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EDUCATIONAL TECHNOLOGY IN MET SIMULATOR BASED TRAINING AND INFORMATION TECHNOLOGY IN MET

AMR MONEER IBRAHIM & AHMED KHALIL TAWFIK

Arab Academy for Science, Technology & Maritime Transport, Alexandria, Egypt

ABSTRACT

No doubt Information Technology (IT) nowadays is involved in almost all of our modern lifestyle in one form or another; simple tasks like making a phone call or reserving a table for dinner will not take place without the interference of IT. If this is the case in simple life tasks, then it would be more appropriate and practical to use IT in education.

Maritime education is a vocational education to a great extent. The best educational method in any vocational education is on-site training, backed up by theoretical lectures. Most of Maritime Educational and Training Institutes (METs), and because of number of factors, are doing it exactly the other way around, Theoretical lectures backed up by on-site training.

This paper is trying to illustrate and discuss how to resolve this dilemma and amend the MET's educational policies in order to put more vocational reality weight into their theoretical education with the usage of information technologies.

KEYWORDS: Assessment and Evaluation, Computer Based Training, Distance learning, E-learning, Education, Educational Policies, Information Technology, Maritime Education, MET, Sea Time Remission, Simulators, STCW, Training, Vocational Education, Web-Based Learning

List of Abbreviations

CBT: computer Based Training

CD-ROM: Compact Disc – Read Only Memory

DGSM: Directorate General of Shipping and Maritime Affairs

DNV: Det Norske Veritas

DP: Dynamic positioning

DVD: Digital Versatile Disc

ECDIS: Electronic Chart Display and Information System

E-Learning: Electronic learning

ER: Engine Room

IMLA: International Maritime Lectures Association

IMO: International Maritime Organization

ISO: International Organization for Standardization

IT: Information Technology

MARENG: Maritime English

MCQ: Multiple Choice Questions

ME: Maritime English

MET: Maritime Education and Training

QMS: Quality Management System

RORO: Roll on / roll off

SMCP: Standard Maritime Communication phrases

SOLAS: Safety of Life at Sea Convention

STCW: International Standards for training and Watch keeping

USCG: Unites States Coast Guard

WBL: Web based Learning

WBT: Web Based Training

WMU: World Maritime University

INTRODUCTION

Maritime education is by far a vocational education, students during their primary maritime studies should be prepared to work in a harsh, unfriendly, strict and sometimes even hostile environment, yet, they are required to do so in the most proficient, and competent method.

In order to do so, students (in a perfect world) should be educated in the same environment they would work in after graduation. However due to the impracticality of this method of education because of various reasons (mainly financial ones); most Maritime Education and Training (METs) institutes follow a pattern of a mix between practical and theoretical education.

To this extent, there are no major problems. Unfortunately, this is not the case. Most METs over rely on theoretical education over practical education, mostly because of its availability and ease of application in an educational policy, and no matter how hard an MET institute tried to increase the time students spent on an on-hand job, still would not reach a satisfactory level of vocational competence.

This paper is trying to illustrate how an MET institute may put more weight on its practical education through converting theoretical education from plan lectures into something that would put the student in a practical-like environment through the usage of Information Technology.

It will also discuss the concept of “Sea-time remission” and how some countries had approved the reduction of required Cadet-ship time using Simulators. And finally, a short presentation and evaluation of one of the various E-

learning methods being used widely in the Maritime educational sector nowadays will be presented.

E-learning Methods

Ward (2002) defines e-learning as "learning that is supported by information and communication technologies", and "may encompass multiple formats and hybrid methodologies, in particular, the use of software, Internet, CD-ROM, online learning or any other electronic and interactive media"

A learning method is successful when it holds added-value to learners and proves through assessing, that learning outcomes were achieved. From that perspective, this paper will examine three methods of e-learning devices.

Simulators

Simulator-based training is one of the key factors in any considerate MET institution nowadays. The need for the simulator is caused by financial and environmental pressures that are leading to insufficient availability of training grounds. Simultaneously, simulators are becoming easier to manufacture and cheaper to buy.

Cross (2011) believes that simulator training is mainly of a psycho-motoric nature. Simulator environment allows cadets to practice skills / competences that he/she would take longer time to obtain, especially with the trend of short sailing times and less port-stay.

On higher levels, simulators put seafarers in conditions and situations he/she would not normally encounter in his / her daily routine. Not to mention, it runs under projection of real-time, physical realism, and well-prepared scenarios, this would put the trainee under the same psychological pressure he would endure when dealing with the same situation on-board. The difference is that consequences of failures in a simulated environment are incomparable to consequences on a real ship. This kind of low-cost, safe, and fast training had become indispensable for officers moving up ranks or preparing for command. Simulators simply allow the luxury of learning from your own mistakes.

As an assessment tool; if the three assessment elements (objectivity, reliability, and validity) were achieved in any assessment tool, then this tool would reflect the candidate competency level. Using simulators in assessing may be influenced by the assessor as an individual, which endangers the assessment objectivity. SEA system (Simulator Exercise Assessment) was introduced mainly to avoid subjectivity in assessing performance in simulator-based training. It developed an automatic assessing method to assess performance against “hard parameters” inserted by the instructor, while leaving the “soft skills” to be assessed subjectively.

On the other hand, simulators are like any other kind of electronic devices, liable for breakdown if not maintained properly and needs qualified instructors to operate it. Misuse of simulators may result in over / under confidence of the trainee, having the training program too easy or too hard may have unsatisfactory consequences; Poor-designed programs would not deliver required competences either. Therefore, quality training under qualified instructors is the only way to guarantee satisfactory results.

Web-Based Learning / Training

“Web-based learning is the confluence of three social and technical developments: distance learning, computer-convoyed education, and internet technologies” says Horton (2000). Understanding that, any MET institute can use WBL to draw student’s attentions to new educational technologies putting them on the road of self-paced education that awaits them after graduation.

Main advantages in any WBL is that it is “online”; this means that learning programs can carry more than a normal DVD would, and that materials are constantly available and updated. This makes the teacher’s job (if any) allot easier. In contrast, McKimm, Jollie & Cantillon (2003) claims that literature on WBL shows that poor internet access may be a bigger issue than the course materials itself. This affects the use of such WBL on board ships, when the matter of the fact is; internet is still a distant hope for most seafarers on-board.

In the designing process, programmers can use “plugins” or “addons” to produce interactive course materials adds entertainment to educational materials, says McKimm, Jollie & Cantillon (2003). This enables better teaching techniques and increases the learner’s interaction making them feel in-control, thus more responsible and effective education is produced. Speaking of which, WBL promote collaborate education, not only in the class room circle, but extended internationally with users using the platform synchronously.

Furthermore, Lynch (2002) argues that “faculty development is critical to the success of any web-based education effort”. This requires training academic staff to be in a better position ready to handle this methodology.

From assessment perspective, it is a reliable, valid, and objective tool, being “online” allows access to huge databases of questions and tasks. However, like most electronic based assessments, it depends on qualitative methods and does not support subjective assessment; therefore, it only reflects lower cognitive levels.

Computer-Based Training / Learning

CBT is the most simple and primarily form of e-learning; still, it is the most commonly used in the maritime field. Williams & Zahed (1996) defines CBT as “a technique of instruction which involves defining what is to be learned, breaking the learning into component elements, and sequencing these elements via computer”

The mobility and independency of CBTs are the main factors of its privilege and the secret behind its broad usage in the maritime field, especially on board ships where it is favoured on WBL because of scarce of internet. There are limited companies that shown interest like Marlins, Seagull or Video-Tell; all were leading companies in this field recognizing seafarers need for constant training with their limited access to conventional educational institutions.

Unfortunately, independency has drawbacks; CBTs can easily be outdate, especially when it is related to IMO conventions that are constantly updated. Also, prevents renovating the data within, meaning that a consumed CBT most probably will not be reused, considering its price.

Another barrier to efficient CBTs is the consumers themselves, People acquainted to conventional methods may have trouble dealing with CBTs, people with language difficulties, computer literacy, or lack of interest, may find CBTs challenging.

CBT functionality in assessment is limited but fairly accepted for knowledge-based rather than competence-based education. Lynch (2002) states that any computer-based education mainly use objective assessment “which often measures only low-order thinking skills” and rarely reflect high cognitive levels in Bloom’s (1956) taxonomy. Assessments although valid, but doubtfully reliable, due to limited questions stored within the program, making it unjustly possible for learners repeating the assessment and improving results.

Implementing Simulators in MET Institutions

Simulators are considered an essential factor in the Maritime education process nowadays. Establishing a new

simulator department in an MET is a hard task, with a lot of issues that needs to be evaluated and considered beforehand. A practical way to manage such project is to divide the tasks into two phases.

Phase 1: Infrastructure

Type of Simulators

There are several types of marine simulators manufactured to serve different sectors of the industry. Simulator types to be purchased will be decided according to:

Funding and Payment Method

How much money is dedicated for the project, will the funding be on single or several payments? Funding and payment method will sort simulators being purchased through a prioritization process, where simulators with higher priority should be purchased first. This requires having a list of required types of simulators sorted according to its essentiality to the education process. This list should be approved from all departments in addition to the top management.

Targeted / Expected Students

Selecting simulators and allowing them to determine the training programs leads to courses and training programs being dictated by the simulators type. Instead, choosing the tools should be decided according to the training needs of the institution (Lynch, 2002). In this process, the management needs to analyse and define the basic needs of training in the institution.

Simulators types can be chosen according to the nature of the MET institute, the needs of the region, or the expected sector of seafarers that are more likely to come for training. Everything is related when it comes to this matter. For example, if the MET was for undergraduates, the simulators should be mainly for ship-handling, engine and cargo operation. If the MET was a training centre, more sophisticated simulators may be required like dynamic positioning (DP), dredging, or anchor handling. If the centre was in North Sea region, then trainees are expected to be interested in offshore services training….etc.

Instructors Availability

Instructors may be the main problem for any new simulator establishment. Due to the worldwide shortage in seafarers; a shortage in maritime instructors is accumulated (Cross, 2012). Simulator instructors are even harder to find because of their special training requirement according to STCW. Availability of instructors is an essential point to consider. The MET can buy a DP simulator with massive amounts of money but would not find suitable instructors for the job. “A teaching tool is as good as the instructor using it” says Cross (2011). A plan shall be emplaced, either for training candidates internally, or by hiring externally.

Regional Simulator Centres

Surveying simulator centres available in the region and the service they provide might be useful to avoid any unnecessary competition and to amend own priority list, taking into consideration the market needs and maybe future collaboration.

Operating Staff

In addition to instructors, a team of technical-support staff will be responsible of operating, up-keeping, and

periodically maintaining the system. Training courses may be needed to prepare this team, internally or externally. Some simulator manufacturers offers training programmes for operating staff in their own training centres prior to equipment installation (Kongsberg, i.e.).

Place to Be Installed

A simulator establishment requires a place suitable to accommodate certain equipment depending on simulator's type. Some require high-ceiling like the 360 bridge simulator. Others require a room with specific dimensions for equipment layout like ECDIS simulator (IMO, 2012) or DP simulator.

Simulators Providers

There are many simulators manufacturers in the market; a thorough study is needed to choose between deferent makers, taking into consideration the items mentioned above, not to mention prices and after-sale service. An opinion of an expert can be useful.

Phase 2: Operational Readiness

Training Programs

Training programs is the "heart and soul" when using simulators as a training and assessment tool, the efficiency of training depends on the training program. The tip-top simulator technology cannot ensure training quality without a well-designed training program. That includes curriculums, exercises, and lesson plans; all should be predefined well in advance. Programs maybe later developed and enhanced after purchasing the simulators says Farmer, Rooij, Riemersma, Jorna, & Moraal (1999).

Accreditation

There are obligatory and optional accreditation that is required to Marine simulators designed for training/assessing seafarers; obligatory, like the country's maritime administration (IMO, 2011), or Nautical Institute when operating DP simulators (Nautical Institute, i.e.). Optional, like the DNV's ISO, which certify the simulators against Marine Simulators Standards (DNV, i.e.). Although it is voluntary, yet supports the MET QMS and adds market-value to the centre. Sea-Time Remission Using Simulator-Based Training

STCW forces Cadets to undertake a period of 12 / 18 month before endorsing him/her to work as an officer in charge of a navigation / engineer watch. The cadet should train in this period on all kind of practical matters that had been covered theoretically during his / her studies.

Some countries had enabled a system that allows a remission of that sea time by attending training courses on simulators covering deck, engine, and cargo, during of which, the student will undertake exercises increasing his competence in these fields.

According to Cross (2012), it started in Norway 1987, after a shortage in second engineers, they introduced a plan to reduce sea-time from 18 to 12 months + 6 weeks ER lab + 3 weeks ER simulator. It was adopted in Netherlands 1994, following a study concluded that students had improved their performance by 83% after 120 hours (15 days) of simulation. Therefore, a reduction of sea-time by 60 days is granted if the student successfully attends 120 hours of simulator.

Although remissions system is used in USCG, Honk Kong, India and many countries, where the usage of simulators are common, knowing that STCW had not strictly limited the training to ship-board training. However, the fear

still exists that seafarers with remissions will be less competent than seafarers with full sea-time.

The main concept behind sea-time is that seafarers gain all the competencies they need un-structurally, to qualify as an officer of charge, according to his working level. Sea-time remission is simply transforming training from unstructured to structured. Therefore, the main question shall be, is structured training is of any added-value over unstructured training, and if so, are experiences and skills lost when replacing sea-time will degrade seafarer's competence? This inquiry was introduced by the National Research Council (1996) assessing the use of marine simulators as a substitute for sea-time training. To answer this inquiry, a study by Directorate General of Shipping and Maritime Affairs (DGSM, 1994) compared two groups of students; one had completed full sea-time training, while the other attended only three weeks of simulator training, in the attempt of determining how many simulator hours will compensate for the cadet's first 30 days of sea. The study concluded that "30 days of sea time could be replaced by 40 hours of simulator time".

However, there is a lot more to learn from onboard training other than STCW competences, in form of hidden curriculum, experiences, self-confidence and living the high-tension life of ships. This cannot be replaced under any circumstances by simulator training. Therefore, any training center should design carefully what kind of competences the training program will provide, leaving the rest to the onboard period.

It is clear now that any MET / Administration wants to allow sea-time remission, should take responsibility in ensuring the quality of its simulator's training programs, and that it provides quality-training with qualified/certified instructors with specified training objectives that would justly compensate deducted sea-time. As Barsan (2009) said "You could have the most expensive and up to date simulator on the market, but without well-designed simulation scenarios, the training aims will not be achieved"

To conclude, onboard training had been traditionally the sole source of skills/competence for seafarers, and it still remains to a great extent. However, it would be unpractical to turn a "blind-eye" to the blessing of technology in the form of high-tech marine simulators and its role in enhancing proficiency of seafarers. Nevertheless, the excessive / uncontrolled / poorly-designed training may have reciprocal results. Therefore, any sea-time remission program must ensure that seafarer competency are not compromised by carefully designing programs focusing on skills that structured simulator-based training would be more effective in, areas where ship's safety maybe endangered.

Evaluating a Web-Based Learning Sample

Title "MarEng plus"

MET Relevance

It teaches Maritime English (ME), using terminology employed on-board ships, ports, and different aspects of the shipping chain (European Commission, 2010b); this learning program will not only improve the general user of ME, it also utilize the language usage on different levels. In addition, it collaborates with terms/vocabulary used in the Standard Marine Communication Phrases (SMCP) (IMO, 2002) and facilitates its usage into the day-to-day work on-board.

Delivery Method

The contents are divided into three levels, elementary, intermediate, and advanced. On each level, there are topics that the student should cover during his/her ME studies. For example, in the elementary level, there are 9 sections; cargo /

bridge / engine-room / radio-room/ first aid /weather / severe weather / environment, and security. Each section is sub-divided to different working activities that take place in this section. For example, cargo section, is sub-divided into; bulk / container / liquid / dangerous cargo, and RoRo. Each sub-division contains exercises/tasks educating learners about the language used in this particular sub-division. Furthermore, it includes a glossary of all words used within the program for further perusal.

On the other hand, the program takes into consideration that ME teachers may not enjoy a maritime background, and for that it provides an extensive "teacher manual" demonstrating optimal use of the program, describing its compatibility with IMO ME model course, "answers sheets" for all exercises, and illustrating how to utilize the glossary in class activities saying "The glossary should not remain a passive collection of words but, if possible, should be used actively within the program."

Content Quality

This program was developed by more than 27 educational, shipping, and administrative bodies, funded by the European Commission, and driven by the feedback from the industry on the necessity of having such a learning tool. This gives the program quality assurance; it was designed by the stakeholders themselves, and according to practice requirements.

The quality of the program is also supported from its side-to-side consistence with model course 3.17, and with SMCP when taking more interest into vocabulary and pronunciation of words rather than grammatical structure.

What is noticeable, that it does not provide students with correct answers when they answer wrongly, although the exercise is not completed before the student gets all the answers right. Fortunately, if the exercise were to be re-taken, the questions will be re-shuffled, so that students will not answer memorizing the questions order.

Content Attractiveness

The program are designed in an attractive interface, using pictures, soft fonts, and coloured backgrounds, it surly does not resemble dull educational CBTs that uses dark backgrounds with text-rich pages. Being a web-based program allows larger areas for designers to work with its "user-friendly" aspect.

From educational perspective, it uses over 20 different methods of exercises; from crosswords to MCQs to complete the missing words, this saves the student from getting board of repetition and opens the door for intervention with the topic. Also uses modern methods of teaching by reading, listening and viewing pictures of the word simultaneously, with the possibility of stopping, replaying, and repeating a miss-heard word or a phrase. Hill (1990) confirms that using pictures is useful in linguistic education; it stimulates the brain to digest the word and make students recall the sound of the word when the word is read or its picture seen. In addition, it helps to draw student attention outside the closed classroom environment.

Course Duration

There is no specified duration, although it is related to the student completing model course 3.17, which is designed to be completed in 470 hours (IMO, 2009)

Assessment / Evaluation Method

There is no assessment / evaluation included in the program. Still, teachers can use the exercises within as an assessment method, using the answers key sheets for model answers. The exercises themselves are printable; teachers can print an exercise and use it as quizzes or in group-work. Following the same pattern, the glossary included can be used to design subjective assessments as writing essays or assignments for hierarchized cognitive levels.

CONCLUSIONS

In conclusion, MET institutes, like any other educational institute, are in an ever-lasting conflict between educational goals and economical limitations; such a dilemma is far from being resolved. Indeed, it can be controlled / reduced, and that what makes one MET institute better than another.

This paper followed a pattern that would help any MET institute to move towards more practical education without putting extra pressure on the financial burden, throughout the developing of its e-learning facilitations on different aspects. Some of those facilities, on one hand, may need some moderate budgets; on the other hand, some would need only a good will for development.

The paper also introduced a simple demonstration and an analytical review for a wide-spread CBT in the maritime sector, in order to examine this method of training for its successfulness and effectiveness in the maritime educational process.

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