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Assessment for Ensuring Adequately Qualified Instructors in Maritime Education and Training Institutions

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Introducing new technologies, knowledge, understanding and proficiency for seafarers is a challenging task for maritime instructors in the consideration of maritime safety. Effective teaching strategies depend on qualified instructors working both within the International Convention of Standards of Training, Certification and Watchkeeping (STCW Convention) requirements and having adequate teaching arrangements. According to the STCW Convention every party shall ensure that all instructors of Maritime Education and Training institutions (MET institutions) are appropriately qualified for the particular type and levels of training they are responsible for delivering. This article presents a review of factors that are not included in the STCW Convention requirements and are considered important for the development of instructor's competences and appropriate best practice strategies for teaching and learning. Adoption of a wider set of guidelines, currently proposed by the International Maritime Organization (IMO), but not broadly adopted is advocated based on a fast growing industry and a need to continuously challenge and review safety standards.

Keywords: *Maritime science, Maritime education, Maritime safety.*

Introduction

According to analysis conducted by the United Nations Conference on Trade and Development (UNCTAD 2018), world seaborne trade has gathered momentum and reached 10.7 billion tons per annum, with an annual growth rate of 4%. The world's commercial fleet exceeded 100 gross tonnages in seagoing merchant vessels and, as of the 1st January 2018, consisted of 94,171 vessels and circa 1.9 billion dwt, representing an annualized growth of 3.31% when compared to 2017. Furthermore, world seaborne trade is projected to further expand at a rate of 3.8% between 2018 and 2023 annually. The current average age of the commercial fleet is 20.8 years, which would be considered old or outdated, and most probably, modern new ships will be equipped with the latest technology not present on the majority of current merchant vessels (UNCTAD 2018).

Advances in ship building, incorporating the latest technologies to comply with current and future requirements and expectations, make ships more complex

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to operate and maintain. Larger modern ships, with these new technologies (for example ECDIS) and operational complexities (such as different propulsion systems), potentially increase the risk both of maritime accidents and efficiency of seaborne transportation if operating personnel are not properly educated (Bielić et al. 2017). In order to increase adequacy of education International Maritime Organization (IMO) enforced model courses as an aid to instructors and lecturers in their work (Vujičić et al. 2018, Horck 2003). The International Transport Workers' Federation recognized the value of ongoing qualified personnel in paper from 2013 (p3), "the shipping industry depends on competent, well-trained seafarers to ensure safety of life at sea, maritime security, efficiency of navigation and protection and preservation of the marine environment" (International Transport Workers' Federation 2013). According to the Baltic and International Maritime Council's (BIMCO/ICS) Manpower report 2015, crew manpower increased significantly between 2005 and 2015. An estimated 1,647,500 seafarers (774,000 Officers and 873,000 Ratings) were working on commercial vessels during 2015. One of three main challenges presented by BIMCO is MET related. These include availability and flexibility of training, quality of MET delivery/ facilities and the effectiveness of competency assessments (The Baltic and International Maritime Council & International Chamber of Shipping, Manpower Report 2015). Each of these aspects is critical and form independent nodes which need to be combined to ensure optimal outcomes.

The quality of MET is crucial for effective seafarer development. Therefore, it became an imperative for countries wishing to effectively develop and sustain their maritime industry. New technologies and ship operations, followed by practices and STCW requirements, influence the demand for highly qualified instructors and assessors across the maritime industry and dictate the defined quality standards for education. New standards that are driving updates to critical navigation equipment such as ECDIS, emergency communications and cyber security regulations introduced more complexities.[1] Consequently, norms should be established regarding the proportion of on-shore vs. on-board experience which is required to impart the best level of knowledge to students or seafarers.

As per STCW Code, all seafarers should be appropriately qualified for the position that they hold onboard, as well as instructors, supervisors and assessors (IMO 2017d). Each Administration (IMO member states) will decide upon adequate requirements for instructors, supervisors and assessors in accordance with their respective national regulations. Of equal importance, Maritime college lecturers have to be properly qualified to have an appropriate level of knowledge and understanding of their subject matter and have an up-to date appreciation of modern day ship operations and of new technologies prevalent aboard modern ships (The Nautical Institute 2012). In order to increase safety at sea, seafarers need to be well educated and qualified (Belev et al. 2018). Training must be provided before and during sailing time, together with training assessment in order to ensure that the training goals of are achieved (Bal Besikci et al. 2019).

[1]https://www.marinemec.com/news/view,be-prepared-for-regulatory-changes-on-the-bridge_53623.htm.

Regulations and Standards

Besides STCW Convention which sets requirements for seafarers and lecturers, International Organization for Standardization (ISO) ensures, among many others, consistency and quality of organization that provides education for seafarers.

Not only do instructors in MET institutions need to have an appropriate level of knowledge and understanding of their subject matter but should also receive appropriate training in instructional techniques and assessment methods.

Training and assessment requirements as part of Regulation I/6 and Quality standards Regulation I/8 as per STCW Convention, place particular emphasis on maritime education. Guidance concerning the aforementioned regulation is part of section B-I/6 and B-I/8 of the STCW Code. Measures in section B part are not mandatory but provide effective suggestions and examples for administrations in terms of best compliance with certain Convention requirements (IMO 2017d).

As per STCW Regulation I/6 and section A-I/6 of the STCW Code, each IMO member state shall ensure that those responsible for the training and assessment of competence of seafarers, instructors, supervisors and assessors are appropriately qualified for the particular type and level of training or assessment they are delivering. This may vary depending on whether this is either on board or shore based (IMO 2017d).

As per the STCW Code, every person conducting in-service training, the assessment of competence or providing training and assessment within an institution shall (IMO 2017d):

- have a full understanding of the specific objectives of the particular training being conducted and have knowledge and understanding of the competence to be assessed;
- be qualified in the task for which the training is to be conducted;
- in the instance of simulator training, every instructor shall receive appropriate guidance in instructional techniques and gain practical operational experience on the particular type of simulators used.

According to the recommendations of Section B-I/6 of the STCW Convention (which is currently non-mandatory) any person, supervisor or assessor on-board or ashore, conducting in-service training of a seafarer intended to be used in qualifying for certification, should have received (IMO 2017d):

- appropriate guidance in instructional techniques and assessment methods using relevant IMO Model Courses;
- appropriate guidance in assessment methods and practice;
- gained practical assessment experience under the supervision of an experienced assessor;
- for those individuals responsible for supervising in-service training, should have appropriate knowledge of instructional techniques, training methods and practices.

IMO Member countries shall ensure that qualification and experience of instructors and assessors are covered in the application of the Quality standards provision of Section A-I/8 which incorporate appropriate training in instructional techniques, training and assessment methods and practice (IMO 2017d).

As per the non-mandatory section B-I/8 each Party or member country should ensure that the quality standard model implemented in MET institutions includes academic and administrative organization structure, staff responsibilities and procedures, qualifications of staff and sufficiency of equipment. MET institutions should ensure quality control at all levels of teaching, training, examination and assessment through internal and external audits (IMO 2017d).

The correct and widespread adoption of the IMO Model Courses could help to effectively implement the STCW Convention requirements with regard to knowledge, understanding and proficiency. The main purpose of IMO's Model Courses is to support training providers and competent teaching staff in designing and delivering new training courses but they do not extend to the provision of a comprehensive teaching package which instructors should follow blindly and are not an official interpretation of the STCW Convention.

The International Organization for Standardization (ISO) and its committees collaborate with national bodies in particular fields and set standards for institutions. As for ISO/IEC 17024 Conformity Assessment, the development of certification schemes, in response to the ever increasing velocity of technological innovation and specialization of personnel, can compensate for variation in education and training and thus facilitate the global job market. Assessment is systematic method and procedure for ascertaining work-related knowledge, skills, abilities or performance of a group or individuals (ISO/IEC 10667-2 Assessment Service Delivery 2011). Assessor training should be an integral part of any assessment training programme and have clearly stated performance guidance and training objectives which include training content, length and performance (Development Dimensions International (DDI) Task Force on Assessment Center Guidelines 2000).

General provisions about education, certification, training, knowledge and assessment of MET lecturers are set by national bodies of member states and can differ in each state. Factors affecting teaching practices and instructors' competences are elaborated in the next chapter.

Factors Influencing Teaching Practices and Instructors Competences

Maritime instructors should have all necessary teacher competences and be aware of all topics required by SCTW. They should also be cognisant of human elements and potential issues experienced by trainees that can affect the teaching progress. Awareness of the factors which could influence teaching and spill over into the behaviour of both the trainees and instructors is of outmost importance for adequate transfer of knowledge.

In author's opinion, factors influencing instructors' competences and defining the appropriately qualified instructors are the following (Figure 1):

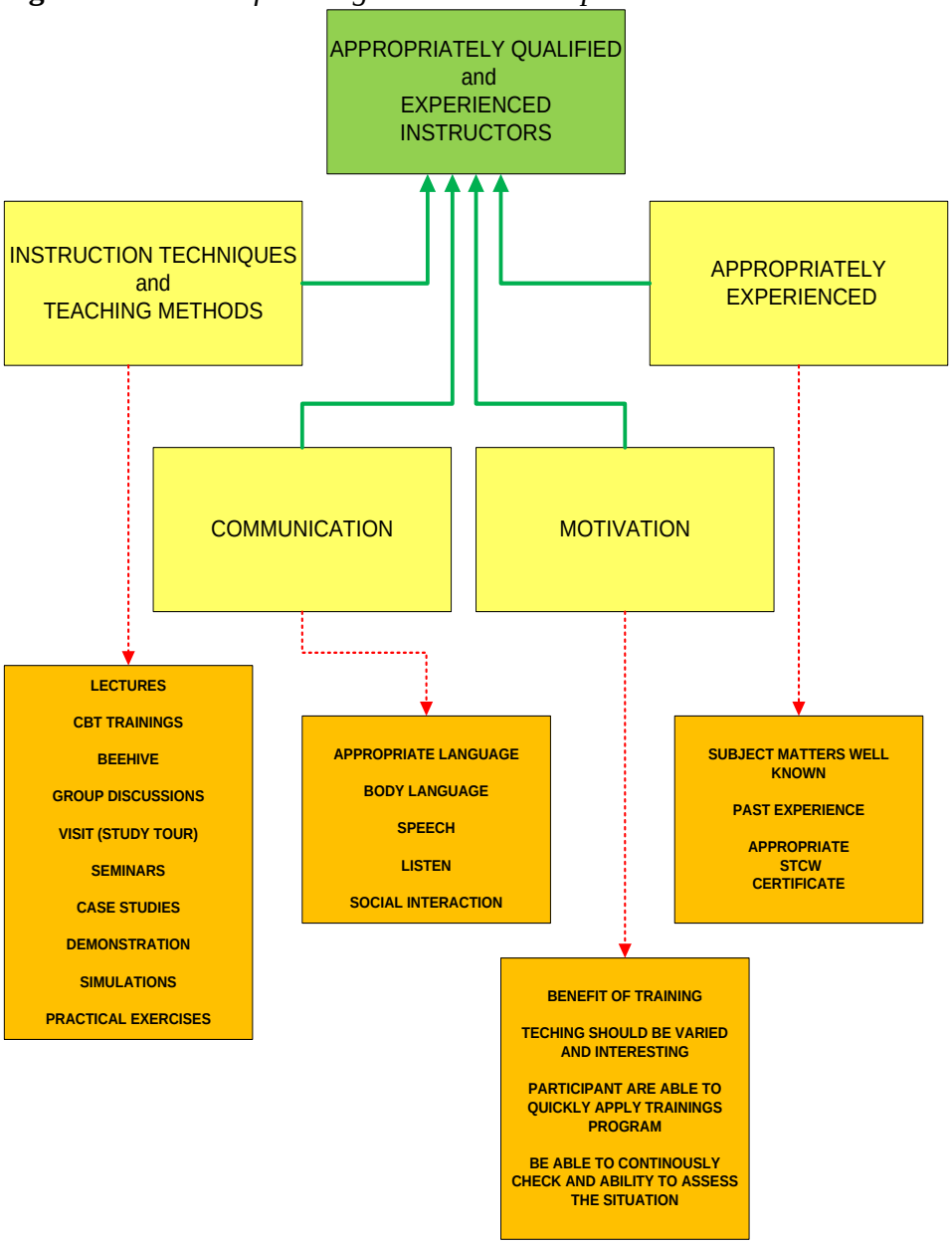
- Motivation – ability to self-motivate and motivate others (Tang and Sampson 2017, IMO 2017c, Kalulu 2018).
- Instruction techniques and teaching methods – accessibility to a conducive learning environment and teaching aids and ability to devise an appropriate training programme for delivery (IMO 2017c, Justice et al. 2007.
- Communication – ability to effectively monitor and communicate (behaviour analysis) with their students (IMO 2017c).
- Appropriate experience – having marine background and holding STCW certificates (The Nautical Institute 2012).

It is preferential for instructors to be respected in their field of work and to be acknowledged professionals who have the student's attention. Language barriers and cultural awareness can influence the teaching and learning processes and therefore instructors should be fully aware of the importance of clear delivery of both oral and written communication and materials. Ideas have to be presented in a clear and simple manner and instructors should be confident in their presentations (both in individual and group work). After delivering course materials the instructor should continuously and objectively adopt a systematic approach of the classes' effectiveness by looking for possible causes and effects (IMO 2017c). The aim should be to resolve any ambiguities and continually improve the materials for future use.

Motivation of trainees in each training, is critical to the success of a training course and it is also one of key factors for successful learning (Tang and Sampson 2017). Motivation can be described as the processes that can guide a trainee's behaviour in an appropriate direction (IMO 2017c). Trainees can be motivated through various methods such as feedbacks, surveys and course evaluations (Kalulu 2018). Intrinsically motivated trainee is the one who shows an interest in or is self-challenged to understand the subject matter. An extrinsically motivated trainee has a fear of consequences of failure or responsibility in a given topic (Zeigler-Hill and Shackelford 2016).

The instructor should be familiar with teaching strategies and should be able to select appropriate teaching skills for a certain group of trainees (IMO 2017c). The authors' experience shows that unmotivated group usually consists of over-experienced or over-confident mariners. Teaching should be diverse and interesting, and trainees should be able to understand the concept of the training programme. Instructors should continuously check and assess the motivation and the trainees (IMO 2017c). Occasionally, an overly experienced instructor and a jaded attitude due to a long-term teaching routine and a lack of diversity may also influence the motivation of trainees.

Figure 1. *Factors Influencing Instructor's Competences in MET*



Source: Authors as per (The Nautical Institute 2012, IMO 2017c, Tang and Sampson 2017, Justice et al. 2007, Kalulu 2018).

The instructor's STCW qualification has to be at least at the same level as the STCW qualification of trainees. 'Appropriately qualified' implies knowing the present situation on board modern commercial vessels. Refresher sailing periods are the best way to assure this (The Nautical Institute 2012). The trainees' sea experience, their personality, cultural background and age could have a strong influence on the teaching method to which they respond best. Experienced instructors can assess the situation and resolve any potential problems by communicating with trainees or individuals in advance or after the first training session.

Appropriate teaching methods could improve effective instructor qualification. Simulation and practical exercises, effective demonstration skills, group discussions, case studies and controlling trainee's behaviour are effective teaching methods, which together with technical knowledge should improve the instructor's effectiveness. As part of research of this topic, authors have solicited the opinions of a number of MET institutions as to their use of the appropriate IMO Model courses and training for their instructors to build appropriate teaching competences (questionnaire).

The education systems and cultural background of trainees across the maritime sector considerably vary globally. Any MET institution must be accredited by an authorized professional or governmental authority, either national or international, in order to ascertain that a continued high standard of quality is assured. Brief requirements from The Code of Qualifications and Seafarers' Certificates of Qualification in the Republic of Croatia are given in the text below as an example. The Code is published by the Official Gazette of The Republic of Croatia (No. 130/13) and it regulates qualifications, educational requirements, examination programmes, qualification programmes, conditions and ways of obtaining certificates and additional qualifications for the Master, Chief Engineer, Mates and other crew members of seagoing vessels. Besides the aforementioned, The Code also regulates the following (Učur 2014):

- Conditions which must be fulfilled by the universities and high schools which educate candidates for certificates for qualification.
- Conditions which must be fulfilled by the examiners and members of the examination committees.
- Procedures and the way of issuing the approval to the institutions which organize seafarers' qualifications,
- Procedures and ways of issuing certificates for qualified seafarers education.

The Code has been compiled in accordance with certain EU Directives (Učur 2014). Part G1 of the Code covers basic requirements and part G2 covers specific requirements including quality standards, technical requirements for instructors and educational programmes (The Official Gazette of The Republic of Croatia No. 130/13). When concerning teaching staff every teacher or instructor should have:

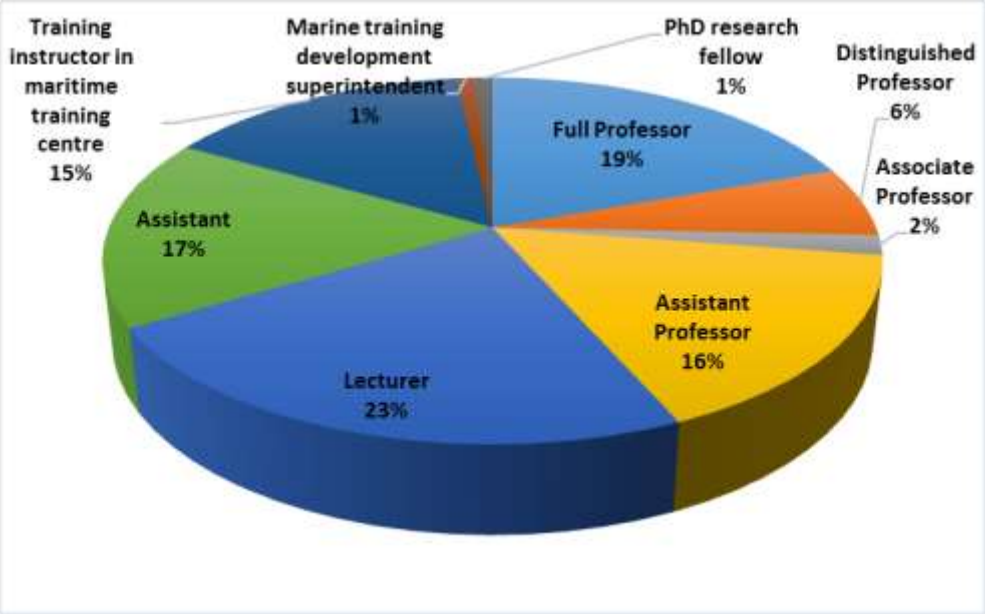
1. Sufficient sea-experience and knowledge in the relevant subject.
2. Knowledge of the entire programme of education/training in which the teacher participates.
3. Knowledge of the specific objectives of the relevant education or training.
4. Knowledge of relevant teaching methods, their application and effects.
5. A conscientious and consistently adaptable approach to incorporating technological and other changes in shipping into teaching activities.
6. An ability to evaluate and favourably shape the professional and human personalities of the participants, as future seamen.

Methodology

In order to determine current situation and address the main problems in teaching the authors conducted a survey. Tool for the survey was questionnaire based both on literature review and authors expert opinion. It was available online (google forms) over social media networks and in a paper form. In order to avoid a biased participation in the questionnaire it was anonymous and confidential. Furthermore, before final survey, pilot survey was prepared in order to avoid the response bias. Authors did not offer any incentive since it could also result in speed runs of some respondents. All questions within survey were as neutral as possible in order to avoid stereotype bias. Finally, it was disseminated all over the world in several MET institutions in order to compile answers from as many different institutions as possible.

Questionnaire involved 113 instructors of different nationalities and ranks working in MET institutions all over the world. Nationalities of respondents were Croatian, Turkish, Montenegrin, Panamanian, Singapore, British, Latvian, Indonesian, Polish, Italian, Russian, Spanish, Japanese, Georgian, Filipino, Swedish, Vietnamese, German, Canadian, Peruvian, Egyptian, Bangladesh, French, Dutch, Norwegian, Indian and others.

Figure 2. *Majority of Academic Ranks and Non-Academic Ranks*



Source: Authors.

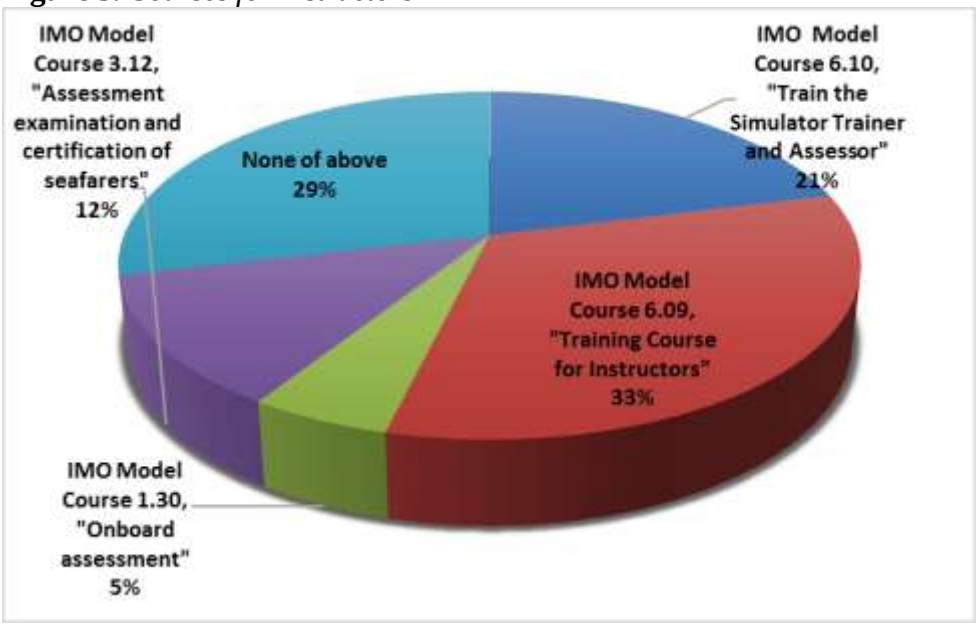
Academic ranks and non-academic ranks represented in survey were aged between 35 and 45. Academic ranks were Full Professor, Distinguished Professor, Associate Professor, Assistant Professor, Lecturer and Assistant working in Faculty of Maritime Studies or University. Non-academic ranks in maritime trainings centres were Training instructor in maritime training centre and Marine training development superintendent working in maritime training centres (Figure 2).

Results

Basic difference between section A-I/6 and Section B-I/6 of STCW Convention are that specific requirements in section A are necessary for instructors' competence and B are some recommendations on how those competences could be achieved. For instance, in part B it is mentioned that relevant IMO Model Course(s) may be the assistance in preparation of the training courses. There are also relevant IMO Model Course(s) and methods which could assist maritime training instructors in their teaching.

In one question respondents were asked to tick course or courses that they have attended. The analysis of answers shows (29% respondents) that this guidance is at best overlooked and at worst unrecognised. Only 33% respondents were familiar with the additional recommendations of the IMO Model Course 6.09 which is recommended as a supplement to the STCW code in the section B (Figure 3). This highlights a gap in the understanding of certain individuals in the current thinking on safety and preventive measures.

Figure 3. *Courses for Instructors*



Source: Authors.

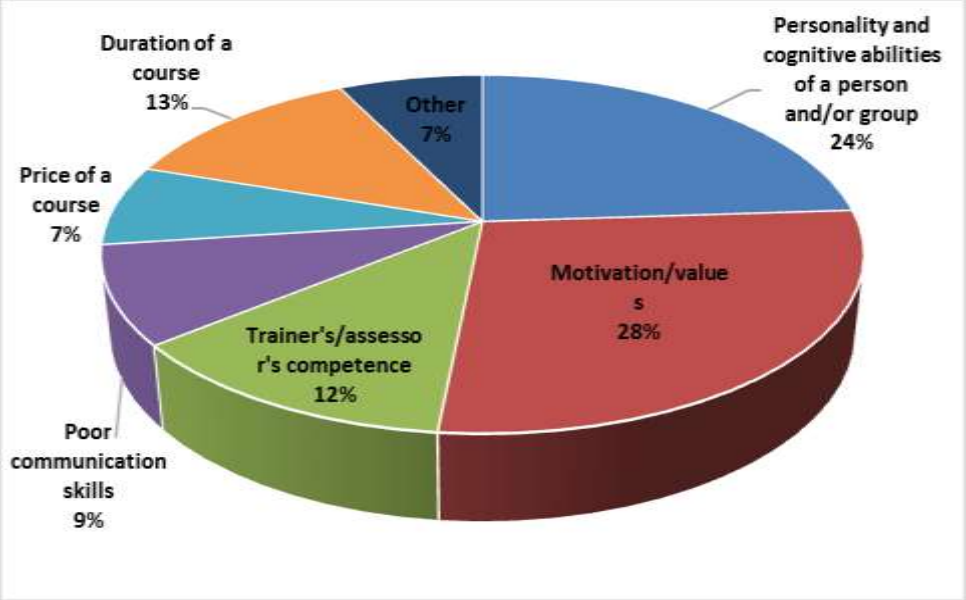
IMO Model Course 6.09 includes planning and preparation for effective teaching, methods and instructions and evaluation of the teaching and learning process (IMO 2017c). IMO Model Course 6.10 provides necessary knowledge and skills in instruction techniques using simulator. It is intended for nautical and engineering instructors as a tool for effective teaching (IMO 2012). IMO Model Course 1.30 and 3.12 could be suitable for experienced shore-based instructors with sufficient onboard experience and personnel of the training institution who conduct examination leading to the award of COC and other documents (IMO 2017a, 2017b).

When asked if they are satisfied with the available teaching materials, 71.4% of the respondents answered affirmatively and 28.6% negatively.

According to questionnaire analysis 55.8% of respondents have the highest Certificate of Competency (COC) Master and Chief mate (Management level) 500 GT or more and 16.3% Certificate of Competency (COC) Chief engineer and second engineer more than 3000 kw (Management level).

As for the analysis of the given answers, the major problems of disruptions during courses by attendees are motivation (28%), personality and cognitive abilities (24%) followed by the duration and the price of courses (Figure 4).

Figure 4. *Reason of Attendees Disruption the Classes*



Source: Authors.

Personality could be defined as a natural tendency to act spontaneously in a certain way when in a specific situation and it is usually consistent during lifetime and is making people different. The BIG 5 Model consists of open mindedness, control, enthusiasm, affection and emotional stability (Murugesan and Jayavelu 2017). Cognitive abilities are perception/attention, reaction times and reasoning skills (Ispas and Borman 2015). Motivation could be defined as an energy that activates, supports and maintains behaviour towards certain direction or individual concern in a specific situation. Competence in social interaction (activate the participant), teaching and continuous assessment of understanding could motivate trainees. Motivation can be influenced by adequate environment, interesting and varied teaching, involvement of participants, etc. (IMO 2017c). Instructor qualification, motivation and personality can influence motivation of the trainees.

Conclusions

Whereby the STCW puts a significant emphasis on the qualifications required from instructors and assessors, it gives very little specific information as to how training should be best delivered and associated with the teaching methodologies. Maritime instructors, supervisors and assessors are to be properly qualified for the specific type of training and courses they provide in accordance with the STCW Convention. However, it is up to each respective Administration to decide the adequate requirements and competencies required for teaching and instruction in accordance with individual national regulations. Authors propose the IMO Model courses to be an obligatory component of qualification for MET instructors and assessors given that almost all factors which have been identified as potentially problematic are included as the main topics of some IMO Model Courses. Finally, the authors propose that pedagogical competencies and a minimum knowledge of the IMO Model Courses 1.30, 3.12, 6.09 and 6.10 should be part of the minimum requirements for 'adequate' instructors in MET institutions. Besides courses, 'appropriately qualified' implies knowing the present situation on board modern vessels. Refresher sailing periods are the best way to ensure this. Therefore, the quality of instruction will largely depend on the experience and expertise of the staff in the training institute; which means that, despite the global acceptance of the STCW, there still will be considerable differences between various MET institutions and consequently between the product of their educational efforts.

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