

Best Practices in Competency-based Education in Maritime and Inland Navigation

L. Martes

Romanian Seafarers Center, Constanța, Romania

ABSTRACT: The purpose of the present paper is to present the most important aspects for competency-based education and training for both maritime and the Inland Waterways sector, to ensure that every student/trainee in the EU possesses the same competencies on operational level (OL) and management level (ML) after graduating from their study or training. To reach these goals, trainers need to be able to educate and train students in the competency based system, which serves two purposes: defining minimum key competencies needed for crew members on board maritime and IWT vessels throughout the EU or worldwide, and thereby improving safety of navigation at sea and on the European interconnected waterways, and an increased level of labour mobility for crew members educated with the competencies as laid down in STCW 2010 and the new European directive.

1 INTRODUCTION

Investment in education and training for competences development is essential to boost growth and competitiveness. In the long-term competences can trigger innovation and growth, move production up to the value chain, stimulate the concentration of higher-level competences in the EU and shape the future labour market.

By 2020, 20% more jobs will require higher level of competences. The education and training system need to drive up standards and levels of achievement to match this demand, as well as encourage the transversal skills needed to ensure young people are able to be entrepreneurial and adapt to the increasingly inevitable change in the labour market during their career.

As a general approach, emphasis has to be placed on delivering the right competences (knowledge and abilities) for employment, increasing the efficiency

and inclusiveness of education and training institutions and on working collaboratively with all relevant stakeholders.

Compared to maritime sector, the future development of inland waterway sector is hampered by difficulties in terms of labour mobility, persistent vacancies and skills mismatches. The potential benefits of inland navigation can only be brought about if a skilled workforce is available to ensure that the sector can take on its role in the logistics chain in a safe way.

Taking into account the new developments in both maritime and inland waterway sector, the present paper is aimed to present examples of best practices collected from six education & training institutes: Stichting STC-Group, the Netherlands, University of Craiova, Romania; Schiffer-Berufskolleg RHEIN-Duisburg, Germany; University of Zilina, Slovakia; Maritime Academy Harlingen, the Netherlands and CERONAV, Romania, that can be implemented both

in the maritime and Inland Waterway Transport education and training to ensure that every student/trainee in the EU possesses the same competencies on operational level (OL) and management level (ML) after graduating from their study or training.

To reach these goals, trainers need to be able to educate and train students in the competency-based system, as this type of training serves two purposes: defining minimum key competencies needed for crew members on board vessels throughout the EU and the world, and thereby improving safety of navigation and an increased level of labour mobility for crew members educated with the competencies as laid down in the STCW 2010 and the new European directive.

2 REGULATORY FRAMEWORKS FOR PROFESSIONAL QUALIFICATIONS OF MARITIME AND INLAND NAVIGATION PERSONNEL

2.1 STCW 2010 Amendments

On June 25th 2010, the International Maritime Organization (IMO) and other major stakeholders in the global shipping and manning industry formally ratified the so-called "Manila Amendments" to the current Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) and its associated Code. The amendments aimed to bring the STCW up to date with developments since its conception and initial adoption in 1978, and the subsequent amendments in 1995. The STCW Amendments entered into force on January 1, 2012.

Among STCW objectives, we are presenting the following key improvements to competency-based education realized through the new Amendments:

- Introduction of modern training methodology i.e. distance learning and web-based learning;
- new competencies required to be built and curriculum to be updated in line with modern developments and real-life needs

2.2 Directive 2017/2397 of the European Parliament and of the Council on the recognition of professional qualifications in inland navigation

On 27 December 2017, the **Directive 2017/2397** of the European Parliament and of the Council on the recognition of professional qualifications in inland navigation was published in the Official Journal of European Union.

This EU Directive 2017/2397 shall enter into force on the 20th day following that of its publication in the Official Journal of the European Union (Article 40).

Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 17 January 2022. They shall immediately inform the Commission thereof.

By providing the common standards across the Union necessary to achieve the internal market for

workers in IWT, the new Directive streamlines the legal framework related to professional qualifications in the European IWT sector, which is currently fragmented.

For ensuring safety of navigation, **Member States should identify inland waterways with a maritime character** in accordance with harmonised criteria.

With a view to contributing to the mobility of persons involved in the operation of crafts across the Union, and considering that all certificates of qualification, service record books and logbooks issued in accordance with this Directive should comply with required minimum standards in accordance with harmonised criteria, **Member States should recognise the professional qualifications certified in accordance with this Directive.** Consequently, the holders of such qualifications should be able to exercise their profession on all Union inland waterways.

Member States shall issue certificates of qualification only to persons who have the minimum levels of competence, the minimum age, the medical fitness and the navigation time required for obtaining a specific qualification.

To safeguard the mutual recognition of qualifications, certificates of qualification should be based on the competences necessary for the operation of the craft. **Member States shall ensure that persons receiving certificates of qualifications have the corresponding minimum level of competence, verified following an appropriate assessment.** Such assessment could take the form of an administrative examination or could form part of approved training programmes carried out in accordance with common standards, in order to ensure a comparable minimum level of competence in all Member States for various qualifications.

2.3 CESNI standards for competence for inland navigation personnel

The harmonisation of legislation in the field of professional qualifications in inland navigation in Europe is facilitated by close cooperation between the Union and the CCNR, and by the development of **CESNI standards.**

The CESNI, which is open to experts from all Member States, draws up standards in the field of inland navigation, including standards for professional qualifications. European River Commissions, relevant international organizations, social partners and professional associations are fully involved in the design and drawing up of CESNI standards. Where the conditions laid down in this Directive are met, the Commission should refer to CESNI standards when adopting implementing acts in accordance with the EU Directive 2017/2397.

CESNI was created at CCNR's plenary session in June 2015 with the main mission to adopt IWT technical standards in various fields, in particular as regards vessels, professional qualification, information technology and crew members certification.

The following categories of Standards will be part of the EU Directive 2017/2397, as delegated acts, 18 months from the adoption (July 2019):

- Standards for competences;
- Standards for simulators;
- Standards for practical examination;
- Standards for medical fitness.

CESNI Standards for competence for inland navigation personnel were elaborated for the personnel at Management level and Operational level also.

During the CESNI meeting in Prague, November 2018, Member States adopted 14 standards in the field of professional qualifications which have to be implemented until January 2022.

The standards represent the content of the new approach requesting an approved training programme or an examination for all new entrants to the sector before becoming a boatman. As from 2022, it will no longer be possible to qualify as a helmsman solely by experience.

The mandatory competences for obtaining Union certificate of qualification for both Boatman and Boatmaster, according to the CESNI Standards for competence, are grouped in 7 learning modules as presented below:

- 1 Navigation
- 2 Cargo handling, stowage and passenger transport
- 3 Controlling the operation of the ship and care for persons on board
- 4 Marine engineering and electrical, electronic and control engineering
- 5 Maintenance and repair
- 6 Communication
- 7 Safety, health and environmental protection

3 BEST PRACTICES IN MARITIME AND INLAND WATER EDUCATION AND TRAINING

3.1 Competence Based Learning Environment

In order to be able to give a sound definition of **best practices** for both maritime and IWT education and learning, we defined the following terms: *competence*, *competency-based education*, *competency-based learning* in order to understand the difference between them. In this respect we presented several definitions as found in prestigious dictionaries, EU Directives and specialized literature, as follows:

‘**Competence**’ means the proven ability to use knowledge and skills required by the established standards for the proper performance of tasks necessary for the operation of inland waterway vessels (1).

Competency based education, which focuses on the mastery of learning outcomes rather than on academic achievement through fixed time structures, is an approach that has the potential to offer trainees an efficient, less costly path to degree, employability, and enhanced professional skills.

Competency based learning refers to systems of instruction, assessment, grading, and academic reporting that are based on trainees demonstrating that they have learned the knowledge and skills they are expected to learn as they progress through their education.

Having in view the definitions above-mentioned we all agreed that **Best practices** represent “*Various methods and processes used to establish the extent to which a learner has achieved particular knowledge, skills, attitude (competence) confirming that certain assessed learning outcomes are achieved by the learner correspond to specific outcomes which are required for a module or qualification*”.

3.2 Best practices in maritime and IWT education and training

The purpose of competency-based education and training is to ensure that every student/trainee possesses the same competencies on operational level (OL) and management level (ML) after graduating from their study or training. To reach these goals, trainers need to be able to educate and train students in the competency-based system, and thereby improve safety of navigation, and an increased level of labour mobility for crew members educated with the competencies as laid down in STCW 2010 and the new European directive.

Before giving an overview of the best practices, we should take into account the different educational systems in Germany, Netherlands, Slovakia and Romania and ways of doing traineeships.

In Germany there is a dual system of apprenticeship. A large part of the training takes place on the vessels where trainees are working most of the time in Germany. Best practices are therefore in the responsibility of the apprenticing company.

In the Netherlands the Dutch Qualification Framework is used in the secondary vocational education system. An important document in this system is the Qualification file (Kwalificatiedossier) describing the qualifications and occupational standards covering one qualification profile. It describes desirable learning outputs of VET programmes related to the job, citizenship and further learning. This document is developed in close cooperation with the industry and it is competence based. Training is done on Inland Shipping Simulator and during the internship on board.

Nowadays, in Slovakia there is not any secondary schools that prepare crew members. They used to have two schools in the 1990s, but they were closed because of lack of students (low interest of young people to study especially in the IWT). Their knowledge on best practices is from their bachelor’s and master’s degree.

In Romania the students get their training on board of the school ship, an internship and during visits to different shipyards. They also work in the laboratories of the school to get practical training. They also have simulators to practice their skills.

Below we are presenting examples of best practices and their detailed description for Learning

and Assessment that can be used not only in maritime or IWT but in any other industry.

3.2.1 *Best Practices for the Learning Process*

3.2.1.1 Navigation

- *Classroom lessons supported by PowerPoint presentations, photos, videos, e-learning* (winches, bollards, ropes and wires considering relevant work safety measures including the use of personal protective and rescue equipment; characteristics of main sea-ports and European inland waterways, ports and terminals, planning a journey and conducting navigation in a difficult situation etc.);
- *Practical training (exercises) on board cargo vessels* (berthing and departure maneuverings, VHF and intercom communication, convoy set up and disentanglement maneuvering and anchor maneuvering, take appropriate actions after a collision and assess the damage and control the situation, etc.);
- *traineeship on board cargo vessels* (navigate safely on a given short route, under certain conditions complying with all regulations in force, etc.).
- *Training on simulators* (Radar, ECDIS, loading and discharging of liquid dangerous goods, engine-room simulator, etc.)

3.2.1.2 Cargo handling, stowage and passenger transport

- Classroom lessons supported by PowerPoint presentations, photos, videos, e-learning (cargo vessels, (un)loading, safety, preparations, cleaning the tanks etc.);
- Classroom lessons supported by PowerPoint and assignments (to make a stowage-plan and calculate the stability of different types of vessels
- Practical training on board of the training vessel (reading gauge marks, opening hatches, practicing cleaning tanks, safety, loading procedure, etc)
- Training in the Oil Terminal on training vessel for 2,5 hours
- Working with lashing straps in practice setup.

3.2.1.3 Controlling the operation of the craft

- Classroom lessons supported by PowerPoint presentations, photos, videos, e-learning (deck equipment, anchor and winches, etc);
- Practical exercises in the classroom or on board a ship (drawing a vessel and showing its different parts and describing the function of each part);
- Practice the use of deck equipment, anchor and winches, etc onboard a training vessel

3.2.1.4 Marine engineering and electrical, electronic and control engineering

- Classroom lessons supported by PowerPoint presentations, photos, videos, e-learning;

- Practical activities in the workshop/on board training vessel (starting the boiling systems up to 70°C, starting the recirculating pump in order to preheat the main engine, opening the cooling system of the main engine and shutting down the boiling system when the temperature reaches the specified value, monitoring the generator's parameters (voltage, frequency and phase), parallel connection of the generators, practicing on telegraph remote controllers of the main engines, monitor the starting / shutting down procedure of the main engine, safe maintenance activity etc.);
- Training on engine-room simulators

3.2.1.5 Maintenance and Repair

- *Classroom lessons supported by PowerPoint presentations, photos, videos, text-books, e-learning* (diagnosis and repair of stationary and moving parts of an engine, electrical machines and devices, propellers and turbines);
- *Practical training on board vessels* (different types of damage of machines, mechanisms and ship structures, and the diagnostic and repair procedures and technologies that are used for the maintenance and repair, etc.)

3.2.1.6 Communication

- Classroom lessons supported by PowerPoint presentations, photos, videos, text-books, e-learning (regulations, introducing communication phrases,
- Practicing radio communication with real VHF-devices in a training room/in a simulator
 - use of CBTs (IMLP- programme, River-Speak, MarEng-Plus,etc)

3.2.1.7 Safety, health and environmental protection

- *Classroom lessons supported by PowerPoint presentations, photos, videos, text-books, e-learning, equipment* (safe working practices, examples of emergency situations, fire-fighting equipment, pollution prevention equipment and procedures, safety and security measures on board, damage control plans)
- *Simulation, drills* at the training facility or on-board vessels (MOB, fire-fighting/ oil spill drills, etc)

3.2.2 *Best Practices for the Assessment Process*

3.2.2.1 Navigation

- *Checklist covering competences during practical examination on board training vessel/cargo vessels* (planning a journey and conducting navigation on the given route applying the relevant national and international regulations and using the necessary navigation aids and traffic supervision tools)
- *Computer-based exam*
- *Simulation* in the navigation simulator (given scenario)

3.2.2.2 Cargo handling, stowage and passenger transport

- Checklist covering competences during practical examination on board training vessel/cargo vessels
- Operational Assignment about Personal Safety (contact with dangerous goods, 'reading the gauge on board' to show the student has the right knowledge to execute the task, etc.)
- Digital exam covering theory
- Practical exam on board training vessel. (Skipper on board the vessel checks the competence. The student has to proof he can apply the knowledge and ability to execute the task with the right attitude. The Skipper on board the learning vessel checks the competences of the student according to a checklist.)

3.2.2.3 Controlling the operation of the craft

- Checklist covering competences during practical examination on board training vessel/cargo vessels (correct handling of deck equipment, anchor and winches, etc)
- Computer-based exam
- Practical exam at the training facility or on board a ship (showing different parts of a vessel and describing the function of each part, correct handling of deck equipment, anchor and winches);

3.2.2.4 Marine engineering and electrical, electronic and control engineering

- *Practical examination in the workshop/on board training vessel* (starting the boiling systems up to 70°C, starting the recirculating pump in order to preheat the main engine, opening the cooling system of the main engine and shutting down the boiling system when the temperature reaches the specified value, monitoring the generator's parameters (voltage, frequency and phase), parallel connection of the generators, practicing on telegraph remote controllers of the main engines, monitor the starting / shutting down procedure of the main engine, safe maintenance activity etc.);
- Theoretical examination (multiple choice tests)
- *Simulation of a given situation*

3.2.2.5 Maintenance and Repair

- Theoretical examination (multiple choice tests)
- Operational assignment (maintenance and repair of vessels in case of damage of the vessel or its devices, types of diagnostics and repair of stationary and moving parts of an engine, electrical machines and devices of the vessels, and propellers and turbines of the vessel);
- Practical assessment on board vessels (different types of damage of machines, mechanisms and ship structures, and the diagnostic and repair procedures and technologies that are used for the maintenance and repair, etc.)

3.2.2.6 Communication

- Written tests, e-learning based tests
- Practical examination on real VHF-devices in a training room/in a simulator (specific scenario)
- Practical examination showing that the trainee can apply the knowledge in different situations, is able to operate the VHF-device and to communicate according to the rules and use the correct phrases, is able to operate the AIS/RIS, to get information of other vessels and to enter data, e.g. travelling data.

3.2.2.7 Safety, health and environmental protection

- *Assessment of skills onboard training vessel* (safe working rules and safety, emergency situations, fire-fighting scenario, pollution prevention procedures, safety and security measures on board, damage control)
- *Simulation, drills* at the training facility or on-board vessels (MOB, fire-fighting/ oil spill drills, etc)

4 CONCLUSIONS

Given that the education and training system for maritime navigation has already been changed and for inland navigation personnel has to be changed until 2022, as a result of transposition of EU Directive 2017/2397 into the national legislation of Member States, the entire education and training system addressing inland navigation personnel will be reformed according to the new European legal requirements and the professional education and training of inland navigation personnel will be done only on the basis of CESNI Standards of competences as it happens in the maritime sector where the education and training system complies with STCW 2010.

Standards of competences must be used during the elaboration/revision of the education and training programmes for inland navigation personnel to meet the requirements of the EU Directive 2017/2397 regarding the level of knowledge and abilities for deck crew members.

Furthermore, the activity developed by maritime and inland navigation training institutions revealed that it is important to follow the following:

- **Use of modern training ships and simulators equipped with latest technologies** to allow candidates to get the necessary skills which would facilitate subsequent mobility in all maritime and inland waterways. The training vessel should be equipped with all facilities, equipment and accessories, repair and maintenance tools, internal communication systems, lifesaving and labour protection equipment, allowing trainees to acquire applicable competences in appropriate real-life conditions under highest safety conditions.
- Exchange of know-how and adoption of best practices from other maritime and IWT education and training institutions is an essential part for the

- development of an innovative education and training system in this sector.
- Curricula/ Courses be based on international harmonized standards
 - **Training programmes be elaborated** and should strongly **differ for different target groups** like apprentices (having already practical training), students (with little experience on board), career changers or nautical personnel (further education).
 - Gaining international experiences is very important. The advantage of a commonly used training vessel is that it could be run with international groups of trainers and trainees. This way the trainees learn to work in international teams and get to know foreign stretches of navigation.

Assessment of competence both in maritime and IWT obtained from one or more of the following:

- approved in-service experience;
- approved training ship experience;
- approved navigation/engine/inland waterway simulator training, where appropriate, having a uniform standard for the technical features and functionalities determined by international standards for approving such tools;

- approved laboratory equipment training;
- knowledge tests about technical details, operating principles, limitations, specific risks, sources of error, etc.;
- a limited number of journeys to be carried out on the stretch concerned, a simulator examination, a multiple-choice examination or a combination thereof;
- practical examinations executed on board a vessel /on a simulator, where appropriate.

REFERENCES

- DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the recognition of professional qualifications in inland navigation and repealing Council Directive 96/50/EC and Council Directive 91/672/EEC, Brussels, 18.2.2016 COM(2016) 82 final
D3-13_Consolidated_STCIN_tables_of_competencies_26-04-2012_(final_draft).doc
The Manila Amendments to the Seafarers' Training, Certification and Watchkeeping (STCW) Code, <http://www.imo.org/en/OurWork/HumanElement/TrainingCertification/Documents/34.pdf>