USING CASE-STUDY IN MARITIME PROFESSIONAL TRAINING (BASED ON THE COURSE "RADIO NAVIGATION SYSTEMS")

ВИКОРИСТАННЯ КЕЙС-МЕТОДУ В ПРОФЕСІЙНІЙ МОРСЬКІЙ ПІДГОТОВЦІ (НА ПРИКЛАДІ ДИСЦИПЛІНИ «РАДІОНАВІГАЦІЙНІ ПРИЛАДИ І СИСТЕМИ»)

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The article is devoted to one of the important problems of higher education – the training of future navigators. One of the effective teaching methods is the use of the method of situational analysis – "case study". The author analyzes the concept of "case study" – it is a teaching method based on solving real situations of professional maritime activity, which activates knowledge, skills and abilities for joint analysis, discussion and development of a solution to a professional problem. It has been proven that the use of this method contributes to more effective training of future maritime specialists, in particular, this method contributes to the development of their independent thinking, the ability to listen and take into account alternative views, to express their opinion in a reasoned manner, both in their native and in a foreign language. Using the method of situational analysis, students have the opportunity not only to improve analytical, logical and critical thinking, but also to learn how to work in a team, find optimal solutions for assigned tasks, demonstrate communicative competence and develop personal qualities "soft skills". The article analyzes practical situations at sea in the context of studying the disciplines "Global maritime communication for search and rescue", "Radio navigation systems", "Radio equipment and communication" in specialization 271. 01 Navigation and management of sea vessels. The author analyzed the lessons learned from the given situations, alternative ways of solving them, prevention of such situations in the future. As teaching aids, the author used authentic material (accident reports, investigations of maritime disasters), the Internet (audio / video materials, news, websites of maritime organizations on safety issues). Prospects of further research consists in learning cases using information and communication technologies.

Key words: *case study, analysis of situations at sea, professional training of maritime specialists, navigation safety.*

Стаття присвячена одній з актуальних проблем вищої освіти – підготовці майбутніх судноводіїв. Одним із ефективних методів навчання є використання методу аналізу ситуацій – «case study». Автором проаналізовано поняття «case study» – це метод навчання, заснований на розв'язанні реальних ситуацій професійної морської діяльності, що активізує знання, уміння й навички для спільного аналізу, обговорення та вироблення рішення з професійної проблеми. Доведено, що використання цього методу сприяє більш ефективній підготовці майбутніх морських фахівців, зокрема цей метод сприяє розвитку їх самостійного мислення, здатності слухати та ураховувати альтернативні погляди, аргументовано висловлювати свою думку як на рідній, так і на іноземній мові. За допомогою методу аналізу ситуацій студенти мають можливість не лише покращити аналітичне, логічне та критичне мислення, але також вчитися працювати в команді, знаходити оптимальні рішення для поставлених завдань, демонструвати комунікативну компетентність та розвивати особистісні якості «soft skills». У статті проведено аналіз практичних ситуацій на морі у контексті вивчення дисциплін «Глобальний морський зв'язок для пошуку та рятування», «Радіонавігаційні прилади і системи», «Радіообладнання і зв'язок» спеціалізації 271. 01 Навігація і управління морськими суднами. Авторами проаналізовано вивчені уроки з наведених ситуацій, альтернативні шляхи їх вирішення, попередження таких ситуацій у майбутньому. В якості засобів навчання автором використано автентичний матеріал (репортажі з місця аварій, розслідування морських катастроф), мережу Інтернет (аудіо / відеоматеріали, новини, сайти морських організацій з питань безпеки судноплавства, що відповідає сучасним вимогам до освітнього процесу у морських закладах вищої освіти. Перспективи подальших досліджень полягають у навчанні кейсів з використанням інформаційно-комунікативних технологій.

Ключові слова: *метод кейсів, аналіз ситуацій на морі, професійна підготовка морських фахівців, безпека судноводіння.*

Problem statement. The main competence which must be encompassed in the maritime professional training is the ability to solve complex specialized tasks and practical problems in the field of shipping, handling and placement of cargo; management of ship operations and care of people on board, which involves the application of theories and methods of sciences about the structure of the ship, navigation, cargo transportation technology, commercial operation of means of transport, resource management. To achieve this integral competence different methods are used. One of the effective teaching methods is situational analysis – "case study". Using case studies in maritime professional training can be highly effective in providing practical and real-world insights to learners. Case studies offer a contextualized approach to learning, allowing participants to apply theoretical knowledge to actual scenarios they may encounter in their maritime careers.

Analysis of recent research and publications. The problems of maritime professional training were raised by many scholars in their scientific papers. O. Gurenkova, A. Svarychevska highlighted the formation of environmental competence of future maritime specialists; M. Musorina focused on formation of technical competence of future maritime specialists in the process of training technical disciplines. Some issues on sociocultural competence of future

navigators were considered in the papers of O. Frolova, L. Lipshyts, O. Tymofeeva, V. Zheliaskov. Also G. Popova provides a research on formation of professional navigational competence of shipmasters by simulation technologies of mixed reality. S. Glikman paid attention to the formation of professional qualities of future navigators; A. Yurzhenko focused on communicative competence of future mechanics based on a game approach; V. Smelikova in her scientific work considered case study as an effective instrument in professional training. S. Voloshinov made a scientific contribution to the professional training of future maritime specialists by using information technology in education.

The purpose of the article is to present some practical cases based on real life situations which can be implemented as additional method for teaching the courses "Radio navigation systems", "Global maritime communication for search and rescue", "Radio equipment and communication". To achieve this goal, some authentic materials were used, namely: accident reports, investigations of maritime disasters, the Internet audio / video materials, news, websites of maritime organizations on safety issues.

Presentation of the main material. In order to understand how case study can be practiced let us analyze different interpretations of this concept in scientific works. One of the definitions of "case" was proposed by Yu. Surmin in his scientific work "Situational analysis or anatomy of the case method". The author considers a case as a certain state of the process, which contains a certain contradiction, the resolution of which is fundamentally important for the activities of people, whose penetration into the situation leads to ambiguity in its further development and change of state from undesirable to desirable [3].

Another interpretation was offered by L. Lynn who defines a case as a story based on real events, and requires careful study and analysis by students with the aim of identifying parts of the problem and development of the strategies for overcoming and decision making [11]. In other words, a case study is a story from real life, presented with a certain educational purpose.

V. Smelikova considers the concept of "case technology" as a group of educational technologies, methods and learning techniques based on solving real communicative problems situations of professional activity (cases) that reflect practical problem and activate the complex of acquired knowledge for joint analysis, discussion and decision-making [2, p. 90].

V. Zheliaskov argues that the case method in communicative interaction of navigators helps to perform a number of important tasks, namely: creates the necessary professional language environment and motivates students to use a foreign language for real communication; contributes to the effective development of skills of all types of speech activity (reading, listening, speaking and writing); helps to form business communication skills, as well as analytical, creative and social skills. According to V. Zheliaskov observations, several points should be taken into account for the successful use of the "case study" method:

– the provided information must be important and essential;

– the teacher's instructions must be clear and understandable;

– the information should be sufficient so that students in the group can discuss the problem and propose methods of solving it;

– the teacher should give clear step-by-step instructions for collecting the necessary information, preparing a presentation or creating another final case product;

– the time provided for solving the problem must be clearly planned and regulated;

– case participants should know where they can find the necessary sources of information [1, p. 309].

In the author's view, case study can be implemented in learning of technical maritime courses. It has some didactical features which are listed below.

Firstly, it has relevance to maritime industry. In educational process we select cases that reflect current challenges within the maritime industry.

Secondly, case study provides multidisciplinary approach by involving students to consider various aspects of maritime operations, such as navigation, engineering, safety, and regulatory compliance. This helps in promoting a multidisciplinary understanding of the industry.

Thirdly, cases provide interactive learning by encouraging discussions, group activities, or role-playing exercises. This fosters collaboration, critical thinking, and problem-solving skills among students.

Next, cases are based on real-world incidents or situations, ensuring that the challenges presented align with the complexities of the maritime environment. This makes the learning experience more authentic and applicable.

One of the important case benefits is simulation integration. A lecturer may utilize maritime simulation technology to recreate scenarios from case studies. This provides a hands-on experience without the inherent risks associated with real-world situations. Simulations allow participants to practice decision-making and problem-solving in a controlled environment.

Another feature of cases concerns legal and ethical considerations. It includes case studies that involve legal and ethical dilemmas commonly faced in the maritime industry. This helps students understand the importance of adhering to regulations and ethical standards in their decision-making processes.

Finally, cases are aimed at feedback and reflection. After analyzing a case study, participants are

encouraged to provide feedback on the decisions made, discuss alternative approaches, and reflect on the lessons learned. This promotes a continuous learning cycle and encourages self-reflection.

Here's how case studies can be incorporated into maritime professional training. We have selected the cases which are based on NTSB reports and can be used for the courses "Radio navigation systems", "Global maritime communication for search and rescue", "Radio equipment and communication".

Case study 1. Loss of redundancy in diving bell launch and recovery (LARS) PLC system

Description. During a vessel transit to an offshore field, Dive Technicians on a routine walkaround noticed an alarm from the LARS for the dive bells. Investigation indicated loss of automatic (LARS) PLC redundancy caused by failure of one of the PLC fibre optic processor synchronization links. This resulted in the loss of normal operation and increased the risk of single point failure of the dive bell Launch and Recovery System (LARS), so the decision was taken to return to port. No-one was injured. The divers in the saturation chambers were not affected by the system fault.

In port, an independent control system specialist reviewed the diagnostic data and confirmed the dive technician's initial diagnosis that one of the redundancy synchronization link fibre optic communication modules had failed.

Unfortunately, it was not possible to immediately repair the loss of automatic redundancy fault as the dive control systems spares inventory did not include spare synchronization modules. The original equipment manufacturer who designed the dive bell LARS PLC system had made no recommendation to hold spare synchronization modules in stock. Spares were immediately ordered but were not readily available.

At a subsequent port call the spare synchronization modules were delivered and installed by the Dive Technicians and the automatic LARS PLC redundancy was restored. The repair was witnessed and signed off by the client's diving subject matter experts. The faulty synchronization module was returned to the manufacturer for further investigation. The company and the client discussed a way forward, and a "return to work" protocol was discussed, risk assessed and approved. Risk assessment involved testing the LARS operation of each of the redundant PLC processors independently and manual changeover of the processors to proof test a temporary manual redundancy option. These tests were carried out successfully on both forward and aft dive bells. The DSV then returned to the field and safely completed the job for the client with no further issues.

Causes. A diode failed: the failure of the LARS redundant PLC synchronization module is classed as a 'random hardware failure.'

– the risk of random hardware failures in programmable control system can be mitigated by proof testing. the dive company did carry out annual proof tests to trigger the automatic LARS PLC redundancy and the proof test records were up to date;

– the company had followed the dive control system spares list guidance provided by the original equipment manufacturer (OEM) and did not have the spare synchronization modules in stock;

– the redundant plc hardware configuration used on the lars was a standard, proven solution provided by one of the leaders in automation systems and used globally on many safety-critical applications;

– the available data led everyone involved to assume that it was highly unlikely that the synchronization module would fail in normal use;

– following their investigation of the faulty module, the manufacturer concluded that the synchronization module hardware had developed a faulty transmitting diode [4].

Case study 2. Radio interference from damaged equipment affects other vessels

Description. On a pipelay barge, radio frequency interference to the vessel's GNSS systems was reported by a surveyor. There was only one other vessel alongside. This vessel was contacted with a request to switch off any transmitting devices. On that vessel, bridge systems with transmittal capabilities were switched off, and the pipelay barge GNSS functionality was restored. Vessel crew started troubleshooting, but the reason could not be identified and technical support from shore was requested.

Causes. The shore service team used radio frequency (RF) detection and spectrum analysis equipment to detect and analyse RF signals transmitted by various sources, after which it was identified that the interference issue was caused by a factory-fitted SAILOR 150 Fleet Broadband which was not in use, but not disconnected.

The radio frequency interference came from a failed connector panel of SAILOR 150 Fleet Broadband System. This caused an outage of GNSS positioning systems for the surrounding vessels in close vicinity.

Recommendations. Failed equipment can transmit a radio signal which can interfere with the communication or navigational equipment nearby; check for any similar equipment onboard that is not in use, but not disconnected or powered down – removal may be worth consideration [5].

Case study 3. Subsea transponder wire parted

Description. A tripod positioning transponder wire parted from the tripod framework whilst the vessel was repositioning and needed to re-plumb the transponder. No assets were close by at time of incident. Whilst coming up on the winch it was noticed that there was no weight on the wire; on recovery to the

surface it was discovered that the 4mm diameter wire had parted approximately 1m from the tripod lifting eye. The lost tripod was subsequently recovered to deck by divers and the crane.

Cause. The equipment failure was caused by excessive wear and tear on equipment; the wire was corroded and was not replaced frequently enough

Action. Replaced the damaged wire and conducted a performance test prior to use; regular visual inspection prior to launch and during recovery now conducted; Replacement of the spool wire every 6 months added to the vessel PMS [6].

Case study 4. Failure of remote control/emergency stop on rescue boat winch

Description. There was a failure of the winch remote control and emergency stop during recovery of the rescue boat to the davit. The incident occurred on completion of rescue boat testing in good weather. The personnel in the small boat were disembarked at sea level and used a ladder to access the main deck. The AB started recovery of the boat using a remote control. When close to the final stowage position the remote control failed and the limit switch did not activate as designed. The main power supply switch was then operated to isolate the power supply to the winch.

Causes. Testing revealed that the control circuitry for davit recovery was fully operational. However, the recovery was not automatically stopped by the limit switch. On inspection and disassembly of the contactor, it was found stuck, with contacts in the closed position. The system had undergone annual inspection by an approved independent inspector three weeks previously with the following notes:

- remote control checked all ok;
- davit fall wire sheave inspected;
- all electronics checked and found ok.

The most probable cause of failure was frequent intermittent use of the winch for fine adjustment of boat level to make it easier for crew to get into and out of the fast rescue craft. The davit winch was being repeatedly switched on and off for very short time intervals, which can cause the contacts to burn out.

Lessons learned:

- ensure correct retrieval procedure is practiced by all winch operators – limit switches should not be relied on to stop the recovery of craft;
- confirm correct installation of components including limit/proximity switches for davit systems.
- where limit/proximity switches have noted systems faults, inspection should be completed before further use;
- ensure planned maintenance system covers regular function testing of emergency stop switches;

limit/proximity switches found to be at fault should be replaced. replacement switches are not high cost items [7, p. 6].

Case study 5. Disabled audible alarm on fire alarm panel

Description. During routine testing of the fire alarm, it was observed that the Fire Alarm panel was not emitting an audible alarm – there was only a flashing light present. The Chief Engineer together with the ETO inspected the fire alarm panel and found that a cable had been disconnected from the panel.

Causes. How the cable came to be disconnected could not be determined. There was no proper testing of the fire alarm system, nor any oversight or recording of maintenance. Members may wish to check fire alarm panels any similar alarm equipment or warning

Remote control which failed | E-stop which failed to stop the winch | Failed breaker

Fig. 1. Remote control, emergency stop and failed breaker

Fig. 2. Disabled audible fire alarm and disconnected cable

systems to verify that all alarms audible and visual are functioning [8, p. 2].

Case study 6. Electric shock due to water in electrical equipment

Description. There was an uncontrolled spraying of fresh water from a sounding pipe in the galley, resulting in electrical equipment getting wet. As a result, someone got an electric shock. The incident occurred during fresh water supply to a vessel, when the sounding pipe cap (located on the floor in the vessel galley) did not withstand the pressure, and so water sprayed out into the galley and onto the electrical stoves and deep fat fryer.

The flow of water was stopped and spilled water was mopped up, and the catering team continued to work. However, it appeared that water had penetrated the electrical circuitry of the deep fat fryer, and the steward received a mains electrical shock. This was reported, and the electrical equipment isolated. The steward was not harmed.

Causes. No-one had assessed the risks of a large volume of water spilling into the galley from the freshwater tank sounding pipes, nor considered the potential contact with electrical equipment; drainage of the spilled water was delayed because the catering staff usually kept drainage system scuppers closed in the galley because of the smell coming out of the drainage system.

Actions taken:

• the drainage system in the galley should be always kept open;

• review, revise and update risk assessments as related to potential water flooding from the freshwater tank sounding pipes;

• ensure the catering crew are kept informed of relevant inspection and maintenance requirements for their equipment [9, p. 4].

Case study 7. Antenna parts worked loose and fell to deck

Description. A member has reported a near miss incident in which part of a single side band (SSB) antenna fell off the mast to deck during bad weather. The antenna had three parts which were threaded and screwed together. The first part of the antenna was not fully screwed into the second part. In high winds, the antenna was waving back and forth in the wind which caused it to loosen and become detached. There were no injuries. Our member notes that this incident could have had a much more serious outcome had one of the base plates dropped from a height.

Actions taken:

• damaged antenna was removed from above bridge and replaced with new one;

• ensured correct practices were used for securing all navigation/communication equipment at height and/or on masts;

Fig. 3. Electrical stove and deep fat fryer

Fig. 4. SSB antenna above bridge and detached antenna shown on deck afterwards

• thorough check of all existing equipment above bridge or at height and/or on masts, most especially after installation or maintenance by a third party;

• crew 'time out for safety' carried out emphasizing hazards and risks of working at height and/or on masts, particularly the area above the vessel bridge (sometimes called the monkey island).

Lessons learnt:

• continual vigilance is called for where there is even the potential for loose objects to fall from height;

• visual inspections should be thorough and careful;

• equipment at height that is exposed to the elements (for example on masts and on the monkey island above the bridge) should be regularly checked to ensure there is nothing working loose or any loose objects which may fall in bad weather conditions [10, p. 2].

Conclusions and perspectives. To sum up, we have analyzed the cases which are based on NTSB reports and can be used for the courses "Radio navigation systems", "Global maritime communication for search and rescue", "Radio equipment and communication". Incorporating case studies into maritime professional training provides a dynamic and engaging learning experience that prepares students for the complexities and challenges of the maritime industry. Case studies offer a contextualized approach to learning, allowing participants to apply theoretical knowledge to actual scenarios they may encounter in their maritime careers. Prospects of further research consists in learning cases using information and communication technologies.

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