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IMPROVEMENT OF SAFETY EDUCATION AND TRAINING FOR SEAFARING OFFICERS

GEMİ ZABİTLERİNİN DENİZCİLİK EMNİYETİNE İLİŞKİN EĞİTİM VE ÖĞRETİMLERİNİN GELİŞTİRİLMESİ

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Abstract

Ships are the largest vehicles ever created by humans. Any failure in the propulsion, navigation, communication and cargo and ling systems or human error may cause serious, even fatal accidents. Nowadays ship management systems are almost fully automated and any automation failure may cause accidents with damages to human life, to the environment, to the ships, to the port facilities and the goods transported. Safety management in shipping aims to avoid or mitigate the effects of any incidents at sea. Automated systems facilitate ship management functions but they must be under the supervision of the human element at all time to prevent any failure. Additionally all users should be aware of the working principals and limitations of them to be able to avoid any accidents. Ships sail with a sole navigator on the bridge and ship owners hesitate to add an additional navigator to bridge team concerning personnel costs. So the only way to provide safe navigation of the ship is to employ competent and best trained officers. This study investigates existing studies on the development of better education and training systems to avoid incidents at sea to improve safety on board and propose new opportunities to improve safety education for sea faring officer to ensure safety at sea.

Key Words: Safety Education; Ship Management; Automation System

Öz

Gemiler insanların bugüne kadar yaratmış olduğu en büyük araçlardır. Ana tahrik, seyir, iletişim veya yükleme sistemlerinde bir arıza veya insan hataları can kaybı ile sonuçlanabilen ciddi kazalara yol açabilir. Günümüzün gemi yönetim sistemleri hemen hemen tam otomasyona sahiptir ve herhangi bir otomasyon arızası insan hayatına, çevreye, gemiye, liman tesislerine ve taşınan mallara ciddi hasarlar verdirebilir. Denizcilikte Emniyet Yönetimi deniz kazalarının etkilerini ortadan kaldırmayı veya hafifletmeyi amaçlamaktadır. Otomasyon sistemleri gemi yönetim fonksiyonlarını kolaylaştırmıştır. Ancak herhangi bir arıza durumunda müdahale edilebilmesi amacıyla bu sistemlerin sürekli olarak insan gözetimi altında tutulmaları gerekir. Ayrıca bir sistem arızası durumunda, muhtemel kazaların önlenebilmesi için tüm kullanıcıların bu sistemlerin çalışma prensipleri ve kısıtlamalarını bilmeleri gerekmektedir. Günümüzde gemiler köprüüstünde tek bir vardiya zabiti tarafından yönetilmekte ve armatörler personel giderlerini arttırmamak için seyir ekibine ilave bir zabit eklemekten kaçınmaktadırlar. Bu nedenle bir geminin seyir emniyetini sağlayabilmek için tek yol gemiadamlarının, özellikle de gemi zabitlerinin kaliteli bir eğitim almasını sağlamaktır. Bu araştırmada deniz kazalarını önleyerek gemi emniyetini arttırmayı amaçlayan halihazır eğitim ve öğretim geliştirme çalışmaları değerlendirilmekte ve deniz güvenliğini sağlayacak şekilde gemi zabitlerinin gemi emniyet eğitimlerinin geliştirilmesi için yeni fırsatlar önerilmektedir.

Anahtar Kelimeler: Gemi Emniyet Eğitimleri; Gemi Yönetimi; Otomasyon Sistemleri

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1. INTRODUCTION

The shipping is developing rapidly over the world to meet the growing economic demands. The number of the ships sailing on the sea line of communications is increasing. The cargo carriage capacity of the world fleet has increased 53% in the past ten years (Table-1). There is a significant increase of chemicals and other types of tankers which carry mostly dangerous goods. Improved cargo handling technologies have reduced port periods of ships and accordingly number of the ships on sea passage has significantly increased. Nowadays approximately fifty percent of the sea line of communications has become congested traffic areas.

Table-1: Growth of World Fleet by Principal Vessels(Source: The Clarkson Database 2014)

Growing of the World Fleet (Million Dwt)						
Years	**Tankers**	**Chemicals**	**Dry Bulk**	**Combined Transportation**	**Others**	**Total**
2004	**279.1**	**25.0**	**299.2**	**12.1**	**189.6**	**805.0**
2005	**295.0**	**25.7**	**317.4**	**11.6**	**200.5**	**850.1**
2006	**317.7**	**26.9**	**339.3**	**11.6**	**213.3**	**908.8**
2007	**334.7**	**29.0**	**367.4**	**11.2**	**232.5**	**969.9**
2008	**352.3**	**31.7**	**386.5**	**10.4**	**253.5**	**1 035.1**
2009	**369.0**	**34.0**	**413.4**	**9.6**	**273.1**	**1 099.9**
2010	**396.2**	**35.8**	**454.9**	**6.8**	**294.9**	**1 191.3**
2011	**413.1**	**36.1**	**532.5**		**309.9**	**1 298.4**
2012	**439.0**	**36.5**	**615.7**		**305.3**	**1 396.6**
2013	**460.5**	**36.6**	**681.1**		**280.7**	**1 458.9**
2014	**471.3**	**36.3**	**718.7**		**293.2**	**1 519.4**

In order to improve safety at sea, ships have been equipped with automated navigation systems and more emphasis is given to the education and training of seafarers. However, collision accidents are increasing as vessels expand in size, in speed and in number (Hwang et al, 2001). Many worldwide studies have been made / conducted to reduce accidents, mostly by improving the quality of automated systems. There are also some studies on the improvement of the education and training systems with a specific emphasis on collision avoidance. The European Union supported MAIDER, SURPASS and ACTs projects are the recent examples of such studies.

In this context, the question of risk and more precisely the element of human factor appear to be crucial point. Hetherington (2006) accepts human error is, in fact, the main factor in maritime accidents. Hetherington described factors that may contribute to maritime incidents and accidents as human performance factors, (fatigue, stress, and health), personnel issues including technical skills, cognitive skills (situation awareness and decision making) and interpersonal skills (communication, language, and teamwork), organizational issues (safety training, bridge team management, and safety climate and safety culture). Pourzanjani (2001) focussed on the human error in collision avoidance and identified cognitive errors such as diagnosis and decision errors as significant contributors to failure in collision avoidance (Chauvin and Lardjane, 2008).

Improvement of collision-avoidance systems have been mostly carried out in the fields of artificial intelligence and navigation for decades. And several expert and fuzzy expert systems have been developed to facilitate collision avoidance decision-making in any two-vessel encounter situation. However, none of these systems can inter-negotiate with each other as seafarers usually do when they intend to make a more economic overall collision-avoidance plan in the collision regulations high cost (COLREGs-HIGH-COST) situations where collision avoidance following the International Regulations for Preventing Collisions at Sea(COLREG) costs too much (Hwang et al, 2006).

The purpose of this study is to find out possible solutions to the deficiencies of current education and training systems of maritime safety issues to improve safety on board, to ensure safety at sea and to provide new academic opportunities in developing safety education and training for seafaring officer as well. Therefore, the main problem of the study is designed to discover the best teaching way of solutions of safety issues which are typically encountered on the bridge of a ship for deck officers.

2. METHOD

The aim of this study is to look through the Maritime Education and Training System (MET) related to safety training and the problem areas and the missing points on application of the education which directly affects safety at sea and determines the measures to be taken for mitigation of the deficiencies.

This study is mainly based on literature review and also includes the results of a working group study of maritime safety experts. All required data have been collected from open available sources, listed, tabulated and evaluated according to the aim and objectives of the study.

The term “safety” is the degree of freedom from danger or harm. Safety is achieved by doing things right the first time and every time. Therefore, this study is designed to designate the best teaching ways of maritime safety systems to make ship systems safer throughout their life cycle.

The study is conducted in three phases. It starts with a comprehensive study which aims to gather detailed information on the safety training applied in the MET institutions; current situation regarding the application and best practices of safety training in different countries.

The second step is based on an investigation which defines the problem areas met and provides proposals to mitigate the deficiencies.The third and last part of the study covers the most reliable and applicable proposals to find remedies for existing and future problems. The result of the study may be used for future studies to produce short and midterm solutions to overcome deficiencies.

3. DISCUSSION

“Safety First” is the most well-known motto of all kind of activities. Maritime safety has the most foregoing importance especially for activities carried out on shipsof all safety concerns due to the nature of maritime transportation.Safety has different aspects in shipping such as safety for the ship and equipment, safety for the cargo, safety for personnel and safety for environment.This maritime environment is not ruled by national legislation and completely an international environment regulated and controlled by international law. Therefore, maritime safety regime is governed by international safety legislation which are mainly provided by three major international organizations namely, the United Nations (UN), the International Labor Organization (ILO) and the International Maritime Organization (IMO).

Since sea transportation is an international activity; maritime personnel should be educated in accordance / compliance with international rules. Ships manned with multinational crew are a reality and this is becoming common practice today. Therefore, transportation cannot be supported only with national education methods.

The education and training requirements for seafarers are regulated by an internationally recognized convention by the name of Standards for Training, Certification and Watch keeping (STCW) which was introduced in 1978. These education and training requirements mostly cover safety issues of shipping activities. All seafarers are required to receive an education and training to work on board ocean-going ships and learn especially safety subjects needed for on ship operations.

3.1.Safe Operation of Ships

The safe operation of ships is important for prevention of both unsafe conditions and acts that have the potential to cause harm or death to people, damage to assets, company/industry reputation as well as environment, response to emergency situations and ultimately assurance of profitability of investment (Okana, 2008). Safety at Sea is the main priority for theInternational Maritime Organization (IMO). The IMO makes deep studies in technical and procedural issues to ensure safety at sea.

The major IMO regulations on safety at sea are theSafety of Life at Sea (SOLAS), Maritime Pollution Prevention (MARPOL)and Standards for Training, Certification and Watch keeping (STCW) Conventions and International Safety Management (ISM) and International Ship and Port Facility Security (ISPS) Codes. The ISM Code regulates safe management of ships and shipping companies. The safety management system covers commitment, competence, attitudes and motivation of individuals involved in matters of safety and pollution prevention starting from the top management to the lowest level seafarer.

Almost any accidentcan, with equal validity, be traced to inadequate design, inadequate training, inadequate instructions, inadequate attention, and an unfortunate coincidence of rare events or just human error (Singleton, 1973). Even though the human factor played a critical role in most of these accidents, much of maritime safety policy developed afterwards focused on “engineering,” or “design” solutions (Nikitakos and Sirris, 2008).

All too often designs simply ignore the people who have to actually use the system, often under pressure. Poorly designed system controls or human interfaces like ECDIS controls, badly designed lifeboats and launch systems, vessels designed to vent cargo spaces into manned spaces have all taken their toll of seafarers and ships. Rarely are they adequately tested with attention to the hazard of errors under stress. There is no point in testing such systems with experts well-trained in their use(Couttie, 2015). The ship construction industry prefers not ergonomic but generally low cost designs. The maritime industry is mostly reluctant for the seafarers’ claims for ergonomic design.

Nowadays ships are sailing with a sole navigator on the bridge and ship-owners, concerning with the increase of personnel costs, hesitate to add an additional navigator to bridge team. So the only way to provide safe navigation of the ship remains is to train well qualified seafarers. To overcome human factor related accidents we need to improve a lifelong learning system for seafarers. This starts with initial education and training at the schools and continues with the vocational education and training and professional improvement in the latter phase.

It will be unfair if any one deny that many developments have been realized in seafarer training so far. However, we cannot claim that all these developments contribute substantially to the prevention of accidents. Insisting on keeping the status quo is not an option. Holbeche (2006) stated that ‘the changing environment is causing organizations to restructure and reconfigure their operations, processes and the nature of their products’. Now it is time to overview the existing safety education and training system on a continuing base and finds a range of tools that will enable the planners in making appropriate choices at all stages of the change process.

3.2. Conceptual Approach

The basic algorithm of the risk avoidance process in any potential risk situation may be resumed as follows;

- Is there a risk to safety?
- If yes, should I take avoiding actions?
- What actions should be taken?
- When should I start to take action?
- If the action is not sufficient to annihilate the risk, which follow on action should be taken?

The risk avoidance requires continues decision making process supported with an uninterrupted observation. The logic of safety management is basically based on risk assessment and risk management process.

Risk management is a process of thinking systematically about all possible risks, problems or disasters before they happen and setting up procedures that will avoid the risk, or minimise its impact, or cope with its impact. It is basically setting up a process where you can identify the risk and set up a strategy to control or deal with it. It is also about making a realistic evaluation of the true level of the risk (Intend, 2009).

The STCW is based on risk assessment. Approximately *Specifications of minimum standards* for every qualification standards cover **'**Assess security risk, threat, and vulnerability**'** in the *Competence* and'Knowledge of risk assessment and assessment tools' in the *Knowledge, understanding and proficiency* sections. For managerial level officers there is a section clearly refers "*Knowledge and ability to apply decision-making techniques: Situation and risk assessment - Identify and generate options - Selecting course of action - Evaluation of outcome effectiveness"* as a part of '*Use of leadership and managerial skills'*. However there is no direct reference to risk management, all above mentioned issues actually covers risk management procedures. Consideration of being vigilant and taking precautions against risks is one of the most important inputs of shipboard management. Shipping – or the maritime adventure – is risk-laden.Some of these risks are physical – ranging from loss of the vessel or loss of life through to minor voyage damage to the ship. Others will be financial. Some (e.g. related to pollution or airborne/seaborne emissions) may straddle the physical and the financial. Others will have their roots in global or national political considerations. Managing risk, consequently, has to be part of the remit. This said, risk management itself is complex and its definition is open tointerpretation (Drewry, 2006). It is strongly believed that it is the time to consider inclusion of the risk management subject into seafaring officer education at least for management level.

3.3.Main Bases of Seafarers Education and Training

The STCW (Standards for Training, Certification and Watch keeping) Convention has moved from being knowledge-based to competence-based training and assessment, where clear outcome-based standards of competence have been established and the tasks and skills are defined in terms of outcomes to be achieved to meet today's industry demands. The knowledge, understanding and proficiencies for the skills needed to ensure that seafarers are capable of fulfilling the roles expected from them on board have been clearly defined and tabulated. Consequently, this necessitated the detailed review and revision of all maritime education and training programmes to ensure the amendments were clearly reflected. Thus, direct and significant responsibility has been placed on trainers and assessors for knowledge and skills acquisition and demonstration of competence by seafarers for safe operation of ships and, by default, for maritime safety (Milhar, 2014).

The following management skills are introduced in the *Competence* 3.5 (Organize and Manage the Crew) for IMO Model Courses (7.01, 7.02, 7.03 and 7.04) for seafaring officers;

- Personnel Management, Organization and Training on Board Ship
- Application of Task and Workload
- Effective *Resource* Management
- *Decision Making* Techniques
- Development, Implementation and Oversight of *Standard Operating Procedures.*

Shipping is a risky business. Ships may meet unexpected situations when sailing under the most changeable weather and sea conditions. Ambiguity and uncertainty are the main facts of sea life. Risk is the main cause of uncertainty. Thus, seafarers, in particular officers increasingly focus more on identifying risks and managing them before they even affect the situation. The ability to manage risks will help seafaring officers act more confidently on their decisions. Their knowledge of the possible risks they may meet and risk management skills will give them various options on how to deal with potential risks.

A survey based research for the improvement of management skills of prospective Deck Officers was undertaken in 2014. The primary aim of the research is to provide discussion subjects for guidance to the Maritime Education and Training (MET) Institutions in the development of their curriculums for Navigation Engineering Cadets. This questionnaire is addressed to the managerial level seafaring officers and shipping companies' officers. The viewpoint of the participants is asked on the type of management skills necessary in achieving in his/her duties effectively as a manager on board (Demirel and Bayer, 2014). The study showed that the following management subjects should be included in the deck officers programmes of maritime faculties which, in addition to the cadets, will improve maritime faculties' academic qualifications:

- Human resources management
- Maritime management
- Total Quality management
- Risk management
- Safety and Security Management

To this end it is strongly believed that at least IMO Model Courses 7.01 and 7.02 which are for managerial level should contain a unit to introduce the risk management procedures supported with on board case studies. Actually most of the seafaring officer education is now conducted in the universities and colleges and they cover both operational and management level courses during their undergraduate programmes. The Level 6 (licence degree) education is suitable to deliver the subject of risk management at the maritime faculties.

3.4. Preventing Automation Failure Related Accidents

Application of the risk assessment and management procedures is highly important to avoid serious results in case of failures. Ships are the largest vehicles ever created by humans. Any failure in the propulsion, communication, command control or cargo handling systems may cause serious, even fatal accidents. Nowadays ship management systems are almost always fully automated and any automation failure may cause unacceptable accidents with damage to human life, the environment, the ship(s), port facilities and the goods being transported.

Automated systems facilitate ship management functions and are comparably more effective than manual systems, but they do not have the decision making capability. What this means is that automation systems must be controlled by the human element at all times. These systems are products of high technology and users should be aware of the working principals, specifications and limitations of them in order to be able to avoid any accidents in case of failure in such systems.

Automation systems failures are significantly important for the merchant sailing in congested traffic conditions. Any failure on navigation and/or command control systems may cause the loss of life and total loss of a ship or ships. The cadets and officers have a background on the operation of the automated systems as users but they have not sufficient information about the system design philosophy, technical specifications and more importantly limitations. This situation limits their decision making abilities in case of emergencies due to automation failures.

A paper (Ziarati, 2006) and report to the IMO (MCA, 2006) clearly identify a major source of accidents particularly in the future as to be the problems with application of automated systems and failures in any aspect of automation. STCW training standards for Engineers have not been updated to account for working with such new systems. Instrumentation and control systems including hydraulics and pneumatics needed to be included in the syllabuses of the programmes for the Engineer and Deck officers. Under the STCW there is no specific training requirement for electrical engineering officers on board vessels, and therefore no internationally or European agreed standard by which shipping companies can effectively assess their knowledge (www.surpass.pro).

To overcome this deficiency a European Union Project named SURPASS (Preventing Accidents due to Automation Failures at Sea) has been introduced. The main aim of the project is to fill this gap created as the result of – appearance and application of the automated systems in the education and training programs of seafarers through provision of training courses which enable them fully understand the automated systems, and these systems' weaknesses and limitations.

SURPASS courses may be delivered using integrated bridge and engine simulators. An integration of scenarios with BRM (Bridge Resources Management) and BRM (Engine Resource Management) courses may provide better understanding of automated systems for both navigation and marine engineering cadets. A SURPASS linked BRM and ERM training may be conducted at the later stages of managerial level (A-II/1 and A-III/1) officer education programmes.

3.5.Preventing Collision

From the mid-19th century onwards, a number of international maritime agreements have been adopted. A treaty of 1863, for example, introduced certain common navigational procedures that ships should follow, when encountering each other at sea, so as to avoid collision, and was signed by some 30 countries (IMO, 2012). The COLREGs (Convention on the International Regulations for Preventing Collisions at Sea) regulates the international rules to avoid collision at sea.

Many studies on sea accident investigations prove that 60 % of accidents are due to human error, 19% structure/mechanical failure and 11% equipment failure (Figure 1).

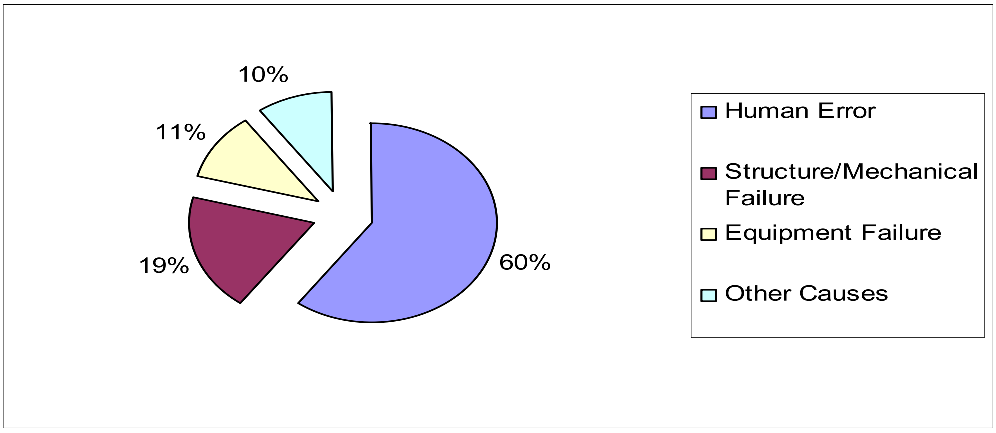

Figure 1: Reasons for Accidents (Source: Ziarati, 2011)

Another fact is that 78 % of the results of accidents are closely related to ship handling (navigation and navigation watch (Figure 2). Fifty percent of large spills occurred while the vessel was underway in open water with allusions, collisions and groundings are accounting for just over half of these. These same causes accounted for some 95% of incidents when the vessel was underway in inland or restricted waters(IMO, 2012). It is not easy to understand whether the reason is a connected to human error and other fact or not because of the complexity of the occurrence of an incident related to ship handling. Although we do not have a reliable study on this subject, we can assume that the reasons of this kind of accidents are lies with the human error, structure/mechanical failure and equipment failures. So studying allthis factors together could present a good solution to reduce the number of accidents.

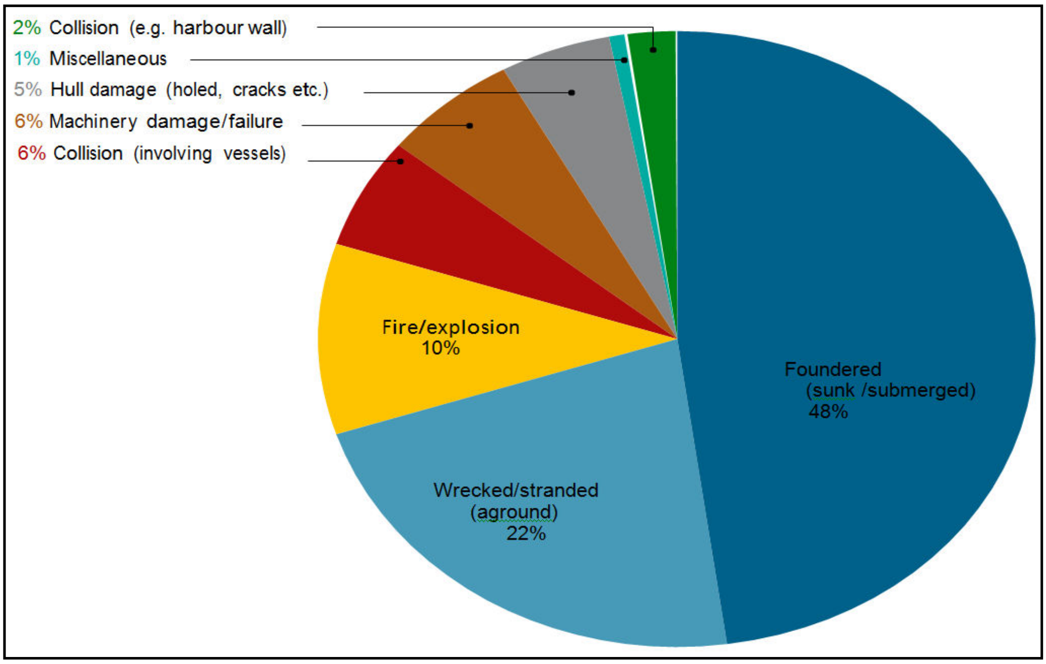

Figure-2: Causes for shipping losses in 2012 (Lloyd's List Intelligence Casualty Statistics)

Most recent study on the improvement of a COLREGs training is ACTs (Avoidance Collision at the Sea) Project supported by the European Commission. The project partners are working on developing an online training course to improve the COLREGs training and determine if new rules or changes are necessary (http://ecolregs.com/).

The results of study may be resumed as follows;

- The existing rules have to be interpreted precisely so that they are understood in the same way by everyone.
- The rules that have priority over the others have to be clearly determined and navigation officers should be able to apply them without having a difficulty. So the bigger part of training scenarios should be based on these rules.
- Establishing a common understanding of an individual rule through some kind of guidelines and standardizing the education, training and assessment of COLREGs through the proposed COLREGs Model Course are needed. Partners are of the view that the COLREGs model course should be an integral part of the STCW.
- In some rules certain definition(s) should be added in order to clarify the rules
- Developing COLREGs e-course to be used with fundamental and cheaper means of information technology, rather than expensive simulators should be considered.
- To improve learning methodologies it is suggested to use multiple case real life study scenarios which cover each individual rule, Court decisions for interpretation of case studies, visual images, simulators, CADs and 3D dynamic animations.
- A Global COLREGs online test is strongly supported and recommended. The test should be taken in English and in the mother language.

The development of COLREGs e- course is to be used with fundamental and cheaper means of information technology and a global COLREGs online test are the significant findings which should be evaluated by MET planners.

The application of COLREGs is actually the practice of risk assessment and risk management. Klimczak (2007) states that 'The Working on the risk assessments we can improve our risk management plans which will help us to create our standing checklists before accident happens and "to do" list in case of an incident'. Achieving what we need to improve scenarios in the light of the existing accident investigation reports is related to application of the COLREGs, and then we should select the most applicable scenarios for training purposes. Based on these selected scenarios we should study risk assessments.

A holistic and formative course should be designed to meet the requirements of contemporary education system. Therefore we must decide on the aim, objectives and learning outcomes for our training which will help us to decide on the content of the programme supported with the scenarios. The main part of the training should be constructed on a real time scenario and case studies.

Nowadays ship handling is very dependant to the information provided by automated systems and most of the bridge operation systems are automated. Considering the automation related failures, this course programme should also cover the introductory subjects related to basic working principals, capabilities, weaknesses and limitations of the selected automation system.

A working group established to investigate the content and delivery of COLREGs units at MET institutes. Some group members are proposed a linkage between different echelons of the training, such as teacher may take the students to bridge simulator to explain a confusing situation or may use standalone computers for case studies. It is assumed likely possible and provide more flexibility for the lecturers to use different training assets. Considering this proposal the model is named as 'interlinked training method' which allows transitions between different manners of training.

In the light of the results of the discussions, the group has decided to improve a holistic and formative training method. In order to achieve the solutions mentioned in the previous paragraph, an effective and reliable method was proposed and its possible outcomes were also evaluated in the group. Finally, the group agreed on a training method named as "Interlinked Echelons Training Method for COLREGs Courses" which consists of four echelons; Classroom Teaching, Case Studies, Practice based on simple scenarios supported by standalone computers and Bridge Simulator Practices based on more complicated situations mostly similar the M'AIDER type scenarios (See Figure 3).

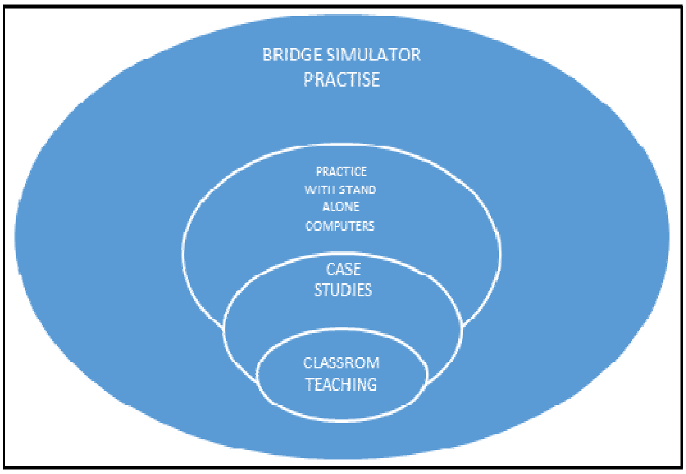

Figure-3: Interlinked Training Method for COLREGs Courses

This method also provides additional benefits;

- Stand alone computer practice (SACP) will help the students to be prepared as OOW who will have to make decision as a single OOW on the bridge,
- SACP will also make possible the application of CBA (Computer Based Assessment) which will provide better assessment for student's achievement,
- The case studies may be better evaluated via forming of Bridge Simulator session,
- This kind of a training method will meet the STCW requirements fully including ample use of simulators.
- The courses that should be included in the IMO model courses (MSC 90/16/126) are to be considered as part of international standards.

The method also presents some disadvantages such as;

- Assignment of additional lecturers are required to be able to handle standalone computer practises
- To achieve an effective simulator training the number of the participating students and instructors should be oriented to appropriate level.
- The recommended guided learning hours in the Model Course 7.03 should be increased.

As a result of this working group study, it is decided that the results of the study should be reflected to the COLREGs course syllabus and to be proposed to ACTs project team.

3.6.Safety Culture:

The term of ''safety culture'' first appeared during the investigation of the Chernobyl nuclear disaster. At the beginning the investigators focused on the technical aspects. But in the latter stages it became clear that in addition to the technical aspects there were also organizational, cultural and management issues as the reason for the accident. It was also understood that there was a lack of safety culture.

According to (IAEA 2009), safety culture should be based on a set of safety 'beliefs' (assumptions) and on a code of conduct that reflects the right attitude to safety which is held in common by all individuals in the organization. Ultimately, the safety culture is manifested in individual and collective behaviour of the organization.

Operation of ships is full of regulations, instructions and guidelines addressing human factors and safety culture to enhance safety. However, there are still serious barriers for the breakthrough of the safety management, even though the roots of a safety culture have been established, One of the most common deficiencies in the maritime transport is the lack of adequacy and excellence in respective monitoring and documentation. Nonetheless, the maritime area can be exemplified from other industries where activities are ongoing to foster and enhance safety culture (Berg, 2013).

Accidents, resulting larger number of fatalities during the last few years, have caused to collect all attention on issues of maritime safety. Accident registration reveals that human related causes have a large proportion, and by looking at cultural aspects, one's misunderstanding of the underlying mechanisms may lead to increasing risk for accidents. Several constructs of culture and climate have appeared on national, organizational and safety levels (Havold, 2013). The education and training is an important tool to improve culture of safety but not sufficient. To achieve improvement of a safety culture we need full support ofthe maritime community with all aspects. Hovald (2013) also stated that 'To be able to reduce the risk for accidents, there seems to be a need for coordination and the cultural perspective seems to be one that integrates and takes the many disciplines and multi-level nature of accidents and safety into account'. The maritime administrations, labour unions and the IMO are required to spend more efforts to establish new rules, regulations and procedures to improve safety culture as well as shipowners are needed to spare sufficient resources to support.

Nowadays in many faculties delivering management sciences Safety Culture become an independent course covering theory, method and improvement of this culture. Antonsen (2009) explains the aim of this course as to show how a cultural approach can contribute to the assessment, description and improvement of safety conditions in organizations. The relationship between organizational culture and safety, epitomized through the concept of 'safety culture', has undoubtedly become one of the hottest topics of both safety research and practical efforts to improve safety.

The safety culture is important in the industry in particular for the branches which deal with risky operations. It is inherent that shipping is a highly risky business. The IMO has repeatedly drawn the attention of the maritime community to safety culture.

In the light of all above mentioned discussions inclusion of a Maritime Safety Culture course in the education programs of management level officers is considered beneficial for improving safety culture in the shipping.

4. CONCLUSION

Safety management in shipping aims to reduce and eliminate, if possible, collisions among ships and accidents on board and minimize their negative effects, if they ever occur. The situations which may end up with collision are the worst cases of unsafe situations involving ships due to their possible high costs in human lives, environment and also in economics. Therefore, avoidance of ship collision takes the highest priority among the studies on maritime safety issues. The existing teaching methods for collision evasion are in line with the COLREGs. But there are doubts that existing COLREGs training methods do not meet all the requirements. Therefore, a lot of studies have been made to find out new methods to make available more effective teaching ways.

There are some other reasons which also force the development of new training methods. One of them is such that seafarers are lone, rare and precious persons. They need to be trained to work in groups and that need introduces extra training requirements. The other reason comes with the economics of business. Most of the time, ships sail with a sole navigator and ship owners, concerning with the increasing personnel costs, are reluctant to hire an additional navigator for bridge team. Considerations of economics in shipping may contradict with the desired safety level on ships operations. So the best way remains for providing safer navigation of the ship is to train seafarers especially deck officers with higher quality standards.

One of the solutions thought for safer navigation is the ship management systems. Ships are the largest vehicles ever created by humans. Nowadays, ship management systems developed for easy handling of such huge vessels are almost fully automated. But any automation failure may cause accidents with damage to human life, the environment, the ship(s), port facilities and the goods being transported. Due to excess dependence on automated systems, any failure in the propulsion, communication, command control or cargo handling systems may end up with serious, even fatal accidents. What this means that even the most developed automation systems must have some form of control by the human element at all times which also brings forward another reason for better education and training requirement on these systems for seafarers.

These systems are products of high technology and users should be aware of the working principles, specifications and limitations of them in order to be able to avoid any accidents in case of failure in such systems. Since safety management is basically based on the risk assessment and risk management process, risk evaluation techniques to be used on ships should cover the automation failure cases as well. It is believed that inclusion of the risk management subjects into seafaring officer education at least for management level should be considered.To reflect the study findings to reality, it is deemed that the Level 6 (licence degree) education may be suitable to deliver risk management issues at the maritime faculties.

To increase the effectiveness of the COLREGs based courses is at the core of the safety considerations in collision avoidance studies. Therefore, it is proposed that the development of e- courses in teaching COLREGs to be used with fundamental and cheaper means of information technology based on the study being made by ACTs Project team should be evaluated by MET planners.

The model named as ‘Interlinked Echelon Training Method’ which allows transitions between different instruments of training is recommended to MET planners to overcome difficulties of COLREGs teachings in maritime education institutions. This method provides trainers a lot of flexibility to overcome difficulties met in COLREGs courses such as teacher may take the students to bridge simulator to explain a confusing situation or may use stand alone computers for case studies. “Interlinked Echelons Training Method for COLREGs Courses” which is consisting of four echelons; Classroom Teaching, Case Studies, Practice with stand alone computers based on simple scenarios and Bridge Simulator Practices based on more complicated situations is deemed as a method worth to be considered in planning of maritime safety educations.

In additions to the subjects mentioned above, inclusion of a maritime safety culture course in the level for management officers is considered beneficial not only for improving safety culture in shipping but also for improving collision avoidance awareness of deck officers.

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