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# Enhancing the capacities of Maritime Higher Education Institutions on marine pollution and environmental protection. Curricula harmonization

M R Apetroaei <sup>1</sup>, E R Avram <sup>2\*</sup>, A Zukauskaitė<sup>3</sup>, T Albayrak<sup>4</sup>, M Perkovic<sup>5</sup>, C Popa<sup>6</sup>, R Mauriac <sup>7</sup>

<sup>1</sup>Ph D, "Mircea cel Batran" Naval Academy, Constanta, Romania

<sup>2</sup>Ph D, "Mircea cel Batran" Naval Academy, Constanta, Romania

<sup>3</sup>Ph D, Lithuanian Maritime University, Lithuania

<sup>4</sup>Ph D, Piri Reis University, Turkey

<sup>5</sup>Ph D, Ljubljana University, Slovenia

<sup>6</sup>Ph D, "Mircea cel Batran" Naval Academy, Constanta, Romania

<sup>7</sup>Ph D, Ecole Nationale Supérieure Maritime, France

\* corresponding author: [rita.avram@anmb.ro](mailto:rita.avram@anmb.ro)

**Abstract.** The navigating personnel with higher education is trained in the profile academies and universities following curricula that must adapt to the specific requirements of the profile ministries, the naval authorities but also the International Maritime Organization. This is one of the reasons why there are differences between the national maritime education systems and implicitly creates difficulties regarding the recognition of educational qualifications and periods of study completed abroad. Taking into account that the protection of the environment has now become a topical issue and International Maritime Organization initiatives provide ample opportunities, this paper will present the initiative of five Maritime Higher Institutions to harmonize the course on Applied Chemistry to Prevent Marine Pollution to comply with Standards of Training, Certification and Watchkeeping for Seafarers. To avoid pollution accidents, it is imperative to provide a quality education for MHEI students, able to provide them with the necessary skills. These aspects are similar in all countries, therefore a closer collaboration between maritime higher education institutions and stakeholders is required. To all this is added the new approaches to higher education in the context created by the pandemic, with an emphasis on the development of online educational tools. Applied chemistry is a new course concept that aims to raise awareness of the concepts and methods of applying the theories and principles of chemistry to protect the environment and the health of the crew on board the ship. The best practices and knowledge sharing, education, keeping up with new technological achievements, and development of information systems form a prerequisite for such cooperation.

**Keywords:** maritime higher education institutions, applied chemistry, maritime environment protection, International Convention on Standards of Training, Certification and Watchkeeping for Seafarers standards

## **1. Introduction**

The article will present the outcomes obtained as a result of the implementation of the BLUE4SEAS project: "Strategic partnership for supporting Blue Growth by enhancing Maritime Higher Education maritime cooperation framework on marine pollution and environment protection field" that has the aims to build a stronger connected and enhanced informed community of maritime education and training institutions, where the harmonization of the curriculum and the exchange of good teaching practices to serve for build a more efficient and effective teaching and learning environment, ready to value the collective knowledge summarized about the simulation potential in teaching and research using of the common training facilities. All participating Maritime Higher Education Institutions (MHEIs) are fully engaged in enlarging their training and research capabilities and are completely compatible with simulation resources. This alignment of training on simulation and research facilities provides better integration of the European maritime education entities with the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) requirements, adding great value to the competitive status of the project members. For students, greater access to international learning resources cumulated to the possibility of traveling within the virtual academic space could improve significantly their future professional profile as graduates, well adapted to the international, multicultural, and globally changing environment. The specialists with specific competence in the fields of pollution monitoring and management (intervention systems, real-time analysis, and transmission systems of pollution situations) are participating in the implementation of the simulation modules related to the intervention and response to marine pollution.[1], [2]

As a result of the analysis carried out by the five maritime higher institutions involved in the project on raising student competencies at the European level and competitiveness in the labor market, it was concluded that although they have included in the curriculum the course modules that cover the International Maritime Organization (IMO) and STCW requirements, the most pressing issue is to find a solution for harmonizing these courses to facilitate the mobility of students and teachers, the recognition of the qualifications, and the exchanging of good practices. [1], [2] Thus, concerning the requirements on the labor market and the economic environment, one of the most important identified directions that ensure the training of the necessary competencies for the graduates of marine universities is related to Applied chemistry to prevent marine pollution. Moreover, the new course concept implemented in this project covers the study of topics such as safety and security onboard ships and offers perspectives for the applications of chemistry in current environmental issues, according to international regulations. In this regard, the necessary competencies, skills, and knowledge to be acquired for undergraduate students of the universities participating in the project, correlated with the needs on the labor market and the requirements of employers, business, decision-makers, and other stakeholders have been established. Based on this, the new and multidisciplinary curriculum is elaborated. The course has 5 ECTS credits, is developed in the English language, having the possibility of introducing them in the current professional activity of all partners, loading them in virtual learning platform also developed within the project to be taken over by other MHEI. [1], [2]

## **2. Methodology**

As a result of the selection process, each partner appointed representatives from among the experienced professors that determined what relevant skills on marine environmental protection are required for the graduates to design the common new curricula following the IMO key conventions. The team of experts thus constituted established a common list of the necessary competencies, skills, and knowledge to be acquired. These were correlated with the needs of the labor market, of the requirements of employers, of the business environment, and of the decision-makers, and based on all of these, the multidisciplinary new common curriculum on Applied Chemistry to Prevent Marine Pollution was designed.



**Figure 1 Requirements covered by the course**

Designed curriculum was also benchmarked with various courses given in the well-known academies and institutions for final touch. The course is mainly addressed to the students from the Maritime Universities studying maritime management, port and shipping operations; however, it will be available for anyone from the maritime industry and/or other individuals as part of continuous learning in different modules. Specific team training courses will be also provided for interested maritime companies and local bodies that are willing to train their respective staff in this regards. The course will help the MHEI students to become familiar with terms and notions on international regulations for the safe carriage of substances in packaged forms: IMO [3], International Convention for the Safety of Life at Sea (SOLAS) - chapter 7, part A [4], and the International Convention for the Prevention of Pollution from Ships (MARPOL) -Annex III, and Annex V [5]. After completing the course, the students will acquire skills on understanding the important physical characteristics and chemical properties of dangerous and hazardous substances, the carcinogenic, mutagenic, and reproductive toxicant substances classification with the greatest health and environmental concern, classification of dangerous and hazardous substances and materials possessing chemical hazards including the International Maritime Dangerous Goods Code (IMDG) dangerous goods classes 1-9 and the hazards associated with each class. Furthermore, the notions related to the prevention of pollution by garbage from the ship, collected onboard during normal operation are especially important in the content of the course [6-11].

### 3. Results

After establishing the necessary competencies, skills, and knowledge to be acquired by the MHEI students, the objectives and course structure were established.

Based of the research, the team of experts designed the syllabus and contents of the course taking into consideration that it is necessary to introduce basic knowledge of chemistry so that students understand the terms used in the IMO's Codes of dangerous goods (marine pollutant identified) and to show them how to use IMDG Code [6,7]. They must also be aware of the hazards associated with the dangerous goods they are working with and, as well as, have the necessary competencies to prevent pollution of the marine environment [12]. The MHEI students have to understand the meaning of the terms of dangerous goods and to have good knowledge of the nine groups or classes the substances are divided into, and they have to be familiar with notions about international standards for the safe carriage of substances in packaged forms: IMO, SOLAS (chapter 7, part A) and MARPOL (Annex III and Annex V) [1-5].

Students passing the course successfully will acquire knowledge and skills as listed below and should be able to:

- Understand the importance of dangerous goods regulations in maritime transport to prevent injury to human health, ship, and marine environment.
- Acquire knowledge of the basic principles of hazard classification of Dangerous Goods.
- Know the 9 Classes of Dangerous Goods under the UN Model.
- Distinguish of differences between hazardous chemicals and dangerous goods, in terms of toxicity, which of the chemicals are covered by the 9 Classes of Dangerous Goods list and do not fall under the Globally Harmonized System classification.
- Identify, apply, and use the labelling and marking required by the IMDG Code.

- Apply the knowledge about the environmental capacity of Hazardous Chemicals, organic pollutants with their degradation, and marine environmental management.
- Comprehend and know the basics of pollution prevention methods of garbage generated during normal operations onboard the ship

The course is designed to take place over 28 hours and will cover the following topics: seagoing regulations, introduction of the concept of dangerous goods, and IMO's codes dealing with dangerous goods: IMDG Code, International Maritime Solid Bulk Cargoes (IMBSC), International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code), International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), MARPOL 73/78 - Annex III and Annex V – MARPOL, UN Recommendations on the Transport of Dangerous Goods Model Regulations, differences Between Hazardous Chemicals and Dangerous Goods, introduction to the IMDG Code, physical-chemistry terms and properties used by the IMDG Code, UN system classification used by IMO, IMDG classes (1-9) classification, packing and tank requirements, consignment procedures, transport operations, health, and environment.

#### 4. Conclusions

The positive effects have been achieved by strengthening the capacities of marine education institutions in Romania, France, Slovenia, Lithuania, and Turkey to modernize and internationalize them, supporting the transfer and the recognition of the qualifications and the competencies at the European level, and to enhance the competitiveness of MHEI graduates on the labor market.

The course module designed will be introduced on the platform and will be available to all Maritime Higher Education Institutions and can be replicated at the European and international levels. The course is addressed to all students from maritime universities and responds to the requirements on the labor market and the economic environment.

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