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ENHANCING CRITICAL THINKING SKILLS WHILE LEARNING MARITIME ENGLISH

This study examines the role and significance of an inquiry-based approach in developing future seafarers' critical thinking skills and abilities in English language classes. The approach is examined in detail, with particular focus on the key characteristics that have made it a highly sought-after method for developing critical thinking skills, establishing logical, cause-and-effect relationships between phenomena and events of professional importance. The inquiry-based approach offers a number of advantages for educators and students alike. It is student-centered and active, flexible and easily modified to suit different educational settings, and it encourages curiosity through real-world connections and practical skills training. Furthermore, it is designed to facilitate lifelong learning.

The study is focused on the application of the fishbone method of analysis as a widely used tool in both learning and working environments for the identification of solutions to emerging problems. It is acknowledged as an efficacious instrument for enhancing both the English-language communicative and professional proficiency of future specialists. This method of learning is recognized as an effective approach in complex environments where decision-making is challenging due to the influence of numerous factors. The practical implementation of the fishbone diagram strategy in the context of the ESA lesson format is described, with specific examples provided. In particular, several types of this diagram are considered. These include simplified diagrams, which reflect only the main impact factors; regular (standard) diagrams, which identify the causes and subcauses; complicated diagrams, which directly determine the factors that should be taken into account, thereby determining a clear direction for the analysis; and more complicated diagrams, which must take into account a wide range of factors.

Key words: *critical thinking, inquiry-based approach, fishbone diagram, future seafarers.*

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РОЗВИТОК КРИТИЧНОГО МИСЛЕННЯ ПІД ЧАС ВИВЧЕННЯ АНГЛІЙСЬКОЇ МОВИ МОРСЬКОГО СПРЯМУВАННЯ

У статті розглянуто роль і значення проблемно-орієнтованого підходу у розвитку навичок і вмінь критичного мислення майбутніх моряків на заняттях з англійської мови. Визначено ключові характеристики підходу, що зумовлюють його затребуваність для розвитку здібностей критично мислити, встановлювати причинно-наслідкові зв'язки між явищами та подіями професійного значення для морських інженерів. Серед переваг проблемно-орієнтованого підходу відзначено його студентоцентрований та активний характер; гнучкість і універсальність застосування; скерованість на зацікавлення у навчанні через націленість на зв'язок із реальним життям і формування практичних навичок і вмінь, а також спрямованість на розвиток загальнонавчальних компетентностей заради можливості навчатися упродовж життя.

Дослідження зосереджено на застосуванні методу критичного аналізу ситуації на основі схематичної діаграми у формі риб'ячого скелету. Даний спосіб навчання визнано таким, що стимулює розумову діяльність і є дієвим саме у складному середовищі, де через вплив багатьох факторів прийняття рішень суттєво утруднюється. Широко застосовувана як у навчальному, так і в робочому середовищі, діаграма «риб'ячий скелет» визнана ефективним інструментом удосконалення як англомовної комунікативної, так і професійної компетентності майбутніх фахівців. Описано практичну реалізацію даної навчальної стратегії у контексті формату уроку ESA. Наведено варіанти застосування означеної стратегії на прикладі професійно орієнтованого навчального матеріалу. Зокрема розглянуто декілька видів означеної діаграми, а саме: спрощена, що відображає лише основні фактори впливу; стандартна з визначенням головних і другорядних причин; складна, що безпосередньо окреслює

фактори, які слід врахувати, визначаючи тим самим чіткий напрямок аналізу; ще більш ускладнена через заданий широкий спектр факторів, що мають бути враховані.

Ключові слова: *критичне мислення, проблемно-орієнтоване навчання, діаграма «риб'ячий скелет», майбутні моряки.*

The Problem Statement. The ability to think critically is essential for marine engineers, given the complex, uncertain, and distinctive challenges they face. Working as a marine engineers requires a combination of technical expertise, innovation and insight. The ability to identify potential problems, assess risks, find solutions and predict consequences is considered crucial for marine engineers. It is also important for them to be able to communicate their ideas and conclusions effectively, as well as to collaborate with colleagues who have different ideas (Ohorodnyk, 2017; McKeon, 2018; Cicek et al., 2019; Khan, 2020).

According to experts, the application of critical thinking techniques enhances the quality of work, ensures safety and reliability, and fosters professional growth. Learning and practicing critical thinking skills is possible in numerous ways in marine engineering. One of the most effective methods for engaging students in the learning process is to provide them with opportunities to apply their knowledge in realistic, problem-based scenarios. This approach, known as inquiry-based learning, has been shown to be an effective way to facilitate the transfer of knowledge from the academic setting to the real world (Elder & Paul, 2009; Holmes et al., 2015). The utilization of hands-on inquiries, wherein students are required to engage in collaborative communication, the analysis of information, and the formulation of solutions to their challenges, is an effective approach to fostering the development of their critical thinking abilities.

An inquiry-based approach encourages students to search for and utilize resources beyond the classroom. It involves making observations, posing questions, reviewing what is already known, planning and designing experiments, collecting data, proposing answers, making predictions, and communicating the results of the work (Buch and Wolff, 2000; Mathis, 2015). According to educators and practicing teachers, inquiry-based learning strategies work well with all the skills in the English curriculum: reading, writing, oral communication and media (Gray, 2016). When teaching English, one of the most effective ways of promoting inquiry-based learning is to design activities that encourage exploring. This paper presents the use of fishbone diagrams as an inquiry-based learning strategy with the goal of fostering problem-solving abilities in students.

The Analysis of Recent Researches and Publications.

Clearly, different academic disciplines have the potential to develop critical thinking. However, each has its own peculiarities. A growing number of researchers and educators are placing greater emphasis on the development of students' critical thinking abilities, while attempting to integrate critical thinking strategies into a diverse range of academic disciplines (Buch and Wolff, 2000; Paul and Elder, 2004; Mathis, 2015; Rahmi et al., 2019). There is a view that STEM subjects (science, technology, engineering and mathematics) are more focused on problem-solving than critical thinking. However, in subjects such as the Arts, Humanities and Social Sciences (HASS), which includes language learning as well, problem solving often becomes an exercise in pure critical thinking.

The advancement of critical thinking skills in engineering students, with a particular focus on future marine engineers, has become a topic of interest for some academic papers (Cicek et al., 2019; Khan, 2020). The importance of fostering critical thinking in seafarers was emphasized. It was argued that an education system that merely encourages rote learning and does not encourage students to apply their own reasoning to subject matter will not produce students who are well-rounded and able to work effectively in the maritime environment (Khan, 2020: 41).

A number of studies have looked at the development of critical thinking skills through English, considering it an optimal tool for interdisciplinary communication. The scholars hold disparate views on the nature of critical thinking in language learning. They believe that critical thinking in language learning means being able to analyze language, judge the trustworthiness of sources, make good arguments, and think about what one is learning (Sun et al., 2020). A variety of techniques and methodologies have been employed by researchers to foster critical thinking among students in the context of language learning (Elder & Paul, 2009; Abrami et al., 2015; Holmes et al., 2015)

The research presented here focuses on works that study the simultaneous teaching of English and the development of critical thinking skills through the use of fishbone diagrams. These are the works of Guo W., Lu H. (2011), Khan U. R. (2020), Munawir A. (2022). Both theoreticians and practitioners agree that a

fishbone diagram is an effective analytical tool for identifying the causes of a problem. As a kind of graphic organizer, it is used to explore the various elements and implications of a complex problem. It assists students in organizing their thoughts in a simple, visual and , on occasion, entertaining way (Munawir, 2022 244).

The purpose of the research. The paper presents the use of a fishbone diagram as a tool to stimulate interest, self-awareness and critical thinking in the context of inquiry-based engineering education. The *objective* of this study is to demonstrate the practical application of a fishbone diagram in the development of critical and creative thinking skills in future seafarers as they engage in discussions of professional issues in English lessons.

The methodology of the research. The paper uses theoretical and practical methods of the research. In particular, an analysis of the key characteristics of the inquiry-based learning approach has enabled the determination of the topics for different types of fishbone diagram activities and their place in lessons based on the ESA methodology. Furthermore, the methods and techniques for their appropriate practical implementation have been described.

The Statement of the Basic Material. Inquiry-based learning is based on the inquiry process that includes gathering facts and observations and using them to solve problems. This approach is not new and is well-known to educators who seek to enhance the learning experience through greater engagement and activity. Its name speaks for itself. It is based on the inquiry process, which involves gathering facts and observations and using them to solve problems (Khan, 2020). It is reasonable to assume that this encourages students to explore the English language professional content by answering high-level questions. These are the questions that designed to trigger students' curiosity and stimulate critical thinking.

Inquiry-based learning is a method that has been shown to have a number of significant advantages. Among the key characteristics of this approach, researchers have identified the following:

– *a student-centered learning.* In a student-centered learning environment, learners are encouraged to take an active role in their own education, with the focus being on meeting their individual academic needs and abilities.

– *an active and engaging learning*. Active learning methods encourage students to become actively engaged in their learning process, through activities such as thinking, discussing, investigating and creating.

– *triggering students' curiosity*. It is important to recognize the role of curiosity as a driving force in the learning process. It can be defined as a kind of special spark that stimulates a person's interest in knowledge and encourages students to explore, discover and even invent.

– *making real-world connections*. The formation of real-world connections depends on the ability to relate information to one's own experiences. This allows students to actually experience or practice some job-related skills. In fact, this process is considered to foster, just mentioned, curiosity and sincere interest in learning and problem-solving.

– *practical skills training.* Practical skills are beneficial in any workplace. Skill-based learning for seafarers typically encompasses both technical (hard) skills related to ship operations and maintenance, as well as non-technical (soft) skills essential for safety, communication, and teamwork. Skill-based learning for seafarers often involves a combination of formal education, onboard training, simulator exercises, and hands-on experience to achieve the best results in developing both types of skills.

– *a learning and development strategy*. Learning and development is a continuous process of encouraging professional development. A learning and development strategy for future seafarers should address the evolving demands of the maritime industry, technological advancements, regulatory requirements, and the need for sustainable practices. It includes integration of technologies relevant to the maritime sector (such as automation, digitalization, artificial intelligence, and remote monitoring systems); simulation training to replicate real-life scenarios on board and provide practical experience; soft skills development to enhance interpersonal skills and promote effective collaboration within the mixed crew, etc.

– *suitable for any subject.* The approach can be applied for both general studies and job-related training. To ensure a successful learning strategy, it is crucial to develop high-quality, engaging learning content that aligns with the goals and objectives of maritime studies and students' career needs.

– *pretty flexible and easily modified to educational settings*. A flexible mode of learning can be delivered across a variety of settings, including classroom or virtual lessons, as well as a blended learning approach. Flexible learning for future seafarers is essential to meet the challenges of their profession, including long periods away from home, remote working conditions, and changes in working environment (Buch and Wolff, 2000; Paul and Elder, 2004; Mathis, 2015; Rahmi et al., 2019).

It is evident that all essential characteristics support inquiry-based learning. It is not surprising that it is considered an ideal teaching aid for future marine engineers, given that it is able to cope with the challenges presented by the latest technologies, which are now being implemented with great intensity on cargo vessels.

The list of advantages of this approach is extensive and can be further elaborated upon. According to practicing teachers, it contrasts with conventional education by focusing on the process of learning, rather than outcomes. It makes the learning process more engaging and meaningful, encouraging students to become more independent learners It fosters the development of logical reasoning and provides practical experience in problem-solving, while also helping students to gain a deeper understanding of the content. The role of the teacher is that of a facilitator, imparting soft skills that will be of long-term benefit to the students (Elder & Paul, 2009; Holmes et al., 2015; Gray, 2016).

Inquiry-based approach includes a wide range of learning strategies. This paper presents the use of fishbone diagrams as a tool to stimulate interest, self-awareness and critical thinking in the context of inquiry-based engineering education. A fishbone diagram (FBD) is also known as a cause-and-effect diagram (Guo and Lu, 2011: 438), which is a widely used tool in both learning and working environments for identifying solutions to emerging problems. So, being competent in this type of activity (having suitable skills, knowledge, experience, etc.) can be very helpful, particularly when discussing workplace issues within a team.

As a problem solving technique designed to help identify the problem's root cause, fishbone diagram is considered to be an efficient way to brainstorm in a complex environment, such as those with multiple unknown variables. A visualized fishbone-type mind map template is an effective tool for categorizing potential causes of a problem. The head of the fish represents the primary issue. The bones represent the various causes that could be contributing to this problem. The backbone serves to connect all the bones to the head.

There are different types of FBDs, as well as a great number of their modifications. A simple diagram is represented by a basic set of components, so-called sufficient minimum. It has been practiced with the fourth-year students on the topic *Workplace Fatigue*. The above approach has been employed at the Engage stage of the ESA (Engage-Study-Activate) lesson format, which is typically recommended for senior students. A group brainstorming session has been initiated with the objective of generating suggestions regarding the potential causes of work fatigue in the engine room.

The manner in which a question is posed to a cadet will determine the skills they will employ. The key objective is to facilitate the cadets' cognitive processes by posing questions and guiding them in the development of critical thinking skills, rather than simply imparting information. So, while guiding cadets through inquiries the main thing is to help them in *how to think* instead of *what to think*. The ability to ask applicable questions is perhaps the most crucial skill of an effective teacher (Mathis, 2015; Sulaiman, 2019).

The best way is to pose open-ended questions. According to researchers, open-ended questions encourage respondents to provide more detailed responses ((Elder & Paul, 2009; Holmes et al., 2015). These higher-level thinking questions typically begin with the words *What*, *Why*, and *How* as well as *Tell me, Explain, Compare* and *Describe*. They are designed to elicit the respondents' knowledge, opinion or feelings. The selected wording will determine the level of cognitive engagement required of cadets. As an example, the following questions may be posed in relation to the topic under discussion: *What does the well-being of seafarers on board a ship depend on? In your experience, what are the main reasons for fatigue among engine room crew members? When do you feel most comfortable and happy at work? How did you like your workplace on ship? How did your crew members treat you? How does experience affect how quickly work is done? How did most experienced seafarers feel on the ship? What bored and tired you most on the ship? What do you think was the most exhausting thing on the ship? And what made tired your crew members?*

Once completed, the diagram appeared as follows: the head of the fish represented a stated issue, namely *Work Fatigue*, with four fish bones indicating the most probable causes of the problem, as proposed by the students: work load, work environment, professional competence, and personal factors. This may be sufficient for the Engage stage (Fig. 1).

However, the *Work Fatigue* FBD can be used again during the Activation stage to further investigate the causes of fatigue after reading or watching the relevant material. First, the group discussion can be initiated with the objective of identifying the four the most generic factors of fatigue in the engine room. Then, in four subgroups, the causes should be clarified by identifying the subcauses (Fig. 2).

The findings of the discussions on work fatigue are depicted graphically by labelling the ribs added to

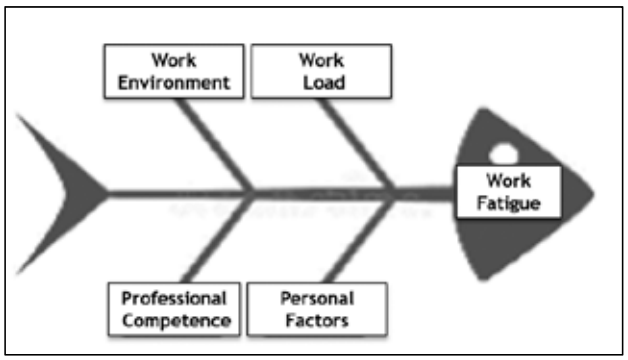

Fig. 1. Work Fatigue fishbone diagram (simplified)

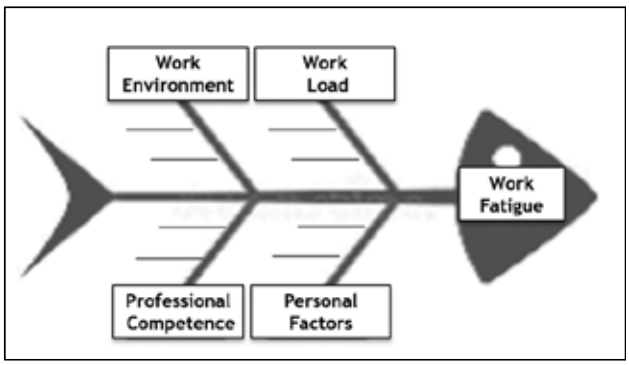

Fig. 2. Work Fatigue fishbone diagram (regular)

the fish bones. If students find the problem difficult to discuss or require a starting point, it is recommended that the teacher uses key phrases deemed appropriate. These can be: *work related / non work related factors, overwork, sleep disorders, heavy workload, lack of experience, insufficient rest, work intensity, bad fatigue maintenance, lack of knowledge, etc.*

Another strategy to this task is to perform the activity in reverse order. If the ready-made diagram is available on the internet, it also can be utilized. Students are asked to analyze the completed diagram and decide what problem can arise under given factors. The most appropriate answer, as acknowledged by all parties, is recorded on the head of the FBD.

The 4S fishbone diagram is more complex than the previous one, as it sets limits on the categories that should be considered. In the original variant, 4S are proposed for *Surroundings, Suppliers, Skills*, and *Systems*. However, it is always possible to make modifications according to the specific learning needs. The third-year students have participated in filling out the 4S FBD about *Main Engine Troubleshooting* (Fig. 3). The preset categories have been tailored and modified to align with the following four key areas: *Signs* (symptoms), *Spares* (spare parts), *Systems* (that provide smooth operation), and *Skills* (necessary to maintain the main engine to prevent crankcase explosion). The principle of work was consistent with the previous diagram. The difference was that students have been required to investigate the prescribed factors. To ensure a productive discussion, it is advisable to have a set of guiding questions from a teacher acting as a facilitator. This type of FBD is pretty detailed. Therefore, it is most suitable for the Activation stage of the ESA lesson format.

The 5M/1E fishbone diagram is much more complicated as its name suggests. It may be advisable for advanced students, particularly those undertaking the master's course. In any case, they must be adequately experienced and competent. It is a good practice to utilize the ready-made diagrams sourced from the internet, which have been created by marine engineers for the purpose of troubleshooting engine room machinery. Then, there is no need to construct the diagram independently, as it is a highly detailed and time-consuming process.

This can also present challenges for teachers who are not subject matter experts. To effectively manage a group discussion, it is essential to have a comprehensive understanding of the subject matter and the challenges that may arise. For those lacking the necessary qualification, the task is not easy. So, the optimal approach is to use the ready-made FBD created by marine engineers for the most common or typical troubles with engine room machinery.

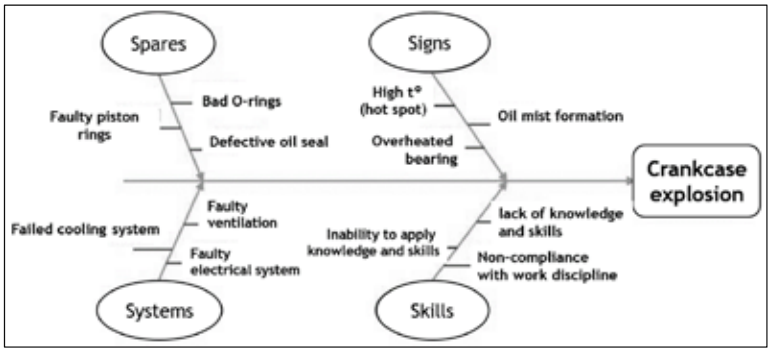

Fig. 3. The 4S fishbone diagram (complicated)

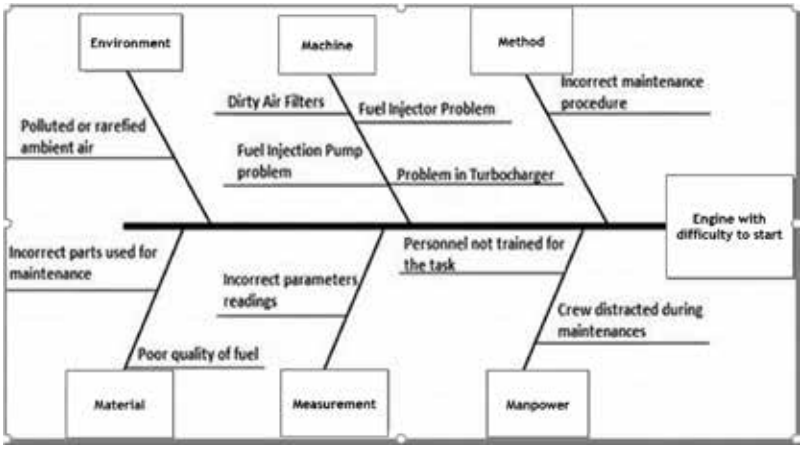

Fig. 4. The 5M/1E fishbone diagram (more complicated)

(https://www.intechopen.com/chapters/78118)

The 5M/1E fishbone diagrams are a highly informative tool. In order to optimize the use of time, it would be more efficient to form mini-groups for discussion on each category, or alternatively, to allow pair work during the Activation stage. The group presentation may be regarded as the logical conclusion of the preceding small discussions.

The 5M/1E fishbone diagram offers a more structured approach to analysis, with prescribed categories. The 5M categories are for Man, Machine, Method, Material, and Measurement, with the additional 1E category for Environment. Students are supposed to study the specified categories in their mini-groups and then provide their comments on how these factors can cause a trouble.

The Conclusions and Prospects for Further Research. Using critical thinking activities when teaching English can bring many benefits to marine engineers. Primarily, it can facilitate the development of their maritime English communicative competency, given that English is the working language on board, as well as enhance their professional skills required to perform their daily duties at work. In such a combination, these competencies will undoubtedly contribute to the quality of their work by developing solutions that meet or exceed industry standards and regulations. Furthermore, they will ensure their safety and reliability by reducing the likelihood of incidents or failures.

FBD learning strategy is not solely about the students' abilities to think critically and creatively. Moreover, it is about teachers who are resourceful and inventive. To avoid having false expectations of complete success, it is important to understand that the key to successful language learning is not the technical issue. The key factor is a person's mindset, which is reflected in his positive attitude and motivation.

As the world continues to evolve, maintaining student engagement and motivation can be challenging for educators, who must consider the diverse needs, interests, and concerns of young people. Further research should be conducted to identify effective strategies for overcoming these challenges in order to facilitate the learning process by engaging learners. This covers the initiative on student-led learning, which is focused on creativity and discovery. It also includes the inclusive learning space, which respects students' needs and interests and encourages independent work. Reflection is another key element, as it provides self-awareness and boosts confidence and mindset growth. All of these areas of further research do not put the primary objective of teaching English as such. They aim to facilitate the learning process by keeping students engaged and motivated.

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