

THE SIGNIFICANCE OF WEB-BASED REVALIDATION SUPPORT FOR THE SEABORNE TRADE AND AUTONOMOUS TECHNOLOGY

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ABSTRACT

The seafarers are the main domain of the main supply chain cycle of the sea borne tradesinceit achieved nearly 80% of global trade by volume, which in 2017 reached about 10.7 billion tons of cargo (UNCTAD, 2018). There is a rapidly growing demand for revalidations of certificates of Competencies and Proficiencies; however, seafarers cannot simultaneously work onboard and attend onshore training courses. Therefore, the International Maritime Organization (IMO) set up digital training in the International Convention on Standard of Training, Certification and Watch keeping for Seafarers (STCW) Code Part A, 2010 to speed up the waiting time for training courses and to satisfy these training demands and provide the recommended guidance provisions regarding the use of distance learning and E-learning, in addition to support marine companies to delegate its seaborne trading in accurate schedule (Chang 2019). Owing to these conditions the academic institutes and flag states authorities support the revalidations of the certificates by E-learning methods to serve this cycle to achieve its goals. This kind of web-based revalidation also is compatible with the new autonomous technology since sooner or later all marine cycles processes will be automated. The E-learning for competencies revalidations is a more intelligent way to facilitate the seafarers' issues, and which copes with the technological advancement in the future, since the operators and authorities encourage the implementation of the automated system in education and in ships.

This paper analyzes the numbers of seafarers holding certificates of competency and proficiency in Egypt as a pilot study, and the data collected in qualitative analysis based on descriptive analysis methodology.

KEYWORDS: *E-Learning, Autonomous Ships, STCW, Competencies*

Article History

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INTRODUCTION

As considerable attention has been drawn to environmental protection, international regulations and safety issues have been growing in relative importance. Seafarers constantly have to attend training programs to meet international standards of safe navigation and environmental protection. Accordingly, the International Maritime Organization (IMO) set up (STCW) to satisfy these training demands. The STCW was first established in 1978, and the current version for digital learning was revised in 2010.

As the IMO adds complimentary competence regulations over time, the need for seafarers to recurrently renew their certificates so as to comply with the convention makes onshore training a time-consuming task for seafarers.

The International Convention on Standards of Training, Certification and Watch keeping for seafarers (STCW Convention) try to give the international minimum standards for maritime education and training and the minimum requirements for the competences of seafarers. In 1995, the STCW Convention was totally amended to emphasis on the minimum competence of seafarers. In 2010, this minimum competence of seafarers was clearly enhanced by newly Manila Amendments of STCW Convention. The use of distance learning and E-learning in Maritime Education and Training (MET) is encouraged by the new amendments once again (Ruan, 2013). Distance learning and e-learning for training of seafarers are suggested under approval in Section B-1/6 of STCW Code.

MANDATORY STANDARDS REGARDING PROVISIONS OF THE ANNEX TO THE STCW CONVENTION

The STCW Code contains mandatory provisions, to which specific reference is made in the annex to STCW 78, as amended, hereinafter referred to as the STCW Convention. These provisions give in detail the minimum standards required to be maintained by Parties, in order to give full and complete effect to the Convention at the following levels of responsibility:

- Management level
- Operational level
- Support level

Functions and levels of responsibility are identified by subtitle in the tables of standards of competence given in STCW chapters II, III and IV of this annex. The scope of the function at the level of responsibility stated in a subtitle is defined by the abilities.

Definitions and Clarifications

Management Level Means

The level of responsibility associated with serving as master, chief mate, chief engineer officer or second engineer officer on board a seagoing ship, and ensuring that all functions within the designated area of responsibility are properly performed.

Operational Level Means

The level of responsibility associated with serving as officer in charge of a navigational or engineering watch or as designated duty engineer for periodically unmanned machinery spaces or as radio operator on board a seagoing ship, and maintaining direct control over the performance of all functions within the designated area of responsibility in accordance with proper procedures and under the direction of an individual serving in the management level for that area of responsibility.

Support Level Means

The level of responsibility associated with performing assigned tasks, duties or responsibilities on board a seagoing ship under the direction of an individual serving in the operational or management level.

Certificate of Competency

Means a certificate issued and endorsed for master, officers and GMDSS radio operators according to STCW chapters II, III, IV or VII.

Certificate of Proficiency

Means a certificate, other than a certificate of competency issued to seafarers, stating that the relevant requirements of training, competencies or seagoing service in the convention have been met.

CERTIFICATES AND ENDORSEMENTS

Where, as provided in STCW regulation I/2, paragraph 6, the endorsement required by article VI of the Convention is incorporated in the wording of the certificate itself, the certificate shall be issued in the format shown in section B-I/2 of the Code, provided that the words “or until the date of expiry of any extension of the validity of this certificate as may be shown overleaf” appearing on the front of the form and the provisions for recording extension of the validity appearing on the back of the form shall be omitted, where the certificate is required to be replaced upon its expiry. Guidance on completion of the form is contained in section B-I/2 of the Code.

GUIDANCE FOR TRAINING BY DISTANCE LEARNING AND E-LEARNING STCW SECTION A1/6, B-1/6

Each Party should ensure that any distance learning and e-learning programme is provided by an entity that is approved by the Party is suitable for the selected objectives and training tasks, to meet the competence level for the subject covered; has clear and unambiguous instructions for the trainees to understand how the programme operates; provides learning outcomes that meet all the requirements to provide the underpinning knowledge and proficiency of the subject.

STATISTICAL PROCESSING OF SEAFARERS' CAPACITY IN EGYPT 2018

The data subject to review was extracted from the national registries on certificates and endorsements issued to seafarers, maintained by the Egyptian authority for maritime safety (EAMS). The statistical review presented in the paper is based on data extracted from certificates and endorsements, registered by EAMS until 31 December 2018 and received in the STCW information system (STCW-IS), the beneficiaries of the statistics review shows the numbers of manpower available in Egypt, who will support the use of the E-learning system to continue their way process.

Endorsements Distribution

Masters, Officers and Engineers Holding Valid Certificates of Competencies

The numbers of masters, officers and engineers holding valid certificates of competencies (COCs) according to requirement of (Chapter II, III of the STCW Convention) are presented in table 1, reached to 13076. It illustrates that the number of masters and officers entitled to serve in the Deck Department (Chapter II of the STCW Convention) was 50% higher than the number of officers entitled to serve in the Engine Department (Chapter III of the STCW Convention).

Rating holding Valid Certificates of Proficiency

The data presented below is based on the information provided on certificates of proficiency issued to ratings under regulations II/4, II/5, III/4, III/5, III/7, and VII/2 of STCW conventions. The total ratings holding valid COPs in 2018 related to Deck, Engine and Catering departments was 11247 with 47% of total ratio.

Table 1: Egyptian Certificates Capacity

COCs Deck	8129	COPs Deck	3056	COPs Catering
COCs Engine	4947	COPs Engine	5852	2366
Total COCs	13076	Total COPs	11247	Total number of certificates 24350

Source: EAMS.2019

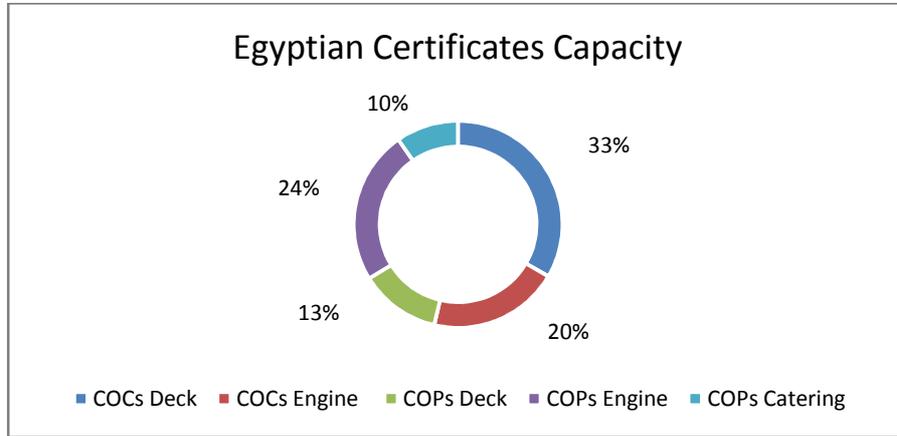


Figure 1: Egyptian Certificates Capacity.

DOCUMENTARY EVIDENCE REQUIRED UNDER THE STCW CONVENTION

The table 2 below identifies all certificates evidence described in STCW convention, which authorize the holder to serve in certain functions on board ships. The certificates are subject to the requirements of regulation I/2

Table 2: Summary for STCW Mandatory Courses

	Certificates	Management Level	Operation Level	Support Level	Revalidation of Certificate	Regulations
1	Certificates Proficiency in survival craft and rescue boats other than fast rescue boats and advanced fire fighting	√	√		Yes	II/1,II/2, II/3, III/1,III/2, III/6,IV/2, VII/2
2	General operator’s certificate for GMDSS	√			Yes	II/1,II/2, II/3, III/1,III/2, III/6,IV/2, VII/2
3	Certificates Proficiency or endorsement on oil, chemical or liquefied gas tankers	√	√		Yes	V/1-1, V/1-2
4	Certificate of Proficiency-Ship security officer	√	√		Yes	VI/5
5	Certificate of proficiency-Ship awareness training for seafarers with designated security duties	√	√	√	No	VI/6
6	Medical care and medical first aid	√	√	√	No	II/1,II/2, II/3, III/1,III/2, III/6,IV/2, VII/2

Table 2: Contd.,

7	Passenger ships completed training in “crowd management”, “crisis management and human behavior”, “passenger safety, cargo safety and hull integrity	√	√	√	No	V/2
8	Certificate of Proficiency for ratings on oil, chemical or liquefied gas tankers			√	No	V/1-1, V/1-2
9	Certificate of Proficiency for ratings duly certified as able seafarers deck, engine or electro-technical rating			√	No	II/5, III/5, III/7, VII/2
10	Certificate of Proficiency for ratings duly certified to be a part of a navigation or engine-room watch			√	No	II/4, III/4, VII/2

In addition to the above courses required to revalidate for time span 5years, the Egyptian authority for maritime safety requires to revalidate the

- Certificate of proficiency-security awareness training for seafarers with designated security duties
- Electronic chart display information system (ECDIS) management level as mentioned in ministerial decree number 221 for 2013.

SEAFARER SURVEY RESULTS

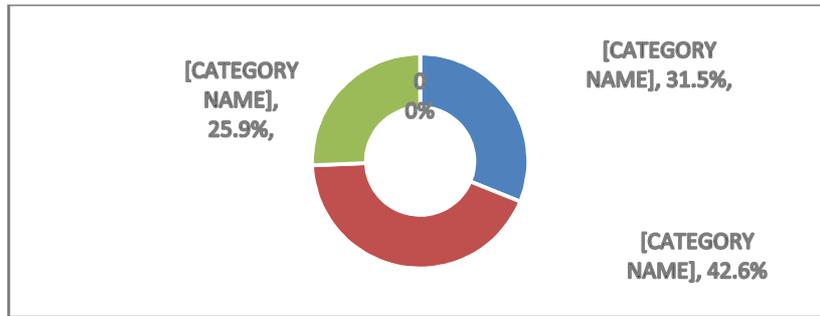
Owing to the world maritime university report 2019 (WMU), Seafarers today are in the spotlight, arguably more than ever, with an increased international focus on seafarer issues such as health and wellness, both physical and mental. At the same time the maritime industry, following trends on land and in the air, pursues various levels of automation which will eventually change the responsibilities, the roles and perhaps even the very definition of “seafarer.” The path is clear, the pace of change is not. Regardless, training and education will remain a core tenant for seafarers, and increasingly seafarers are picking up the cost of their own training.

Training Expenditures

The highest proportion of responding individual seafarers reported being fully responsible for funding their training, as opposed to companies paying for their training. For those who reported that their seafarer training was a mix of the two sources, the average distribution was roughly equal (their company funded around 50.6%, and the individual paid for around 49.4%). Nearly, a fifth of the responding seafarers spent 10% - 20% of their annual income on seafarer training. This personal expenditure goes mostly towards travel-related expenses and required training/retraining for certification purposes. Some reported spending on training for leadership and non-technical skills.

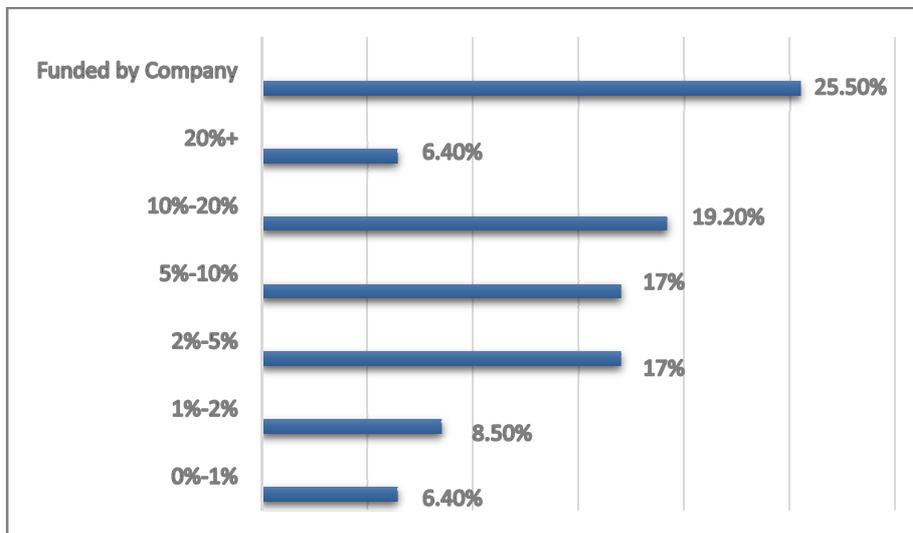
- Certificate of Competence
- Hotel, travel (transportation and living expenses)
- STCW certification, refreshers
- Oil and Chemical advanced training

- Leadership training
- Recertification and renewal
- Environmental training
- Chief Mate training program
- Medical First Aid



**Figure 2: Who is Responsible for Funding your Seafarer Training
Maritime Training Insights Database 2019 Training Practices Report?**

As seen in figure 3 with vessel operators and training institution, spending for individual seafarers is also increasing. Over 68% of seafarers have increased their training expenditures in opposition to being fully funded by their company.



**Figure3: Approximate Percentage of Annual Seafarer’s Income Allocated to Training
Per Year Maritime Training Insights Database 2019 Training Practices Report.**

DEFINITION OF DISTANCE LEARNING

Distance education is an educational process and system, in which all or a significant proportion of the teaching is carried out by someone or something removed in space and time from the learner United Nations educational, scientific and culture organization (UNESCO, 2016). Therefore, distance education is a broad approach characterized by a high degree of variation of space and time. There are a considerable number of researcher’s analyses that the concept of distance learning as additional mode of acquiring/transferring knowledge and skills in maritime education (Buzadija, 2011; Hanzu-Pazaraet

al., 2010; Kadioglu, 2008). With the rapidly developing of information technology, the new electronic teaching methods particularly through the internet and different types of media and platforms narrow the distinctions between generations (JIANG, 2017).

Reasons for Integrated Distance Education in Maritime Education Training MET

Distance education has its own advantages and disadvantages like any kind other educational program. Before the distance education program start to enroll students, carefully consideration should undertaken by both students and teachers in order to make sure that the distance education program meets the minimum requirements illustrated in STCW.

Distance Education Advantages

As the traditional classroom training program requires the seafarers to fix time and location, however, distance education program in MET can give a flexible alternative on time and location. Distance education can also relatively reduce the training fees and allow the students to learn without entering school. Besides, with the highly change of maritime technology and legal requirement, many refresher courses can also be delivered through distance education.

Distance Education Disadvantages

However, there exist some disadvantages for the distance education in MET. Lack of social interaction is one of the main disadvantages. Although the student can have some interaction through email, chat rooms and other on-line platform, however, it is quite different than traditional classroom education. Besides, not all courses can be offered online. Some courses directly with practical skills are hard to deliver by distance education.

AUTONOMOUS SHIPS AND FUTURE TECHNOLOGY

The theme for 2019 is Autonomous Operations. Autonomy is all around us, pervasive in nearly every transport and logistics sector, from aerial drones and self-driving cars to robotic cargo systems and subsea vehicles. Fully autonomous ships traversing the world's oceans is likely in a generation or two in the future, with a number of technical, political and insurance hurdles to clear, to name a few. However, steps toward increasing levels of automation onboard ships are taking place now, steps that will impact maritime training.

Autonomous Level

AL0: Manual - No Autonomous Function. All action and decision-making is performed manually - i.e. a human control all actions at the ship level. Note: systems on board may have a level of autonomy, with 'human in the loop'.

AL1: On-ship Decision Support. All actions at the ship level are taken by a human operator, but a decision support tool can present options or otherwise influence the actions chosen, for example DP Capability plots and route planning.

AL2: On & Off-ship Decision Support. All actions at the ship level taken by human operator on operator on board the vessel, but decision support tool can present options or otherwise influence the actions chosen. Data may be provided by systems on or off ship, for example DP capability plots, OEM configuration recommendations, weather routing.

AL3: 'Active' Human in the Loop. Decisions and actions are performed autonomously with human supervision. High impact decisions are implemented in a way to give human operators the opportunity to intercede and over-ride them. Data may be provided by systems on or off the ship.

AL4: Human in the Loop - Operator/Supervisory. Decisions and actions are performed autonomously with human supervision. High impact decisions are implemented in a way to give human operators the opportunity to intercede and over-ride them.

AL5: Fully autonomous. Unsupervised or rarely supervised operation where decisions are made and actioned by the system, i.e. impact is at the total ship level.

AL6: Fully autonomous. Unsupervised operation where decisions are entirely made and actioned by the system, i.e. impact is at the total ship level. Lloyd's Register Group Limited. (July, 2016).

Today's Level of Autonomy

Autonomous operations is not perceived to be common on today's ship by both reporting operators and seafarers who have recently (or are currently) working onboard a vessel. Over 62% of operators and 43% of seafarers report Autonomous Level 0 (AL0), where ship operations are completely manual. Interestingly, a little over 16% of seafarers also report working on a vessel where decisions and actions are performed autonomously with human supervision (AL3). Maritime education and training institutions seem to be further along in adopting and implementing programs for autonomous operations compared to industry, with a higher percentage of training ready for Autonomous Level 2 to 4.

Expected Future Levels of Autonomy

When asked about expected future levels of autonomy, in regards to actual operations (for operators and seafarers) or to the training programs that will be in place, vessel operators have the most conservative opinion. None of the responding operators expect full levels of autonomy (AL6) in 20 years, compared to seafarers - 7% of whom believe that full autonomy will be possible. Training institutions have the most optimistic view, with over two-fifths believing that full autonomy will be possible in the future (AL5 and AL6).

Skills Needed to Support Autonomy

All three responding groups have common beliefs that a deeper understanding of on-board systems, human-factors skills, management and decision making skills, and collaborative / communication skills are necessary to support future levels of autonomy. A selection of their responses can be found below.

Operators Required

- Younger trainers
- More advanced simulators
- Shore-side management training in resource management and systems
- Alarm management protocols and actions
- Improved risk assessments
- Extensive and E-Learning
- Actual shipboard/on-board training to stimulate real situation awareness
- Autonomous vessel operation will not change in 5 years

Maritime Training and Institutes

- More individual training based on high quality assessment. Change from generic simulated training to simulated training on “real” vessel bridge environments (similar to aviation industry). Instructors/ trainers are to become coaches as well, being available with expert advice to operators.
- Initial set up with simulation ability resources, with plans to migrate some part of these skills onto an online or virtual component for exportable training.
- Increased use of simulation, e-learning.
- Outcomes-based education.
- Remote simulator operators.
- Stay informed and modify existing curriculum as autonomous vessel technologies are advanced and personally implemented to address the additional skill requirements identified.
- Accommodating and/or supporting instruction relevant to autonomously operated vessels is not a priority.

CONCLUSIONS & RECOMMENDATION

The shipping is now a high profile international business, which has adopted the new technology in its management and operations. The structure of competition approach in the shipping industry has changed with the appearance of the new technology phase. Cooperation between government, ship-owners and maritime institutes is a must which will help in revalidating the seafarer’s certificates. This will create innovative and flexible strategies to meet the different market requirements and to achieve the full success of applying the technology. All maritime players in countries need to improve the situation and to meet the requirements for qualified seafarers, which is directly related to maritime education and training system.

REFERENCES

1. Buzadija, N., (2011), *The Way of Students’ Efficiency Improvement in Knowledge Acquisition and Transfer Knowledge Model in Clarolina CMS*, JITA – *Journal of Information Technology and Applications*, 1(2), pp. 127-135.
2. Hanzu-Pazara R., Arsenie P. and Hanzu-Pazara L., (2010), *Higher Performance in Maritime Education Through Better Trained Lecturers*, *TransNav – International Journal on Marine Navigation and Safety of Sea Transport*, 4(1), pp. 87-93.
3. *International Convention on Standard of Training, Certification and Watch keeping for Seafarers (STCW) Code Part A, 2010*
4. Kadioglu M., (2008), *Information and Communication Technology (ICT) Training Application for MET Institutions*, *TransNav – International Journal on Marine Navigation and Safety of Sea Transport*, 2(1), pp. 111-116.
5. Ki-Ying Chang (2019) *Journal of Marine Science and Technology*, Vol. 27, No. 1, pp. 8-16
6. *Maritime Training Insights Database 2019 Training Practices Report*.

7. *Lloyd's Register Group Limited. (July, 2016). Cyber-enabled ships. Ship Right procedure - autonomous ships. Retrieved from <http://info.lr.org/l/12702/2016-07-07/32rrbk>*
8. *Ruan Wei (2013). Views from maritime education and training on the full implementation of 2010 STCW amendments. Journal of shipping and ocean engineering 3(2013)40-46*
9. *UNESCO. (n.d.). Definitions. Retrieved May 2, 2016, from <http://www.unesco.org/education/lwf/doc/portfolio/definitions.html> Webster, D. (2006, November 7). California Maritime Academy offers on-Line Training Course for Maritime Security Awareness. Retrieved May 6, 2016, from https://www.csum.edu/c/document_library/get_file?uuid=791038cc-71bd-4873-af62-adf108b648ee&groupId=61902*
10. *United nation conference on trading and development UNCTAD unctad.org/AnnualReport2018*
11. *Yanning JIANG International Journal of Learning, Teaching and Educational Research Vol. 16, No. 5, pp. 31-41, May 2017*