання та взаємне оцінювання.

Результати. *Отримані дані демонструють позитивну динаміку розвитку професійної компетентності курсантів з англійської мови після впровадження інструментів цифрового бенчмаркінгу. Результати вказують на підвищену навчальну активність, покращену академічну успішність та вищий рівень їх мотивації. Крім того, курсанти продемонстрували краще розуміння критеріїв оцінювання та кращу здатність контролювати власний прогрес. Інтеграція самооцінювання та взаємної оцінки сприяла розвитку рефлексивних навичок, критичного мислення та самостійності курсантів. Дані аналітики LMS підтвердили постійну участь у навчальних заходах та поступове покращення показників ефективності.*

Висновки. *Дослідження підтверджує, що інструменти цифрового бенчмаркінгу є ефективним засобом підвищення якості оцінювання в навчанні з морської англійської мови для майбутніх морських інженерів. Їх використання забезпечує більшу об'єктивність, прозорість та узгодженість оцінювання з результатами навчання, а також підтримує розвиток їх оціночної компетентності. Інтеграція цифрових технологій у практику оцінювання сприяє орієнтованому на курсанта підходу та постійному зворотному зв'язку. Майбутні дослідження можуть бути зосереджені на розширенні використання передових цифрових технологій та інструментів штучного інтелекту, а також на вивченні адаптивних моделей оцінювання та ширшому впровадженні в різних освітніх контекстах.*

Ключові слова: *оцінювання, бенчмаркінг, цифрові інструменти, цифровізація, формувальне оцінювання, судномеханіки, англомовна підготовка.*

INTRODUCTION

The current stage of education development is characterised by active digitalisation, which significantly transforms approaches to the organisation of the educational process, particularly in the field of Maritime Education and Training (MET) (Yurzhenko et

al., 2025). In the context of globalisation and increasing requirements for the professional training of maritime specialists, the quality of English-language training of future ship engineers is of relevance. It is regulated by international standards, particularly the requirements of the STCW Convention, which determine the need to form effective professional communicative competence. In this context, the problem of ensuring objective, transparent and effective assessment of learning outcomes, which should meet modern digital conditions and contribute to improving the quality of specialist training, is of particular importance.

At the same time, the analysis of previous research indicates that traditional approaches to assessment in the educational process do not fully meet modern requirements. They are mostly focused on controlling results rather than supporting learning, which limits the development of students' evaluative competence. According to Kalnik (2013), the lack of transparency of assessment criteria, as well as the low level of student involvement in the assessment process, reduces their motivation and complicates the formation of self-analysis skills and responsibility for their own learning outcomes. In this regard, there is a growing need to rethink the role of assessment as a tool for learning and development.

Several scholars emphasise the importance of formative assessment, which is understood as a continuous, low-stakes process in which teachers and students collaboratively set learning goals, assess current performance, and adjust learning accordingly (Furtak, 2022). In particular, Black and Wiliam (1998) substantiated its effectiveness in improving learning outcomes, highlighting feedback as a key component of the learning process.

Nicol and Macfarlane-Dick (2006) further stressed the importance of integrating assessment into teaching and enhancing student engagement, while Sadler (2010) underlined the role of clearly defined criteria and students' ability to evaluate their own work as essential conditions for effective learning. These studies collectively confirm the need to move from traditional summative models to more flexible, student-centred assessment approaches.

Further research highlights the complexity of assessment as a context-dependent process that integrates teachers' pedagogical beliefs and practical activities (Strydom, 2017), emphasising the importance of implementing modern approaches, including formative assessment and digital tools. Modern studies also support the role of formative feedback in increasing student engagement.

In particular, Umfreville and Dodd (2024) note that effective feedback promotes active learner participation, the development of reflection, and the improvement of learning outcomes. It is implemented during the learning process and functions as a cyclical system based on ongoing feedback, including both informal interactions and structured assessment tasks. Research evidence confirms its positive impact on student achievement across different educational contexts.

A separate area of modern research is devoted to the use of digital tools in pedagogical assessment. The works of Hattie and Larsen (2020), and Ciesla (n.d) reveal the significant potential of digital technologies, in particular learning management systems (LMS), analytical platforms and testing services, for monitoring learning activities, automating assessment and providing feedback. The use of such tools increases the objectivity and transparency of assessment and ensures a systematic increase in learning progress.

One of the promising areas for solving this problem is the use of digital benchmarking tools as the basis for building an assessment system. This approach involves defining clear criteria based on best educational practices, comparing learning outcomes, and using digital platforms to monitor students' progress (Biliakovska, 2021).

The concept of benchmarking in education, originally developed by Camp (1995), is interpreted as a systematic process of comparing performance indicators with best practices in order to improve quality. The integration of benchmarking and digital technologies helps to increase the objectivity of assessment, ensures its transparency, and allows students to actively participate in the assessment process through self- and peer assessment.

Digital benchmarking tools are an effective means of implementing modern assessment. It is advisable to classify them by functional purpose. Also, LMS analytics tools cannot collect and process data on student performance and activity; test platforms provide automated knowledge testing; visualisation tools contribute to the visual presentation of results in the form of graphs and charts; and AI solutions open up opportunities for predicting results and personalising learning. Such a comprehensive approach provides a deeper analysis of educational achievements and supports the adoption of informed pedagogical decisions (Povidaychik, 2021).

According to Popova (2025) implementation of digital benchmarking tools took place in an educational environment based on Moodle, which allowed for an effective combination of learning and assessment. The structure was organised according to the principle of gradual advancement with the use of gamification elements, in particular, course levels and learning activities, which ensured the logical sequence of the military material and supported the motivation of students.

Functionally, digital benchmarking tools provide the ability to track the progress of students in real time, which allows for timely correction of the educational process (Vasylkova, 2013). They also facilitate the comparison of results both between students and with certain standards that ensure the objectivity of the assessment. At the same time, such player tools play an important role in the formation of clear and transparent criteria, which are necessary conditions for the development of evaluative competence (Vashchenko, 2021) and improving the quality of English training for future ship mechanics.

The implementation of digital benchmarking tools was found in the educational environment based on Moodle, which provides ample opportunities for organising the learning process, assessing and monitoring results. The structure was created on the principle of phased provision using gamification elements, in particular missions, course levels and various types of learning activities (Okhrimenko, 2016). Zepke et. al (2014) noted that this approach contributed to increasing student motivation, activating their learning activities and ensuring a logical sequence of learning material.

Perminova et al. (2020) noted that the assessment design involved the integration of modern approaches to formative assessment, in particular self-assessment (self-assessment) and peer assessment (peer assessment). This allowed students to be actively involved in the assessment process, promoted the development of reflection, critical thinking and responsibility for their own learning outcomes.

An important element was the development of clear rubrics and assessment criteria, which ensured transparency, clarity of requirements and compliance with defined benchmarks, as well as facilitated the process of objective assessment of results.

The **purpose** of the article is to theoretically substantiate and experimentally verify the effectiveness of using digital benchmarking tools in the assessment system for English-language training of future marine engineers.

To achieve the goal, the following research tasks were defined: to analyse modern approaches to assessment in English-language training in the field of MET; to reveal the essence of benchmarking as a pedagogical assessment tool; to substantiate the capabilities of digital tools in the implementation of the benchmarking approach; to develop and implement an assessment model based on digital benchmarking; to experimentally verify its effectiveness in the process of training future ship mechanics.

METHODOLOGY

The study used a set of theoretical and empirical methods, which ensured the integrity and scientific validity of the results obtained. Theoretical methods included the analysis, synthesis, and generalisation of scientific sources, which made it possible to reveal the essence of benchmarking, determine its potential in the pedagogical assessment system, and substantiate the feasibility of using digital tools in the English-language training of future ship engineers.

The empirical part of the study involved a complex of complementary methods to verify the effectiveness of the proposed approach. Pedagogical testing in the pre-test and post-test format was used to determine the level of foreign language professional competence before and after the implementation of digital benchmarking tools. Questionnaires (implemented via the Google Forms platform) were used to assess cadets' educational motivation and their attitudes towards self- and peer assessment as components of formative assessment. Pedagogical observation enabled tracking the dynamics of learning activity, the level of student engagement, and interaction patterns within the educational environment.

A key role in the study was played by digital tools integrated into the educational process. In particular, the Moodle learning management system was used as the main digital environment for organising learning, posting educational materials, conducting assessments, and collecting analytical data. Interactive learning modules were implemented using SCORM packages, which provided a structured presentation of the material and the ability to automatically track results. The *LearningApps* service was used to create interactive exercises and tasks, which contributed to increasing student engagement and developing their practical competence.

Assessment of educational achievements was also supported by online testing platforms, in particular *Quizizz* and *Kahoot!*, which allowed for operational knowledge control and provided instant feedback. Self-assessment tools (checklists) and peer-assessment tools (rubrics) integrated into Moodle ensured transparency of criteria and active participation of cadets in the assessment process. In addition, the analytical capabilities of the LMS made it possible to obtain objective indicators of the success, activity and progress of education seekers.

The study involved cadets – future ship engineers of a higher maritime education institution. The participants were not divided into control and experimental groups,

which ensured the integrity of the educational process and eliminated the influence of external variables associated with different learning conditions. This approach allowed tracking the dynamics of changes within a single group by comparing pre-test and post-test results. It ensured a more objective evaluation of the effectiveness of the proposed approach, as all participants were exposed to identical pedagogical conditions and interventions. Moreover, this design supported ethical considerations, providing equal access to innovative teaching and assessment methods for all cadets.

Ethical aspects of the study were observed in accordance with generally accepted standards of pedagogical research. All participants were informed about the purpose and procedures of the study, voluntarily consented to participate, and the collected data were processed in a generalised form, ensuring confidentiality and adherence to principles of academic integrity.

The logic of the study involved the phased implementation of digital benchmarking tools in the assessment system. At the first stage, assessment criteria were defined based on benchmarking analysis of best educational practices. At the second stage, digital tools were integrated into the learning process, including LMS-based activities, online testing, self-assessment, and peer assessment. At the final stage, a comparative analysis of learning outcomes was conducted to evaluate the effectiveness of the proposed approach and its impact on the quality of English-language training of future ship engineers.

RESULTS

Assessment plays another key role in the formation of professional and communicative competence of future ship mechanics, after which it not only fixes the level of knowledge and skills, but also directs the learning process, changes its goals and results. In the context of English-language training, assessment should be integrated into the educational process and perform a formative function, contributing to the development of speech skills in professionally oriented situations (Levy-Feldman, n.d.).

Importance is given to the requirements of international standards, particularly the STCW Convention, which provides for the ability of future specialists to effectively develop professional communicative English in real maritime practice. Thus, assessment should not only be a control tool, but also a means of forming competencies.

Benchmarking in education is considered a systematic approach to improving the quality of education through analysis, comparison and adaptation of best educational practices. Its essence is embodied in certain reference indicators (benchmarks) that are used to assess learning outcomes and improve educational processes (Diahyleva, et.al, 2024).

As a tool for ensuring the quality of education, benchmarking allows you to establish clear assessment criteria focused on international standards and ensures the objectivity and transparency of the assessment process. An important aspect is not only the comparison of results, but also the adaptation of best practices to a specific educational context, which is especially relevant for the training of future ship mechanics (Epper, 1999).

Digitalisation of assessment opens new opportunities for improving its efficiency and quality in the educational process. The use of digital platforms, learning management systems, analytical tools and elements of artificial intelligence allows you to automate assessment, provide operational feedback and ensure continuous monitoring of educational achievements (Chetveryk & Veretiuk, 2025).

This helps to increase the objectivity of assessment, minimise the subjective influence of the teacher, and also creates conditions for a visual presentation of results, which facilitates their interpretation by all participants in the educational process. As a result, assessment becomes more transparent, accessible and focused on the development of students (Cherniaieva, 2024).

An important role in the digitalisation of English training for specialists is played by modern educational technologies, in particular learning management systems such as Moodle. They provide a comprehensive organisation of the educational process, including the creation of educational content, assessment and analysis of results.

The use of interactive platforms expands the possibilities of forming speech skills through various types of task activation and facilitation of students' learning activities. Additionally, the introduction of English gamification elements, such as scores, ratings, badges and levels, motivation for development, stimulates interest and maintains interest in language learning in a professional context (Diahyleva, et.al, 2025).

The practical implementation of the approach included the use of various digital learning activities. Interactive tests allowed to check the level of assimilation of theoretical material and professional vocabulary, case tasks (in particular, engine room scenarios) contributed to the development of professional thinking, and games provided practice of communicative situations typical of the marine environment. Forums for reflection were used as a tool for self-analysis, discussion of results and exchange of experience between students (Niedialkova, 2025).

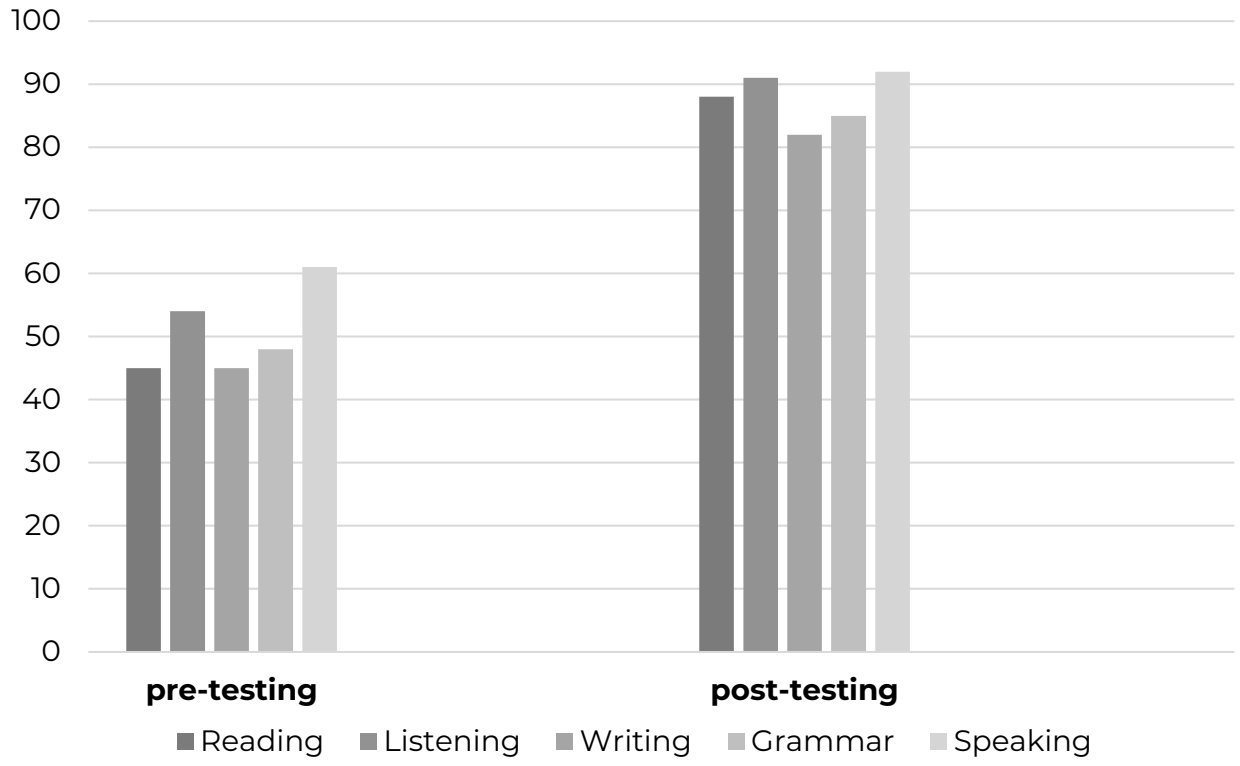
In the process of implementing the benchmarking approach, along with the basic capabilities of the Moodle learning management system, other digital tools were used for tracking student progress (scores, completion rates) to expand the functionality of assessment. In particular, the interactive services *Quizizz* and *Kahoot!* were used to conduct operational knowledge control with elements of gamification, providing quick assessment, instant feedback, and opportunities to compare student performance (leaderboards, rankings), which contributed to increased student engagement (Lutsenko et al., 2024).

To create and analyse tests and questionnaires, the Google Forms tool was used, which allows for automatic processing of results and their further interpretation. The visualisation of the obtained data was carried out using Google Looker Studio, which made it possible to present the learning results in the form of analytical panels and compare them with certain benchmarks. The integrated use of these tools ensured increased objectivity of assessment, constant monitoring of educational progress, and contributed to the development of assessment competence of cadets.

To determine the impact of digital benchmarking tools on the attitude of cadets to learning, a pedagogical experiment was conducted without dividing into control and experimental groups. The results of the pedagogical experiment conducted using digital benchmarking tools showed (Fig.1) positive dynamics in the formation of foreign language professional competence of future ship mechanics.

A comparative analysis of the results of the pre-test and post-test testing showed a general increase in the level of English language proficiency in all types of speech activity, including reading, listening, writing, grammar and speaking. An increase in the accuracy of task performance was recorded, as well as an improvement in the ability to use professional vocabulary in the context of professional activity.

Figure 1
Results chart



The results of pedagogical observation showed an increase in the level of involvement of cadets in educational activities. An increase in student activity during the completion of tasks, participation in discussions, and more regular completion of educational tasks was detected. Increased interaction between cadets and the development of reflection skills regarding their own learning outcomes were also recorded.

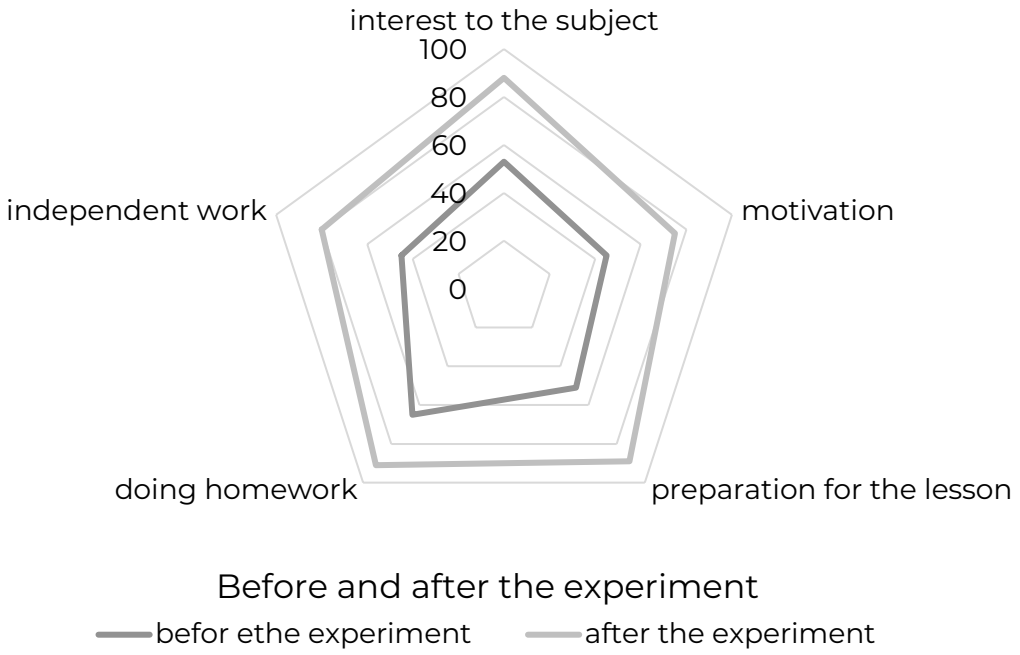
Data obtained from the Moodle learning management system confirmed the positive dynamics of cadets' educational activity. In particular, an increase in the frequency of entries into the system, an increase in the level of task completion, improved success rates, and more systematic participation in the educational process were recorded. Analytical indicators indicate an increase in the regularity of educational activity and the stability of completing educational tasks.

Analysis of the results of the questionnaire conducted before and after the experiment also revealed positive changes in cadets' attitudes to the educational process. An increase in the level of motivation, interest in completing educational tasks, activity during classes, and readiness for independent work were recorded.

The results obtained are confirmed by the data presented in Fig. 2, which reflects the growth of all studied indicators, in particular interest in the discipline, level of motivation, preparation for classes, homework completion and independent work. The most pronounced changes are observed in indicators of motivation and academic activity of cadets.

Therefore, the results of the study confirm the positive dynamics in cadets' learning activities when using digital benchmarking tools. This necessitates their further analysis and interpretation in the context of modern approaches to formative assessment and digitalisation of education.

Figure 2
Results chart of the questionnaire



DISCUSSION

The integration of digital benchmarking tools into the pedagogical assessment system in the process of English-language training of future ship mechanics is effective. The recorded positive dynamics of academic achievements, an increase in the level of motivation and activity of cadets, are consistent with modern approaches to the organisation of formative assessment.

The obtained data confirm the positions of Black and Wiliam (1995) on the effectiveness of formative assessment as a means of increasing the effectiveness of learning, in particular through the systematic use of feedback. The increase in the level of student involvement and their learning activity also correlates with the conclusions of Nicol and Macfarlane-Dick (2006), who emphasise the importance of integrating assessment into the learning process and developing students' ability to self-regulate.

The identified increase in students' awareness of assessment criteria and their ability to track their own progress confirms Sadler's (2010) ideas about the importance of clearly defined criteria and active participation of students in assessment. The integration of self-assessment and peer assessment contributed to the development of reflection, responsibility and autonomy of students, which is consistent with the concept of student-centred learning.

The results of the study are also consistent with modern scientific approaches to the digitalisation of assessment. In particular, the use of digital tools and analytical capabilities of the LMS ensured objectivity, transparency and systematicity of assessment, which confirms John Hattie’s conclusions on the importance of feedback and learning data to improve its effectiveness. The analytical indicators obtained allowed for continuous monitoring of educational progress and timely adjustment of the educational process. The use of digital platforms contributed not only to the automation

of assessment but also to improving the quality of feedback and student engagement (Kostikova & Miasoiedova, 2022).

However, the study has certain limitations. In particular, the results may depend on the specifics of the educational environment and the level of digital competence of the study participants. In further research, it is advisable to expand the sample, apply comparative experimental designs, and explore the possibilities of integrating artificial intelligence tools into the assessment system. Therefore, the results of the study confirm the feasibility of using digital benchmarking tools as an effective means of improving the quality of pedagogical assessment, developing students' assessment competence, and ensuring student-centred learning in the context of digitalisation of education.

CONCLUSIONS

The study confirmed the effectiveness of using digital benchmarking tools in the English language training assessment system for future ship mechanics. A comparative analysis of the results of the entrance and final testing showed an increase in the level of formation of foreign language professional competence in all types of speech activity (reading, listening, writing, grammar, speaking), in particular, an improvement in the accuracy of task performance and the ability to use professional vocabulary in the context of professional activity.

The results of the questionnaire and pedagogical observation showed an increase in the level of learning motivation, interest in the discipline, student activity during classes and readiness for independent work. An increase in awareness of assessment criteria was recorded, as well as a positive attitude towards self-assessment and mutual assessment as tools for tracking one's own progress.

Analysis of data from the Moodle learning management system showed an increase in the frequency of use of the educational environment, an increase in the level of task performance, improved success rates and more systematic participation of cadets in the educational process. This indicates an increase in the regularity of educational activities and the stability of the implementation of educational tasks.

It has been established that the integration of digital technologies, formative assessment, as well as self-assessment and peer assessment tools contributes to improving the quality of the educational process, developing cadets' assessment competence and increasing their learning motivation. The use of digital benchmarking tools ensures greater objectivity, transparency and systematic assessment, and also creates conditions for constant monitoring of educational achievements and correction of the educational process.

Prospects for further research lie in expanding the sample of participants, using experimental designs with control groups, as well as studying the possibilities of integrating artificial intelligence tools and adaptive learning systems into the assessment process. Special attention needs to be paid to the development of tools aimed at further developing the assessment competence of education seekers in the context of digitalisation.

CONFLICT OF INTEREST

The author declares that there are no conflicts of interest regarding the publication of this paper.

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ARTIFICIAL INTELLIGENCE STATEMENT

No artificial intelligence tools were used in the preparation of this manuscript.

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