Computer Based Training: A Global Survey of Current Developments and its Application to Maritime Education and Training

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ABSTRACT

The specialized training of marine students, seafaring cadets, and crewmembers has seen numerous changes in the last few decades. Reduction in personnel and budget cutbacks have led Maritime Education and Training (MET) institutions and shipping companies to utilize new forms of technology to achieve their training objectives. Training mariners at sea no longer remains the only option. Increased demands to reduce cost have led to the development of new training methodologies. The important goal of any method or program is to ensure that quality training is achieved.

With advances in computing power over the last few years, the ability to develop and run interactive media applications has advanced tremendously. Today's desktop and even laptop computers have the computational power, speed, and storage capacity to handle content-intensive multimedia software applications. Parallel with the gains in computing technology have also come rapid advances in training mediums available to instructors. This field of newly developed training mediums has become filled with terms: computer-based training (CBT), computer-based instruction (CBI), computer-assisted learning (CAL), online learning, multimedia instruction, and digital multimedia instruction, to name a few. Each of these terms and existing training systems put a slightly different spin on the same basic theme.

This paper discusses the development and methodologies of Computer Based Training (CBT) from a global point of view, and their applications in MET institutions, and for onboard training. It also considers the impact of CBT on those involved in taking decisions in choosing the training media in MET and in shipping companies.

1. Introduction

The use of computer-based training (CBT) has been increasing over the past few decades. In that time-span incredible advances have been made in computer technology and its availability at relatively low prices has led the educational service to encourage the use of computers in MET institutions and at home. The rapid developments in programs allow interaction via text, graphics, voice and the most recent developments in microcomputer technology provide even greater power and ease of use through advanced visual and auditory devices (Alessi & Trollip, 1991).

In addition, the ability to combine a wide variety of multimedia content is a great advantage to increasing retention of new knowledge. Today's multimedia capable PCs allow developers to take advantage of the fact that people, as educational research indicates, learn 20% of what they see, 40% of what they see and hear, and 70% of what they see, hear, and do (Muirhead, 2000). If that is the case, the combination of computers, networks, and multi-media capabilities is clearly a formidable educational tool. Thus, to create a complete multi-sensory learning program is to allow students to interact with the material, and to learn according to their own needs, pace, and learning styles.

2. Use of CBT

2.1 Definition of CBT

The Nautical Institute has researched and debated the role of computer based technology in training and assessing seafarers, and defined CBT as: "… a broad generic term to describe how computer-run software can be used in support of training applications. These may include initial training or for imparting or reinforcing underpinning knowledge". Furthermore, Dumbleton, (2001, p.3.3) gave a specific definition of CBT for mariners:

CBT for mariners are courses which:
1. Are used by students without the need for support or assistance by instructors.
2. Have built in assessment and produce records of the training time and the student identification.
3. Are interactive.
4. Use multimedia technology.
5. Are run on standalone PCs, networked computers, the Internet, or corporate Intranets.
6. Are run aboard ship or at shore side locations.

However, Eldridge, (2000, p. 2.3) defines CBT as: "… simply another means of delivering good quality training. If we treat it as a separate issue, we are in danger of giving it more than deserves".

The former two definitions give a broad view, in the author's mind, as to how learners, seafarers, and instructors describe CBT. Thus, we may consider CBT as an interactive training using the computer as a delivery medium. The usage of multimedia (the integration of text, photos, graphics, animation, sound and full motion video) creates a dynamic communication environment for learners. CBT, however, does not replace the instructor. Rather, the instructor becomes more effective since the learner will have more time to devote to supervision and counseling (even by e-mail).

2.2 CBT Structure Methodologies (Models)

Training is an important issue in the maritime field and may be carried out in schools, onboard ships, or at the trainee's home by using CBT programs. Below the author presents five CBT structure methodologies (tutorials, drills, simulation, games, and assessment), any one of which could be used in training with standalone PCs.

2.2.1 Tutorials

Tutorials aim to deliver information, skills and guidelines through the initial use of information and skills (Alessi & Trollip, 1991). Figure 1 introduces the structure and sequence of a typical tutorial.

2.2.2 Drills

The computerized drill is a methodology used primarily for trainee practices for retention and fluency of the training process.

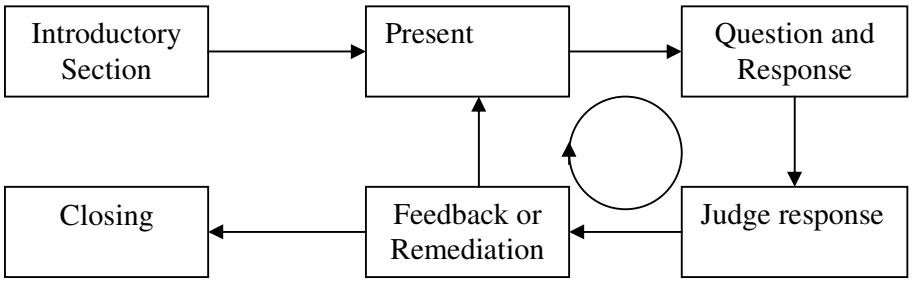

Figure 1: The general structure and flow of a tutorial
Source: Computer-based instruction (Alessi & Trollip, 1991)

2.2.3 Simulation

As the trainee becomes increasingly competent in dealing with the simple case, the simulation then adds details to bring the trainee close to the reality. Figure 2 illustrates the general structure and flow of simulation.

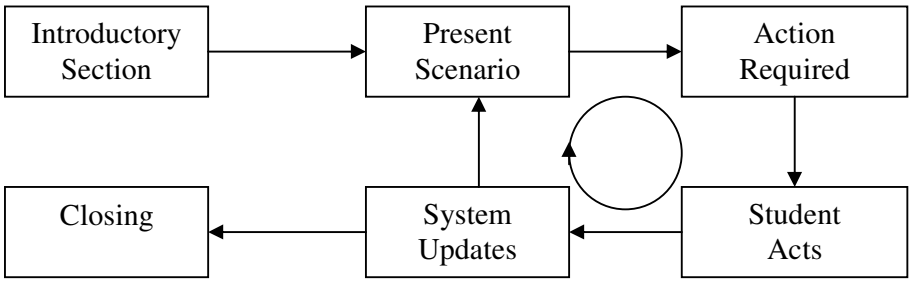

Figure 2: the general structure and flow of simulation
Source: Computer-based instruction (Alessi & Trollip, 1991).

2.2.4 Games

Games are similar to simulation, to a great extent, as both provide an environment that facilitates training and the acquisition of skills. Moreover, their effectiveness is based on

the fact that nothing is more relevant to the trainee than his/her own reactions, understanding, observations, and beliefs (Hoyt, 2001). Hoyt encourages using games onboard vessels, as seafarers will enjoy the training and will not feel it is a drudgery interfering with their free time. Figure 3 illustrates the general structure and flow of games.

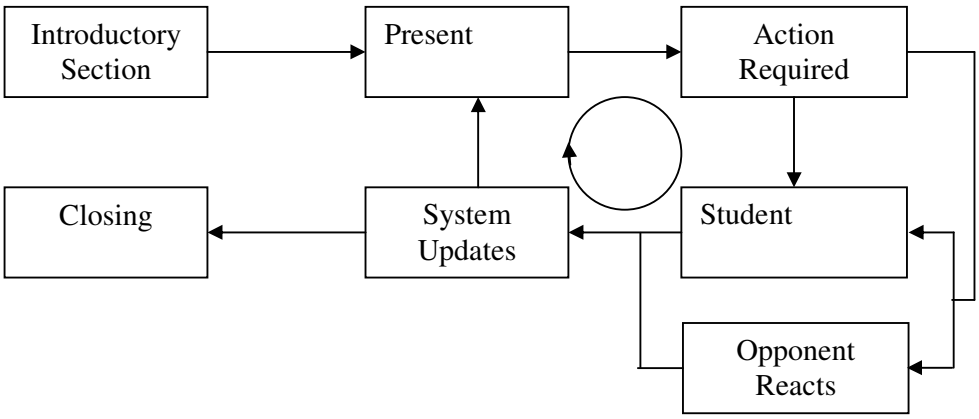

Figure 3 :the general structure and flow of games
Source: Computer-based instruction (Alessi & Trollip, 1991).

2.2.5 Assessment

Assessment is used for many purposes, including the determination of a learner's knowledge (what he/she knows, and what he/she does not), and ranks learners in order in terms of performance, language level and others. CBT is used for assessing individual performance against the agreed competency standard (the outcomes required in the workplace) in many countries. Figure 4 shows how CBT could be used in assessment.

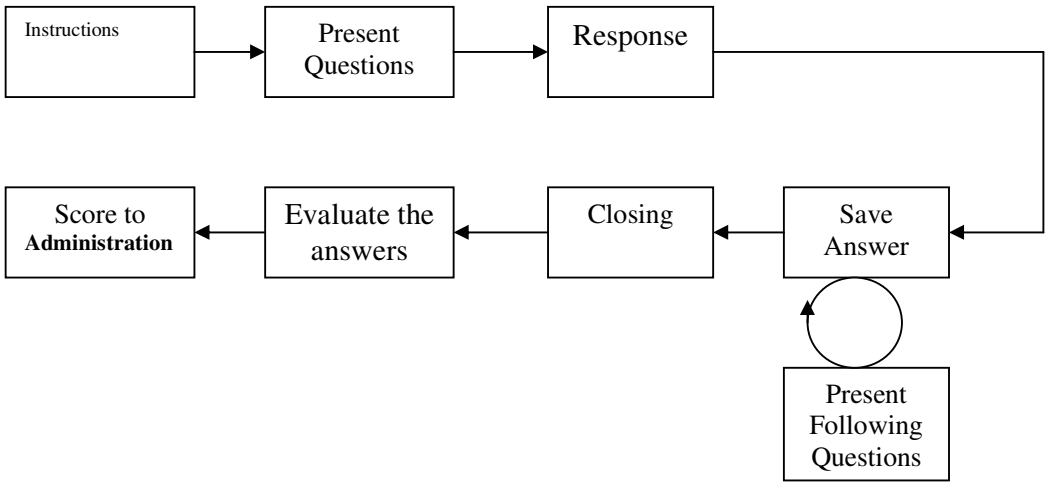

Figure 5: The general structure and flow of an assessment

3. The role of CBT in the Current Development of Education Methodologies

Traditional CBT is slowly giving way to a new generation of educational software, and a new image of how the computer can be used educationally. The new software does not emulate traditional curricular methods and materials, textbooks, workbooks, chalkboards, filmstrips, and overhead projectors. Rather, they exploit the vast memory, logical structures, and impressive graphic capabilities of computers to produce an interactive, flexible, and powerful medium for teaching and learning. The corresponding new image of the computer in education is as a tool for learning rather than as the latest audiovisual device. In addition, learning resources are considered to be at the heart of the education and training processes, whatever the modes of education and training, either in MET institutions or onboard.

3.1 CBT as a Learning Resource

3.1.1 CBT as a Textbook

Computer-based training can start with a book and better illustrations and links to further information, as some materials can be covered with such simple inexpensive CBT. A single compact disk (CD) is capable of containing as much as 600,000 pages of information, or 2,000 books, which means there is no limitation of resource materials, that could be available in MET institutions, or onboard as a CD library (Muirhead, 1995). Moreover, books on CD have the advantage over textbooks when adding clips, sound, graphics, animation or any other available method of presentation via computer. Graphic presentations greatly enhance instruction about spatial relationships, about objects or procedures that can be visually depicted, or for modeling (showing a student/trainee how to do something). Animations allow the computer to demonstrate changes, processes, and procedures in a way few other media can. Sound is a presentation mode quite different from either text or graphics (visual modes). The common use of sound in CBT is for primitive sound effects such as beeps or explosions, not as advanced as the visual modes.

3.1.2 Computer-Based Knowledge Management (CBKM)

“Knowledge management, a sister discipline to training can provide a total picture of the learning curriculum, provide true orientation of the trainee to the learning material and connect the trainee’s vocational activities to reference information that cannot be memorized easily” (Lyras, 2000, p. 4.2). Reference books, video films, seminars, and instructor office hours are all considered scarce resources, which could be covered by using CBKM. A CBKM system may allow students the use of limited resources, such as videotapes, or reference books from their own PCs, or via a network either within the campus, or at home via the Internet. Moreover, students will not have to ask teachers for office hours as the teachers can provide more materials or explanations through the network.

3.1.3 Computer Simulation

Computer simulation, as an educational tool, is relatively new and is rarely specifically referred to in the various learning theories. However, educational theories which support "learning by doing" give credibility to computer simulation as an educational tool. Thus, using computer simulation will motivate the students to learn by interacting in a different manner close to real situations. Students gain the skills of solving problems, learning procedures and understanding the characteristics of phenomena and how to control them safely and efficiently.

These skills can simply be gained by students since most CBT systems are quite simple and straightforward, for example knowledge will be presented and followed by a set of questions to make sure that he/she has understood the information presented, and can apply it in different environments (Farmer, et.al. 1999). Furthermore, a good computer-based training simulation course can provide students with tremendous knowledge, skills and experience, all of which will be useful in achieving the subject's aims and objectives. Thus, such a course can be carried out onboard to train junior officers, or senior cadets to learn, for example how to use new equipment, how to behave in the event of collision cases under COLREG, how to control the ship as an independent officer of the watch (OOW), etc.

3.2 CBT in Distance Education

The structural changes taking place in the maritime industry may have consequences for education and training. In addition, the maritime industry needs to find ways to train seafarers in maritime skills quickly and cheaply, either onboard vessels, or over the Internet while they are at home, which can be cheaper than taking them off vessels to spend time in MET institutions.

The rapid development of computer networks, dramatic improvements in the processing power of the personal computer, striking advances in magnetic storage technology, and the developments in communication's technology in the 1990s has encouraged educators to benefit from using the computer in distance learning in the maritime industry. The environment of distance education has continued to evolve with advancing technology to where knowledge and instructions are delivered by using a combination of live, two–way interactive audio, video or both and synchronous/asynchronous computer–based interaction. Moreover, the use of Local Area Networks (LANs), the Internet, Wide Area Networks (WANs) and the World Wide Web (WWW) extend the opportunities of learning to new students to make learning more efficient and flexible, and to enrich the learning processes. Furthermore, distance learning enables students/trainees to receive personalized learning and training material via their computer terminal, and where appropriate the software could contain existing video streaming and simulation training. The program may also have the capacity to simulate the facilities available to an actual college or university.

On the other hand, the Internet is developing as a repository for good quality information that can be used for undergraduate and post-graduate level study, and the Internet thus is becoming a good alternative to the campus library in some ways. As long as connections

are working, students can read, print, or download the references they need, or the materials sent by tutors.

3.3 CBT v Traditional Teaching Methods – A Critique

Teaching may be regarded as providing opportunities for students to learn, and it is a complex intellectually demanding, and socially challenging task. It consists of a set of skills that can be acquired, improved, and extended (Brown & Atkins, 1999).

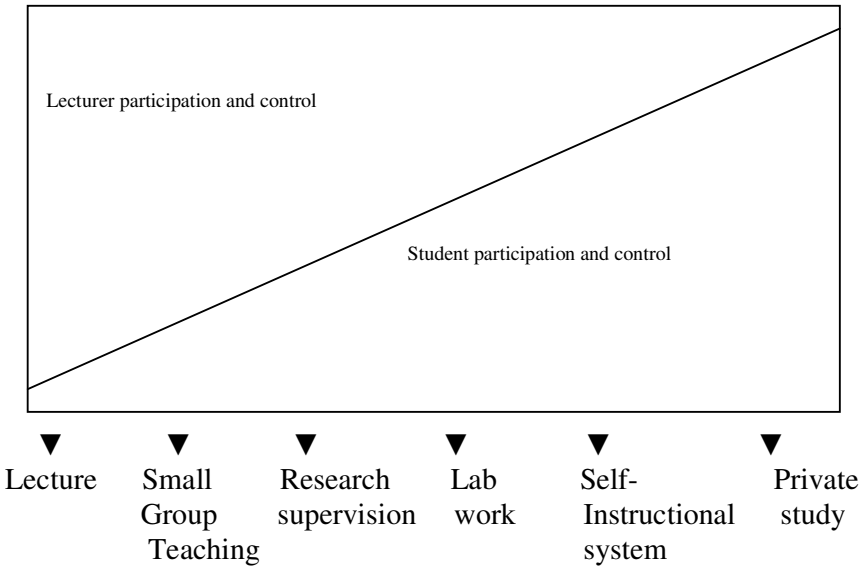

Figure 6: A continuum of teaching methods
Source: effective teaching in higher education (Brown & Atkins, 1999)

There are various methods of teaching, such as lecturing, small group teaching, research supervision, lab work, self-instructional systems, and private study. Figure 5 clarifies the role of the lecturer and the student. In this part the author concentrates on the comparison between the traditional methods (e.g. lecturing and small group teaching), and private study.

3.3.1 CBT v Traditional Teaching

Teaching is an interactive process as well as an intentional activity. In the maritime field, one goal of teaching is to raise the professional standards of seafarers through learning, alone or in a group, at sea or ashore (Baillie, 1997). Teaching could be one-to-one teaching, or a large students-to-instructor ratio in a conventional classroom, or private study, for example by using CBT. The first method is the most effective but it is very costly, and requires a large number of lecturers.

3.3.2 Speed

Lecturers in traditional teaching control the pace of delivering the knowledge, which could affect the students` understanding and learning. On the other hand, CBT offers a means for providing lectures in any CBT structure methodology, at a pace that can be controlled by the learner. Moreover, the lay image of CBT is of serried ranks of students, or individuals, each seated in front of a computer keyboard and screen, all learning in their own way and at their own pace. The importance for each student to learn in his/her own pace is clarified by Lyras (2000, p. 4.4) that, "… you are likely to retain only a small percentage of what you read or hear unless you control the pace of delivery, and seek answers to your own relevant questions when it becomes necessary in your own mental process".

3.3.3 Teaching Tools

Teachers have long used visual and auditory modes in trying to get ideas across, which have often been the most prominent on college campuses. Texts, tests, writing on a blackboard/whiteboard, all are primarily verbal, while the adaptable visual aids, such as overhead transparencies, and the use of power point presentations are all presenting the teaching tools in the traditional teaching. In addition, lecturers should have lecturing skills, such as presenting information, explaning, and generating interest. These skills in their turn are based upon the specific skills of opening a lecture, using audio-visual aids, comparing and contrasting, narrating, varying activities, and summarizing (Brown & Atkins, 1999).

On the other hand, CBT is interactive teaching using the computer as a delivery medium. The usage of multimedia, such as text, photos, graphics, animation, sound, and full motion video (FMV), creates a dynamic communication environment. However, using technology should be for the benefit of the students and not be distracting. It is therefore, important to have clear and easy-to-follow graphics that not only help gain and maintain student interest, but also make the technology transparent, shifting the focus from the technology to the educational process.

3.3.4 Browsing

One difficulty, among many difficulties facing students in traditional teaching, is memorizing. Even though lecturers are concerned with the clear transmission and useful coverage of subjects, students are still taking notes for the accurate recall of definitions, facts, formulae, procedures-perhaps assisted by worked examples. Moreover, students need to read the provided text by the lecturer, find out materials from the library to get whatever they have missed in class, or they have to ask the lecturer to repeat.

In contrast, structure methodologies of CBT use the computer as a mentor and guide through a range of learning resources (database), which might, but need not, be themselves based on a computer. Thus database programs, according to Ward and Swell (1987, p. 145) "… allow the learner to store, manipulate and retrieve information that has been collected by himself or herself". Thus, the power of the computer to store, retrieve, and process information is used to help the student as he/she browses through

the material, responding to questions about related information, retrieving items which are needed, summarizing statistical data, and suggesting possible lines of investigation that may be of interest.

3.3.5 Experience

Can CBT deliver experience? The answer from the author's view is CBT cannot deliver experience. One disadvantage of CBT is that trainees cannot ask computers questions and so are limited to the pre-determined help facilities designed into the training course. Moreover, Eldridge (2000) argues that CBT cannot deliver experience, as it is the vital and irreplaceable asset that an instructor brings to the topic. In addition, discussion in the conventional classroom also develops skills that are central to most professions: the ability to communicate with others (both professional and lay), and the sensitive and precise handling of the language of the subject. This language contains, not only concepts, facts and processes, but also explicit and implicit attitudes and values. Thus, teachers deliver information and knowledge, in addition to improving the students` attitudes and values.

4. The Use of Computer in MET Institutions

The flexibility demonstrated by computer programs in MET institutions offers one solution to the difficulties of enabling teachers to experience, study, review and discuss practices, methods, approaches and techniques being used elsewhere in the educational system, in their own time, at their own convenience. Moreover, Alessi and Trollip (1991, p. 3) add:

> *Teachers have a great deal of routine administrative work, such as grading, producing assignments and handouts, writing letters, and keeping track of resources and materials. When a computer can perform or speed up such tasks, the teacher has more time to work with students.*

In contrast, computer programs can provide an extremely flexible system that adapts to the aptitudes and abilities of a wide range of students and subject areas, thus allowing students to compare, contrast and follow their own investigatory pathways. The pathways will not be those rigidly determined by the technology and the programmer, but those taken in interactive discussion within the program through the computer. There are three ways to use the computer programs in the MET institutions, learning about them, from them, and with them.

4.1 Learning about and from Computer

Due to the wide use of computers onboard ships, MET institutions have introduced computer science as a part of the syllabus. One of the great attractions of the computer as an educational tool is the relative ease with which most students can learn to write simple programs, and to develop their own computer learning materials through programming.

4.2 Learning with Computers

One of the most obvious features of development in the field of education today is the increasing emphasis placed on technology and its impact on classroom instruction. As

computer technology becomes increasingly integrated into virtually every aspect of social living, and more firmly entrenched in education, its prominence is displayed most clearly through the rapidly increasing use of the Internet, World Wide Web (WWW), Computer Assisted Learning (CAL), Computer Based Training (CBT), e-mail and multimedia tools, which open up the use of networks for educational outreach.

4.3 Using Computers by Students

Students in MET institutions need to be in an environment that supports their learning, be motivated to learn, and have the skills, resources and support necessary to help them achieve. These resources are beneficial if they are well organized and catalogued. The use of computer databases is beneficial in this regard. Textbooks and articles relevant to the content, instructional design, and the delivery medium may not only be catalogued on a database, but their contents catalogued and described so that the information can be quickly located when needed. Moreover, by using computers in learning, students can receive personalized learning material via the computer terminal, and when appropriate the software would contain exciting video streaming, and simulation training. As illustrated by Winer and Mothe (1987), learning with computers changes the meaning of the verb "to know" from "having information stored in one's memory" to "the process of having access to information".

4.4 Use of Computers by Teachers

The role of the modern teacher nowadays is to develop classroom-computer integration that provides students with a high level of knowledge and understanding. According to Muirhead (1994) the advent of the very powerful desktop microcomputer, networking, color graphics and interactive workstations has led to a considerable growth of software use in maritime education and training. However, teachers are still suffering from preparing teaching materials, including assessing the initial state of their students` knowledge and individual characteristics, and the development of the teaching program itself as sequences of measures to assure the optimum learning of this material.

The use of database and spreadsheet programs helps teachers to manage and manipulate any information with important aspects dealing with a certain data or task to perform. Graphical spreadsheet programs such as Microsoft excel offer features, which make them potentially very powerful learning tools in a wide range of classroom situations. They can act as databases; they can produce a large range of different types of graphs; they have libraries of built in functions (logical, statistical, scientific, etc), and their cells can be given names. These cells are interactive so that a change in the value of just one cell causes the whole spreadsheet to be recalculated and any graphs to be redrawn immediately.

5. The Computer in the at-Sea Environment

Formal education in marine science and technology is usually carried out in schools, colleges, and universities. Another important area is informal education, which is carried out via media, such as CBT and distance learning. Both formal and informal education are facing a problem in the lack of delivering experience. In the former method, readers may think that

lecturers have the required experience to deliver, but how long will it be before lecturers are out of date.

5.1 An Overview of Training Needs Onboard

Seafarers are the heart of the maritime industry. No doubt, without them ships would not trade, cargoes would not be transferred, and the marine industry would collapse. Muirhead, (1994, p. 11.1) discusses this issue as:

> *Much criticism has been leveled in recent years at the lack of standards and skills displayed by many mariners at sea, and at the high incidence of human error as a causal factor in many casualties. It has also been stated at IMO and in other forums that many officers and seamen today lack the ability to perform tasks effectively in the workplace.*

This lack of standards and skills is mostly due to lack of training, which can be carried out ashore or onboard. The Revised STCW Convention puts great emphasis on training and assessment to govern the qualifications required to operate specialized equipment, or to handle specific cargoes. Moreover, the ISM code, which now is included in the SOLAS Convention, also addresses the subject of crew training. It deals specifically with training in the safety management system, which includes the organization of emergency drills, and the familiarization training required for new crewmembers at the time of joining a ship.

The best way, from the author's viewpoint, for achieving new skills is gained by having competent and experienced officers onboard. Those acting officers onboard have up-to-date knowledge, compared to lecturers who lose much of these skills as long as they are out of touch with the real world of shipping. However, lecturers try to encourage students to learn by possessing special skills, but these are more related to the academic discipline, and lacks the practice of the shipping companies' corporate culture. On the other hand, senior officers have the ability to train and encourage seafaring cadets and crewmembers to gain the required skills to operate navigational and engine equipment, and to handle cargo in a more direct way than lecturers. Thus, depending on the senior sea staff, onboard training is the most beneficial for seafarers. This is clarified by Holder, (1997, p. 45) as:

The expertise and experience of senior staff are the most important resource available to you. In their own training and years of service, they will have had to deal with many different situations and will have gained experience, sometimes through making mistakes. However, senior sea staff face some problems in training, such as lack of time, and fatigue.

5.2 The Role of CBT in Onboard Training

The need for improving training methods challenges shipping companies to use CBT as a training tool onboard their ships. Shipping companies are looking to reduce costs in meeting the requirements of STCW 95 standards, and their specialized specific training. In addition, seafarers want to maximize their leave, and at the same time seek the training and standards required by their company and IMO regulations. This can be done through using approved CBT modules, and assessment can be carried out in MET institutions, as agreed in Norway.

Furthermore, the advent of modern satellite technology opens the door to use network among ships and shore either in MET institutions, or shipping companies. Moreover, the

wide use of the Internet and WWW assists in receiving the instructions from tutors, or training officers to crewmembers onboard. Tutors or training officers will be able to import crewmembers' assessment to evaluate their progress. Thus, using such CBT modules will improve the quality of training, refresh and update existing skills, develop maintenance skills, monitor onboard training program, and assess the competence of trainees in practical skills. In short, CBT is a unique tool to cover parts of the training needs, while reducing the costs of others. It may help shipping companies to identify training needs and to identify seafarers who should not be on their ships at all.

5.3 The Potential Use of CBT for Onboard Needs

There are various specific advantages to be gained from CBT programs onboard, however there are also some disadvantages of using such programs. In this section the author will present, from his viewpoint, the most important advantages and disadvantages of using CBT onboard.

5.3.1 Potential Advantages in Using CBT Onboard

1. CBT programs with built-in training and assessment sections enable shipping operators to comply with keeping training records. Such records will give the seafarer and the vessel the required evidence that the training has been performed. Moreover, keeping such records supports, under the ISM Code, the Safety Management System (SMS), ensures that such training is provided for all the personnel concerned. In addition, training records ensure that each ship is manned with qualified and certified seafarers in accordance with the national and international requirements.

2. CBT is ideal where the processes to be mastered are hazardous, for example, the handling of explosives and dangerous cargoes, in general where training on the real equipment is prohibitive. An example of such a program is presented by Muirhead (1995) in using the onboard computer based Liquefied Natural Gas (LNG), as an interactive training program. This program was developed by a ship operator and teaching institution for crews of LNG ships in Australia. This program allows crewmembers to gain the required skills and procedures to deal with the cargo carried onboard without any risk for the cargo operations or ship's safety.

3. CBT programs supported by distance education via satellite overcome the lack of access at sea of education and training by mariners. Moreover, the development of satellite communications gives the opportunity to update the CBT programs frequently, which provides the marine industry with an option to pursue the goals of improved quality and standards of training.

4. CBT can be available at any time of the day or night; it is possible to make the training material available round the clock for different watches. For example, the chief mate who is looking for promotion, and the time is limited due to the workload, can get the required training in shiphandling PC-based simulation in his free time.

5. There is a lack of formal training in personnel management in marine science, which is the major part of the master's job. Thus, masters are depending upon their personnel skills, which may be improved by experience. However, Roberts (1997) asks a question: Does a master mariner's certificate of competency qualify its holder to command a ship? The answer to this question, according to Roberts, is no, or at best partially.

The writer agrees with him, indeed the CBT courses in management either for crowd management onboard Roll-On / Roll-Off (Ro/Ro) passenger vessels, or crew management in emergency situations, are able to provide them with the required experience, in addition to their experience in command, to act also as a manager of the ship. In short, shipping companies and seafarers can benefit when they correctly implement and monitor computer/based training and assessment in many areas

5.3.2 Potential Disadvantages of Using CBT Onboard

1. The major limitation on using CBT onboard is the need for technical support of the relevant hardware. This is logical when different ships with varying knowledge and experience contain CBT programs on computers with a number of different configurations, as there will be technical problems, and the ship will need support. Even if all the programs are based on the same programming platform, or only require a web browser, some computers will need to be supported because of the nature of computers today. Moreover, this support should be quick and reliable, and must be performed without detaining the ship.

2. The second major limitation of CBT is that it is not reality, but is just a part of it, reality is much more complex and far more unpredictable than a simulated world can ever be (Hensen, 1999). He adds, "It is important, however, to be aware of the degree of fidelity of the simulation and how it influences results, unparticular when safety margins are small". Indeed, the author agrees with this opinion, but there is an advantage from using CBT onboard as the trainee will be able to implement whatever he/she learns from such a program practically onboard.

3. Language may be considered as another limitation. Most CBT programs start with an introductory section, which usually requires reading skills. The common language used in most programs is English, which is not the language for the majority of crewmembers, especially ratings. Thus, they will not be able to read the instructions, indeed they will need an interpreter (usually a certified officer) to explain how to run the program.

4. CBT programs cannot deliver experience, as discussed earlier, as a result seafaring cadets and crewmembers must still seek experience from senior sea staff.

5. Some CBT programs contain over-impressive graphics and animations, which may detract trainees from achieving the specified learning objectives. For example, a shiphandling course in approaching port, may take the attention of the trainees to the port facilities, rather than concentration on the manoeuvring procedures.

6. Conclusions

The results of examining different definitions from users and producers showed that CBT is interactive training using the computer as the delivery medium. The usage of multimedia i.e. the integration of text, photos, graphics, animation, sound, and FMV creates a dynamic communication environment for the student. CBT courses can be instructor-led, self-based, or combination of both. CBT as a teaching/learning tool has benefits over using traditional methods for both students and teachers. Students benefit from using CBT, for example, instead of a textbook, they can cover a lot of material with this simple CBT program without the need to look for such books in the library, or waiting in a long queue for a copy. In addition, simulation in MET, and onboard as well, is very important to train seafaring cadets and crewmembers. However, a simulator is costly and difficult to implement onboard, where as using a computer-based simulation is the solution to this problem.

Furthermore, via distance, CBT can be used in connection with the Internet within shipping companies or MET institutions to download programs onboard, or update existing programs to improve the efficiency of the crew, and get feedback to evaluate their progress. On the other hand, teachers also benefit from using CBT programs; for example database and spreadsheet programs help teachers to manage and manipulate any information with certain important aspects dealing with certain data or tasks to perform. Moreover, teachers become more effective since trainees/students will have more time to devote to supervision and counselling.

The skill of training seafaring cadets and crewmembers is a valuable issue. This study proposes and demonstrates one approach to onboard training, which is the use of CBT. CBT programs afford the trainee the freedom to learn at his/her own pace, at a location of his/her choice, and at a fraction of the cost related to the benefit gained.

In summing up, the writer of the view that the key issues that will impact upon the growth in the use of CBT are:

1. reduce the total cost of training
2. require less time for training
3. standardize the quality of the training
4. improve the effectiveness of learning.

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