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Approaches to distance learning : an evaluation of current methodologies, technologies and operational costs as an alternative means of course delivery for developing country academies

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APPROACHES TO DISTANCE LEARNING

An evaluation of current methodologies, technologies and operational costs as an alternative means of course delivery for developing country academies.

By

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A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the award of the degree of

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DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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ABSTRACT

Title of Dissertation: **Approaches To Distance Learning: An Evaluation of Current Methodologies, Technologies and Operational Costs as an Alternative Means of Course Delivery for Developing Country Academies.**

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This dissertation is a study of the distance education continuum and the constant evolution that is taking place particularly due to the dynamism of information technology. Information technology has become the catalyst for change and, as a result, distance education is becoming the preferred choice of education among adults in higher education.

An overview is made of current and new technologies that are or can be used as media of transmission for distance learning. Effective methodologies used for delivery of distance learning is also examined and reviewed.

The challenges that distance learning pose to developing countries' MET institutions lie in providing STCW courses via distance learning methodology. The issues of cost and quality assurance are additional challenges the developing countries will face. The importance of instructional design in the developmental stage and the information interface is an equally important consideration, which will be discussed throughout this investigation.

The conclusion and recommendation chapter looks at the challenges of change that will be synonymous with distance learning, particularly with MET institutions. The importance of quality standards systems, costs and the acceptance of STCW courses via distance education provide additional challenges which must be addressed upon the development of such a programme.

KEYWORDS: Information Technology, Communication, Effective methodologies, Instructional design, Cost, Interface, Quality assurance, Media of transmission.

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ABBREVIATIONS

ADSL	Asymmetric Digital Subscriber Line
ATM	Asynchronous Transfer Mode
BRI	Basic Rate Interface
CAL	Computer Assisted Learning
CBT	Computer Based Training
CCTV	Closed Circuit Television
CDB	Caribbean Development Bank
CD-ROM	Compact Disc-Read Only Memory
CMC	Computer Mediated Communication
CMI	Caribbean Maritime Institute
CPU	Central Processing Unit
DE	Distance Education
DL	Distance Learning
DMT	Discrete Multitone
DVD	Digital Video Disc
EDI	Electronic Data Interchange
e-mail	Electronic Mail
EU	European Union
GAN	Global Area Network
GHz	Giga-Hertz
HTML	Hyper Text Mark-up Language
HTTP	Hyper Text Transfer Protocol
ICCE	International Council for Correspondence Education
ICT	Information and Communication Technology
IDU	Indoor Unit
IEEE	Institute of Electronic and Electrical Engineers
IFL	Interfacility Link

IMO	International Maritime Organisation
INMARSAT	International Maritime Satellite Organisation
IP	Internet Protocol
IRC	Internet Relay Chat
ISDN	Integrated Service Digital Network
ISP	Internet Service Provider
IT	Information Technology
JMI	Jamaica Maritime Institute
LAN	Local Area Network
LEO	Low Earth Orbiting Satellite
LMS	Learning Management System
LTSA	Learning Technology System Architecture
MET	Maritime Education and Training
MIT	Massachusetts Institute of Technology
MUD	Multiple User Dungeons
MUSE	Multiple-User Simulated Environment
NEA	National Education Association
NGI	Next Generation Internet
OA/DI	Always On Dynamic Integrated Service Digital Network
OUD	Outdoor Unit
OKI	Open Knowledge Initiative
PC	Personal Computer
POT	Plain Old Telephone Line
PRI	Primary Rate Interface
QSS	Quality Standards System
ROI	Return On Investment
STCW 95	International Convention on the Standards of Training, Certification and Watchkeeping for Seafarers 1978 as amended 1995.

UK	United Kingdom
UNESCO	United Nations Education, Science and Cultural Organisation
URI	Uniform Resource Identifier
USA	United States of America
USDLA	United States Distance Learning Association
VSAT	Very Small Aperture Terminal
WAP	Wireless Application Protocol
WML	Wireless Mark-up Language
WSP	Wireless Session Protocol
WWW	World Wide Web

INTRODUCTION

General

The buzzword among economists is globalisation, the transcendence of all geographic boundaries making the world a common marketplace where commerce is concerned. The use of technology is fundamental in the globalisation process. E-commerce is an emerging concept and is slowly becoming the order of the day, in which technology plays a very important role.

In the shipping industry, electronic data interchange (EDI) is now commonplace not only commercially but also among shipyards and other stakeholders. The significance here is the vast amount of information that is and can potentially be transferred using available and emerging information and communication technologies. The level of dynamism that information and communication technologies have brought to the commercial arena has transformed the way business is conducted today, resulting in more efficiency.

Education has been in a state of stagnation or has remained passive for the last forty to fifty years, and is only now experiencing the same dynamism as the rest of the business world. Information and communication technologies have been the catalyst for change and are transforming the way education can be delivered today. This effervescence that is occurring in education mainly in the realm of distance education (often referred to as distance learning) is happening due to the new developments in technology. Distance education is by no means new and dates back to the seventeenth century. What is new however is how effective and efficient distance learning has become and how it has the

acclaim of being more effective than the traditional classroom setting that has long been the epitaph of learning. Distance education/learning is a part of the globalisation phenomenon, and may be looked at as globalisation through education.

Background

The Caribbean Maritime Institute (CMI) the formerly Jamaica Maritime Institute (JMI), is acclaimed as being the regional maritime academy for the Caribbean. In the fall of 2000, Parliament approved the name change to substantiate its regional status, as CMI is the only institution of its kind in the English-speaking Caribbean. In September 1994, a new course was introduced called the Diploma in Shipping Logistics that was geared for the shipping and allied industry ashore. The aim of the course was to offer formal training to personnel mainly at the supervisory and middle management level. The programme has been well received by the local industry that it has become a requirement for promotion and for entry into the industry.

The Diploma in Shipping Logistics programme was introduced to the rest of the Caribbean and was well received. However, the main target group (supervisors and middle managers) found it difficult to get released from work and, due to family obligations, encountered difficulties in taking up a two years full-time resident course. The idea to offer the course by distance education thus emerged. In 1996 CMI got funding from the Caribbean Development Bank (CDB) for a distance learning pilot project that was launched in 1998. The participating countries are Barbados, Trinidad and Tobago, St. Kitts, St Lucia, Dominica, St Vincent and the Grenadines and locally in Jamaica to Montego Bay, and Ocho Rios.

The challenge

As CMI continues to expand and diversify, distance learning is one aspect of the expansion and diversification programme. CMI, being an institution from a developing country, needs to introduce and exploit the use of information and communication

technologies in its current distance learning programme. There are new frontiers still to be conquered by distance education. One such is offering of the International Maritime Organisation's (IMO) Standard of Training Certification and Watchkeeping (STCW) courses via distance learning. This is a challenge that maritime education and training institutions need to confront. In the revised STCW convention the phrase 'media of delivery' is used, which infers that distance education is a viable option for course delivery.

The technology is available to support MET programmes via distance education as used by other higher education institutions, and has proven very successful. The challenge that MET institutions face, like other institutions of higher education, is that of quality assurance. MET institutions have an obligation to fulfil as it relates to the guarantee of quality as stipulated under the STCW 95 convention.

Should developing countries maritime academies like CMI sit back and wait for developed countries to be the pioneers in MET distance education, or can they champion the cause and be the forbearers? The expertise is not lacking in developing countries, but the costs for such development could inhibit progress. Developing countries have to be part and parcel of globalisation for the survival of their economies and, as a result, they must have access to modern technology. Developing countries' MET institutions therefore can piggyback on the available technology to offer STCW courses via distance education. In so doing, such institutions would be transcending geographical boundaries, virtually expanding physical size, while becoming a part of the globalisation phenomenon through education.

Aim and objectives

It is with these notions in mind that this dissertation seeks to explore and clarify the numerous descriptors akin to distance learning and the various methodologies synonymous with distance learning. This is an investigation that looks at trends that are

happening globally and examines how technology has reshaped the educational landscape, especially as it relates to delivery methodology and communication. The issues of cost in the preparation and delivery of distance learning programmes are later addressed, and important concepts are also highlighted that are vital for MET institutions not to overlook in preparing their distance learning models.

The methodology

This dissertation undertakes an extensive literature search due to the new dynamism and continuous evolution of information and communication technology being used in distance learning. The literature search entails reviewing books, magazines, journals and other publications, that were available in the World Maritime University's library as well as other institutions. In addition to this, the research included extensive, diligent and painstaking Internet searches, sifting through thousands of URLs to find supportive material that seems to be credible. Personal e-mails were sent to gather information from companies involved directly or indirectly with distance learning.

CHAPTER 1

DISTANCE LEARNING IN PERSPECTIVE

1.1 Definitions and Concepts

Basic principles of economics lay down that needs within a society lead to a demand, and to satisfy such demand a supply chain is created. Within the same subject area the buzzword is globalisation, denoting that societies' demands can be satisfied by the global supply chain in broad terms. So what is the relevance of this analogy with the topic at hand?

The need for higher education, especially among adults, is constantly rising; to keep abreast with the advancement of today's technological changes among professionals is a growing problem. Companies' rationalisation strategies with regard to human resources make it more difficult to send staff away for upgrading or higher studies. As individuals' personal commitments increase, it becomes more difficult to register into full time studies. It becomes evident that there is a need for distance education and that this need is not a new phenomenon but one that has existed for decades. Hence the demand for continuing education for this niche of adults and professionals has to be met.

The emergence of distance education, sometimes referred to as distance learning, is the supply chain that is to fill the demand created. This educational concept for the

facilitation of learning is by no means new. Williams et al (1999) indicate that distance education can be traced back to the mid-1800s with correspondence study in higher education. This concept for the facilitation of learning has adopted various terms like correspondence education, home study, independent study, external study, distance teaching, open learning, distance learning, e-Learning and distance education.

Keegan (1986) alludes to the definition of correspondence education as coined by the United Nations Education Scientific and Cultural Organisation (UNESCO), as

> "education conducted by the postal services without face-to-face contact between teacher and learner. Teaching is done by written or tape-recorded materials sent to the learner, whose progress is monitored through written or taped exercises to the teacher, who corrects them and returns them to the learner with criticisms and advice".

His criticism of correspondence education is that it cannot encompass the didactic potential that distance education has in the future; print, audio, video, and computer-based possibilities must be reflected by the terminology chosen. His research leads him to beleive that critics of the term tend to associate correspondence education with some of the less successful aspects of distance education. The status accorded to this form of study is still in question in many countries. It is his belief, however, that the term is needed to designate the postal sub-group of the print-based forms of distance education in which student contact is not encouraged.

Regarding to home study, Keegan (1986) indicates that this term has little claim of being all-encompassing as it is used mainly in the United States and is therefore confined to further education, primarily in technical and vocationally-oriented institutions and not higher education institutions like universities and university-oriented colleges. This

suggests that distance students may not in fact study at home but may study in part at home and in part at other centres.

Independent study in the American context is generic for a range of teaching and learning activities that sometimes go by separate names (correspondence study, open education, radio-television teaching or individualised learning). In several European countries such systems are clustered under the term distance education or are still perceived as separate programmes without any basic, generic relationship as suggested by Wedemeyer (Keegan, 1986). Independent study is often criticised for indicating independence from an educational institution, which is not the case of distance education. Wedemeyer notes there is hesitancy in using the term independent study, as it is often used for individual study programmes containing periods of normal lectures organised between a student and a faculty member.

External Studies is the term most widely used in Australia. It describes the ethos of distance education as found in Australian universities and colleges of advanced education. It is a form of education that is external to, but not separated from, the faculty and staff of the institution. The same staffs have two groups of students, one on campus, the other external. Both groups are prepared for the same examination and awards.

Keegan (1986) credits Moore for the definition of the term distance teaching, which he describes as

> "All those teaching methods in which because of physical separation of learners and teachers, the interactive (stimulation, explanation, questioning, guidance) as well as the pre-active phase of teaching (selecting objectives, planning curriculum and instructional strategies), is conducted through print, mechanical or electronic devices".

Williams et al (1999) contend that open learning has meant an arrangement in which learners work primarily from self-instruction, completing courses structured around specially prepared printed materials, supplemented with face-to-face tutorials and examination. They suggest that open learning is a catchword or slogan used interchangeably with distance education. The avid researcher in this field, Holmberg (1989), suggests that open learning is not synonymous with distance education, nor is distance education a subset of open learning. He alludes that open learning is a state of mind. It is an approach taken to the planning, design, preparation and presentation of the courses by educators, and an approach taken for the selection and use of learning strategies and associated resources by students. This approach seeks to provide students with as much choice and control as possible over content and learning strategies.

California Distance Learning Project (2000) uses this definition: Distance Learning (DL) is an instructional delivery system which connects learners with educational resources. DL provides educational access to learners not enrolled in educational institutions and can augment the learning opportunities of current students. The implementation of DL is a process, which uses available resources and will evolve to incorporate emerging technologies.

The United States Distance Learning Association (USDLA, 2000) defines distance learning as the delivery of education or training through electronically mediated instruction including satellite, video, audio graphic, computer, multimedia technology and other forms of learning at a distance. The USDLA notes that distance education refers to teaching and learning situations in which the instructor and the learner or learners are geographically separated and therefore rely on electronic devices and printed materials for instructional delivery.

Regarding distance learning (DL), the California Distance Learning Project (2001) states, “DL as an instructional delivery system, which connects learners with educational resources”. DL provides educational access to learners not enrolled in educational institutions and can augment the learning opportunities of current students. The implementation of DL is a process, which uses available resources and will evolve to incorporate emerging technologies.

The use of network technology to design, deliver, select, administer, support and extend learning. Several key features define distance learning. They are:

1. the separation of teacher and learner during at least a majority of each instructional process;
2. the use of educational media to unite teacher and learner and carry course content;
3. the provision of two-way communication between teacher, tutor, or educational agency and learner;
4. separation of teacher and learner in space and/or time;
5. volitional control of learning by student rather than distance instructor.

Simply put, e-Learning is the emerging term for Internet-enabled, and technology distributed, education and training (e-Learning Europe Conference, July 2000). Imagine being able to access cutting edge knowledge and training on demand that is specific and in just the amount you need, while being able to communicate with your peers, coaches and experts, all through a simple Internet connection. The ultimate goal of e-Learning, the e-Learning Europe Conference (July 2000), in concurrence with the Masie Center, is to bring learning to people instead of bringing people to learning. Beyond delivering learning, e-Learning also represents the ability to personalize the learning based on the learner's knowledge, needs and experience. In its simplest form, e-Learning is the use of technology to deliver learning that is personalized to each learner.

Holmberg (1989) intimates that distance education covers the various forms of study at all levels which are not under the continuous, immediate supervision of tutors present with their students in lecture rooms or on the same premises, but which nevertheless benefit from the planning, guidance and teaching of a supporting organisation. Keegan (1986) credits earlier researchers like Moore for his own definition of distance education as the family of instructional methods in which the teaching behaviours are executed apart form the learning behaviours, including those that in a contiguous situation would be performed in the learner's presence, so that communication between the teacher and the learner must be facilitated by print, electronic, mechanical or other devices.

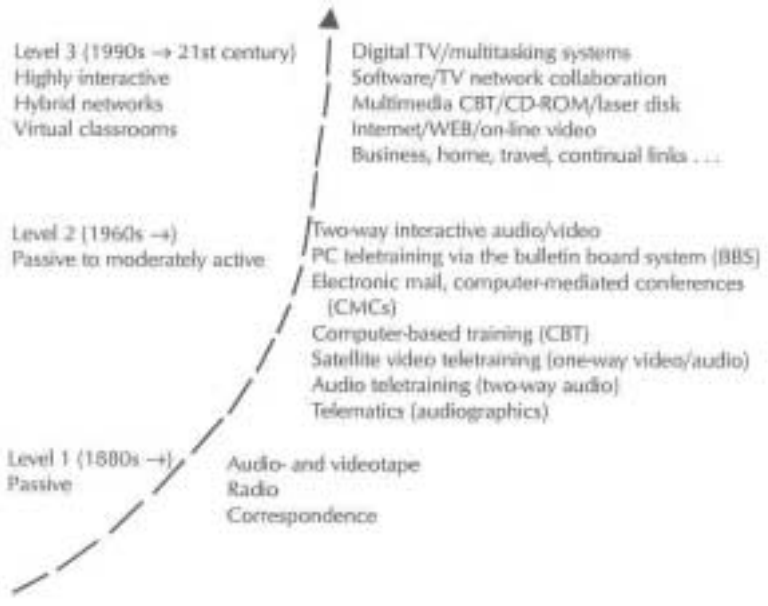
Distance education includes distance teaching (the instructor's role in the process) and distance learning (the student's role in the process). This opinion is supported by Holmberg (1989) whose view is that distance study denotes the activity of the students, and distance teaching is that of the tutorial organisation, particularly its developers and tutors. Hence, it is fair to suggest that distance education constitutes the entire package of teaching and learning. Distance teaching and learning are subsets of distance education and therefore it is more appropriate to refer to this mode of providing education as distance education as opposed to the others. The main characteristics of distance education Holmberg suggests are:

- the separation of teacher and students.
- the input of the facilitating organisation for planning, production of material and student support.
- the use of media and technology to bridge student and teacher for the dissemination of content and feedback.
- facilitation of communication between student and teacher.
- the separation of the learning group(s).

1.2 Growth and Development

Looking closely at the various descriptors and terms used over time to refer to distance education it is evident that, as more technology became available and communications improved between providers and learners, new names evolved. Credence may be attached to the previous statement as Williams et al (1999) indicate that in 1972 the International Council for Correspondence Education (ICCE) coined the term 'Distance Education' which was about the time of the technological explosion in communications and personal computers. This has made an indelible mark on education. In looking at the 'distance education continuum' (figure 1) proposed by Williams et al (1999), the picture becomes clear.

Figure 1.1: Distance education continuum



Source: Williams et al (1999) p. 4

From the beginning of formal education, the classroom has been the focal point of learning. Face-to-face contact between teacher and student has been the epitaph of

traditional learning. In today's educational landscape and that of the future the walls of the classroom are crumbling and soon the classroom will be virtual.

Mention was made earlier about correspondence education, heavily dependent on the postal service, which was the artery of communication. With this there was no true guarantee of reliability, making the feedback process between student and teacher slow. Correspondence education is considered as a passive distance education medium being that the student cannot interact with the teacher in real time. This allows only one-way communication where the teacher transmits messages and material and after a lengthy delay through the mailing system receives a response form the student. Williams et al (1999) refer to this type of communicating environment as asynchronous. This makes the feedback process slow, which can cause demotivation. Demotivation has no place in education; motivation, on the other hand, is the catalyst for success.

If motivation is a catalyst for success and this motivation is attributable to the communication process between teacher and student, the more communication is facilitated the higher the success rate will be. Face-to-face (i.e. the classroom setting) creates the absolute forum for constant communication and interaction. An experienced and competent teacher will use various didactic strategies to maintain students' interest and foster interaction and thus the feedback process is immediate. The technology that is currently available and constantly being improved is able to simulate the face-to-face setting, being that interaction in real time is possible and creative didactic strategies can be employed to motivate and foster greater interaction between teacher and student. The platforms available today for providing distance education like digital TV, multitasking systems software, TV network collaboration multimedia CBT, CD-ROM, Internet, Intranet and the World Wide Web (WWW) are constantly evolving. With these hybrid distance education platforms, distance learning will be the new way forward and the virtual classroom will become a reality.

1.3 Education and the Challenge of Change

Education was seen as an institutionalised process, meaning that to be educated one had to attend an established institution. It was also believed that the face-to-face, 'chalk and talk' approach of teaching was the preferred way to impart knowledge. In today's society such belief has no credence; in this era of information technology the entire educational landscape has changed. The real question now is: are the educators, teachers, students and society at large ready for the changes that are happening on the educational frontier, especially as it relates to distance education. Technology is changing so fast that it is extremely difficult to keep abreast with the changes.

In order for the business community such as private sector companies to maintain their competitive advantage, they have to be very dynamic and constantly upgrade with technology to improve efficiency. This energy of dynamism is not prevalent in education and remains in many cases fortified with the 'old guards'. These 'old guards' are often referred to as dinosaurs, who are often resistant to change because of the looming insecurity of their existence.

1.4 Distance Learning and Assessment

As in traditional educational programmes, communication is an integral component of the teaching and learning process for distance learning. Part of the communication process involves both teacher and learner knowing how well the course is being received and understood. Communication facilitates feedback and feedback is the medium through which the teacher can detect the level of reception and understanding. An integral component of the feedback process is assessment. According to Muirhead (1997), the aim of assessment is to detect the level of learning (i.e. finding out how much knowledge, understanding and skill have been learned). He further contends that assessment fulfils other important purposes, namely motivating students, grading for

advancement, setting standards and providing feedback to students and teacher. Similarly, Thorpe (1998) supports Muirhead's later point by alluding to assessment as "the driver of students' approaches to study in distance education no less than the campus based settings". The integration of continuous assessment with course study is both a vital opportunity for student learning as well as a process of judging the performance of students and assigning grades (Thorpe 1998). The assessment process can be varied however, by the setting of the assignment, test or examination which must be clear about the objectives of the assessment if it is to achieve its purpose.

For distance education to be effective similar didactic strategies used in the classroom setting must be incorporated like that of assessment. Therefore, the platform used to deliver distance education must be able to properly and effectively support methods of assessment. Thorpe (1998) in her research reports that the students' experience of assessment in distance education proved useful to them being that they discovered what they knew and could do, and where their knowledge and abilities were weaker.

It is evident that assessment plays a vital role in the delivery process of distance education. As new technology evolves, the administration, control and security of assessment will be like that of the classroom situation. The primary concerns are based on security. How will the teacher know that the person who has submitted the assessment has actually undertaken the work? The other is assessment: if the work must be done without any external help or references, how will the teacher know none was actually used? These are the real issues that must be addressed in order to maintain quality.

1.5 The Correlation Between Distance Learning and STCW'95: Quality Standard System and Validity

Distance education is an accepted method of acquiring education, particularly in higher education for adults. Maritime education and training (MET) is a form of higher education geared toward adults, especially those who are upgrading qualifications for higher certificate of competency under the 'sandwich system'. Distance education would be a very workable option for this group provided they have access to what is referred to now as 'third generation' distance education.

Maritime education and training courses provide professional education, which is governed by international convention (STCW 1978 as amended 1995). These MET courses are subject to approval by the contracting party's maritime administration. Hence if a contracting party's maritime academy is to offer STCW professional courses via distance education programmes such a programme would have to be approved by their maritime administration. Code A, Section A-I/6, Training and Assessment on page 14 states:

"Each party shall ensure that all training and assessment of seafarers for certification under the Convention is:

- structured in accordance with written programmes, including such methods and media of delivery, procedures, and course material as are necessary to achieve the prescribed standard of competence; and
- conducted, monitored, evaluated and supported by persons qualified…"

Morrison (1997), in his clarification of Section A-I/6, emphasises all maritime education and training under STCW convention requires approval by the contracting party. He further explains that the contracting party must take full responsibility for all education,

training and assessment. The writer therefore draws inference on the point of ‘media of delivery’ to include distance education as an option to deliver MET courses. Further inferences can be highlighted in so far that all MET courses must be approved, that a seafarer must attend an approved course. Therefore if a maritime administration approves a distance education programme of an MET institution, seafarers participating in such a programme would have met the requirements of the STCW convention.

For distance education to fulfil another aspect of the STCW convention it must conform to quality standards. It should have its own independent quality standard infrastructure or be part of the host institution or the maritime administration’s quality standard regime. The quality standard regime that will govern distance education of any MET courses must fulfil all the pertinent requirements of Code A, Section A-I/8 quality standards. In fulfilling such requirements the regulation stipulates that “each party shall ensure that the educational objectives of the related standards of competence to be achieved are clearly defined and identified to the levels of knowledge, understanding and skills appropriate to the examinations and assessment required under the Convention”. The measurement of quality of distance education programmes will be assessed on its ability to affect knowledge, skills and dispositions.

A quality standard system (QSS) that would best honour the STCW quality standard code is one which has a quality assessment system and a quality assurance system. Neilsen (1997) describes a quality assessment system as one which demonstrates the extent to which students have acquired knowledge, skills and dispositions considered necessary for doing their career well. He further describes a quality assurance system as one which is concerned with creating and maintaining the conditions by which students attain the desired outcomes.

CHAPTER 2

CURRENT TRENDS IN DISTANCE LEARNING

2.1 Statistical Overview

> *"…fast computers, the Internet, satellite communication, VSAT, broadband technology, laser discs, CDROM, interactive video, DVD, WAP distance learning, remote polling, the information superhighway, all within the past 25 years." (Muirhead, 2000)*

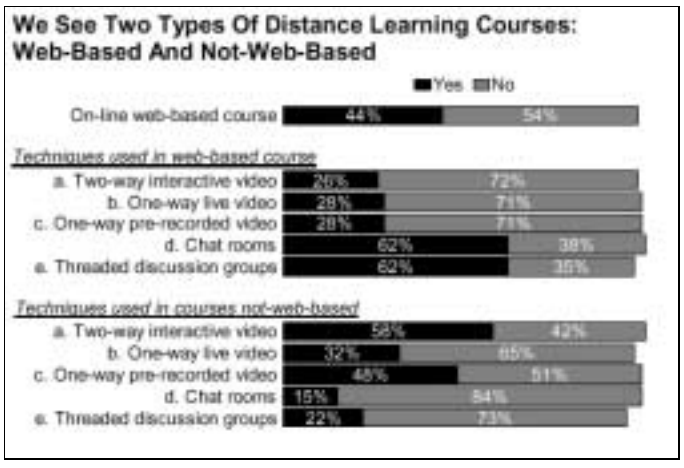
The technological evolution within the last 25 years has opened up vast opportunities in all areas of everyday life. Technologies have changed and are reshaping the way businesses are conducted today. Education is one area in which information technology (IT) has brought about changes and has created a new dynamism, which has not been experienced in the past 40 to 50 years. More and more the 'media of delivery' for education is shifting from the traditional means (the classroom) to the cyberspace environment through distance education. Distance education is in no way a new concept but the emerging methodologies are new.

Countries like Australia, Canada, Germany, Sweden, UK and the USA are leaders in exploiting the emerging technologies in distance education. Globalisation in commerce has been a catalyst for most developing countries to implement policies in order to align themselves with the more developed countries for the facilitation of trade. Developing countries will have no other choice but to make a similar shift as

they relate to the delivery of education and exploit the opportunities of distance education. If globalisation through commerce is forcing them to upgrade technologically then the newly acquired technology can be transferred into the educational sector.

The global affinity for using the Internet for varying interest has not excluded education and according to Lua (1999), the number of college students enrolled in distance-learning courses will reach 2.2 million in 2002, up from 710,000 in 1998. By 2002, 85 percent of two-year colleges will be offering distance learning courses, up from 58 percent in 1998. Eighty-four percent of four-year colleges will be offering distance-learning courses in 2002, up from 62 percent in 1998. It is difficult to ascertain the number of higher educational institutions involved in distance learning, and determining the number of MET institutions engaged in distance learning is even more difficult. Advocating that if the emerging technology will have an impact on education it is only fitting to look statistically on users' trends. Additionally the more lines of communication that exist between tutors and learners, the better the outcome of learning.

Figure 2.1: Statistical overview of communication in web-based and non web-based courses

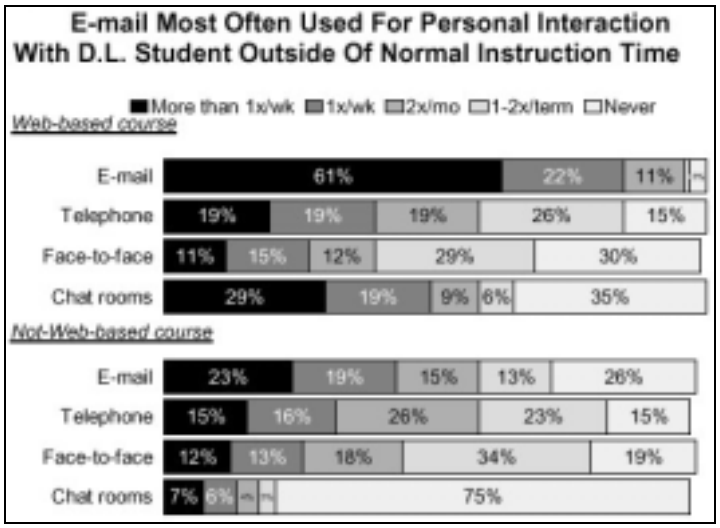


Source: National Education Association (NEA), (2000)

A survey conducted by the National Education Association (NEA) in Washington DC reveals that two-way communication is more favoured and has a greater impact as seen the figure 2.1. Hence web based format is of growing popularity and gives more communication possibilities.

Therefore, using a distance education teaching platform like computer-mediated communication (CMC) would give good learning outcomes because of the variety of communication possibilities. To further boost interaction, the NEA states, "e-mail is the dominant means of communication employed by faculty and students outside of normal instruction time – both the Web-based courses and the not-Web-based courses. Indeed, there is a tremendous amount of faculty-student contact via e-mail". Figure 2.2 gives a good overview of the trends for student interactions.

Figure 2.2: Preferred means of communication for students enrolled in distance learning

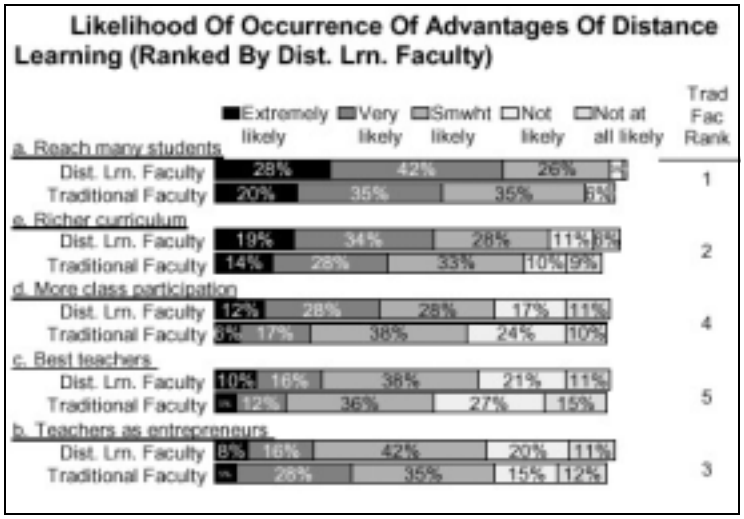


Source: NEA (2000)

Another interesting trend found in the NEA survey is that both distance learning and traditional faculty intimate that it is extremely or very likely that distance education will reach many students who could not take traditional college courses. Applying this to the maritime fraternity, the onboard potential for seafarers is very positive. The NEA feels that smaller institutions will be able to offer a richer curriculum and

both are extremely important advantages of distance learning. Figure 2.3 illustrates the advantages of distance learning.

Figure 2.3: Advantages of distance learning



Source: NEA, (2000)

The synopsis of the current trends in distance education demonstrates that the emerging technologies available are only to improve the 'media of delivery' and to enhance student outcomes derived from distance education. The maritime fraternity, particularly MET institutions, must therefore poise themselves to take full advantage of distance learning. Being that most MET institutions are small and based on the NEA's survey, smaller institutions can offer a richer curriculum, the 'richer curriculum' would be the beginning of quality assurance.

2.2 Effective Methodologies

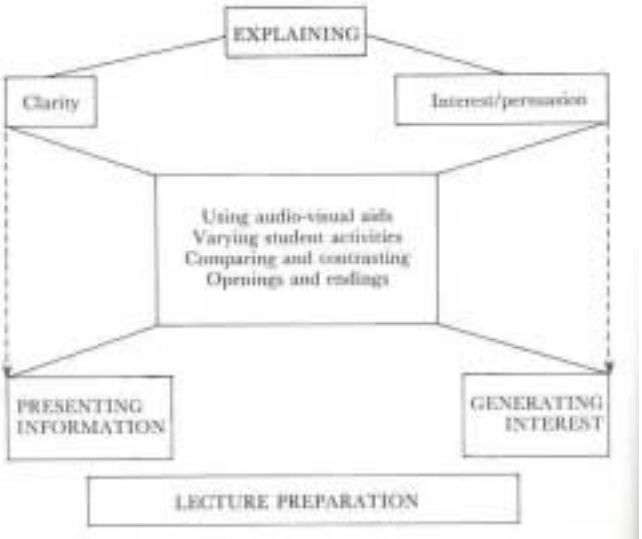
In order to review effective methodologies appropriate for distance learning, a foundation or base has to be established. The base concept lies in the traditional classroom setting, being that the face-to-face classroom setting has been the core mode of delivering education from time immemorial. The core mode of presenting or

teaching students is through lecturing and this method requires the teacher to have special skills to be effective. A vital aspect of the lecturer's skill is how effective he/she is in communicating. Hence communication in lecturing or teaching is of utmost importance.

If communication is the nucleus of teaching, then as Brown et al (1999) postulate, the major skills in teaching are explaining, presenting information, generating interest and lecture preparation. The outcomes associated with these major skills are the topic coverage, understanding and motivation. As a guarantee to ensure that these outcomes are achieved the proper didactic strategies are vital. These strategies include, but are not limited to, using audiovisuals, varying students' activities and maintaining the attention of the audience.

Revisiting the major teaching skills alluded to earlier of explaining, presenting information, generating interest and lecture preparation, the figure 2.4 below illustrates clearly the relationship and interrelationship of the vital teaching attributes. Expounding on each to provide clarity of explanation, Brown et al (1999) deem as giving understanding to another.

Figure 2.4 The skills of lecturing



Source: Brown (1999) p. 20

Understanding, they emphasize, is the creation of new connections between facts, between ideas and between facts and ideas. Presenting information is linked to explanation but more so directed at the methods or strategies used to provide clarity. For the lecturer or teacher to be effective, the ability to captivate the audience by generating interest is indeed the most challenging of the skills. The teacher's approach in effectively explaining a topic is a very vital goal. The presentation techniques will stimulate interest leading to the motivation of the students. Brown and Atkins (1999) support the former view when they state, "if a student is motivated by the lecturers' approach to a subject then he or she is likely to become self-motivated and the lecture will have an influence long after the content has been forgotten". The all-important aspect of major skills of the teacher is embedded in the preparation of the lecture. Preparation will provide the so-called 'blue print' for a clear and coherent lecture. A teacher knowing his/her strengths and weakness can take steps during proper preparation to minimize these weaknesses and also keep them focused (Brown and Aktins, 1999).

Having set the foundation of effective methodology for good traditional classroom face-to-face teaching, the task is to see how best the traditional classroom setting can transfer and apply to distance education. Being that the teacher is separated from the students, it becomes even more important to have these core foundation principles engrained in distance education. This is communication is so important in teaching. It is clear that, for distance education to be effective, communication between teacher and student is fundamental. Therefore to propose effective, methodologies for distance education, the proposition must embody methods that promote the best communication possibilities.

Computer Mediated Communication (CMC)

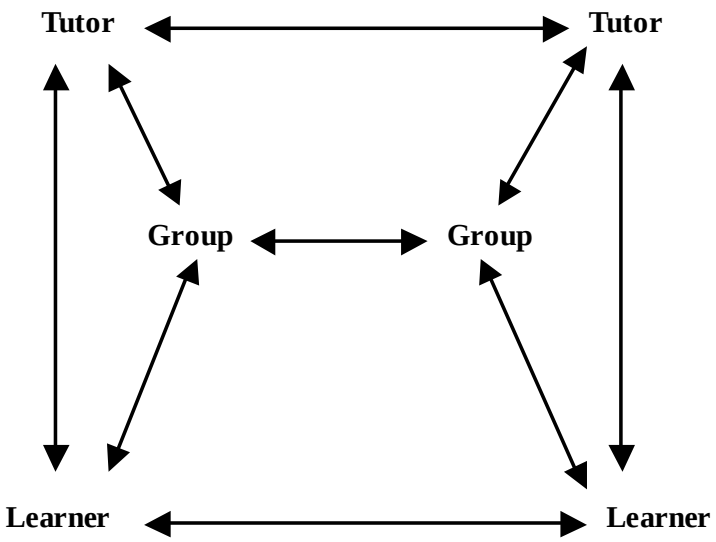
Computer mediated communication (CMC) is a teaching tool or medium used in distance education which is characterized with very good communication possibilities. Magee and Wheeler (2000) describes CMC as "any written interaction

that is generated and transmitted with the use of computer technology". CMC provides communication possibilities like electronic mail (e-mail), internet relay chat (IRC), multiple user dungeons (MUD), news groups and computer conferencing. These modes of communication have a very important role in distance education thus making delivery more effective. D. C. Donovan (Magee et al, 2000) offers explanation of the following modes as:

- E-mail: an asynchronous method of text communication; users have mailboxes and folders where messages can be composed, sent, received and stored.
- Internet relay chat (IRC): also known as interactive messaging, is a synchronous form of CMC; all parties to the communication are online simultaneously; each participant can see what all other participants are seeing as it occurs. (i.e. typing words or generating graphics or calculations on the screen).
- Multiple-user dungeons or sometimes multiple-user dimensions are virtual reality space, so that the user experiences different environments and locations. The MUD concept is being developed further into such applications as MUSE (multiple-user simulated environments) which are mainly used for role playing games, although some more serious MUDs are used for professional and educational networking.
- Computer conferencing: provide a shared working environment which is particularly suited to group communication and collaborative learning.

CMC and its capabilities undoubtedly afford several communication possibilities that make the transferring of communication akin to the traditional classroom situation feasible within the realm of distance education. These communication options are effective methodologies for making distance education more meaningful. Figure 2.5 is an illustration of the interaction possibilities through CMC.

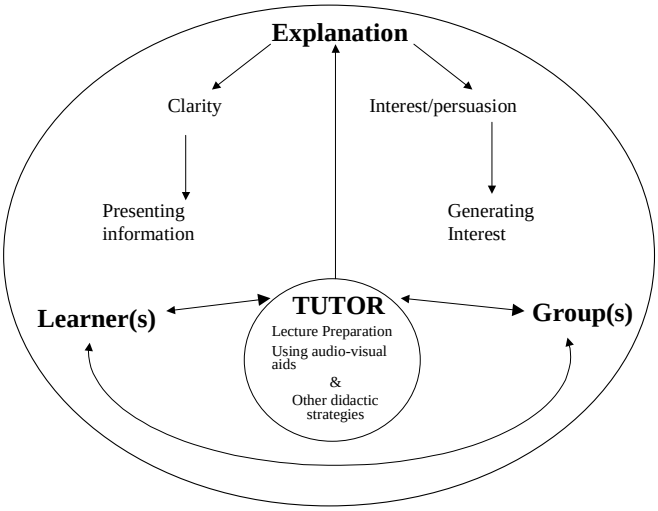
Figure 2.5: Variety of interactions possibilities



Source: Magee, R. & Wheeler, S. (2000)

Within the communication options that the CMC model affords, a genuine link can be established between figure 2.4 (skills of lecturing) and figure 2.5 (variety of interactions possible in the online learning environment). This is because, through the interaction made possible by CMC among tutor, individual learner, group and or groups, an explanation can be enhanced thus providing clarity, generation of interest from the information presented and the incorporation of other aids. The success of the outcome is, however, dependent on the level of preparation the teacher has made for stimulating interest and motivating learners, as illustrated by figure 2.6.

Figure 2.6: Combining skills of lecturing communication possibilities



Source: Writer

Constructivism

Constructivism is an effective methodology incorporated in distance education for the promotion of learning. The responsibility of the learning outcome is centred on the student. Beal (2000) explains the constructivist approach as:

> "modelling behaviour for students, and giving them the opportunity to work hands-on on their own projects. It means engaging students in the learning process and allowing them to discover and construct their own meaning out of their experience, using 3-D objects, models, computer assisted instruction and workplace setting to simulate real-world situations for their learning".

In the constructivist learning approach, students can be actively involved in the use of interactive e-mail, chat-rooms, and bulletin boards and web browsers to further enhance their learning.

Collaborative learning

The term 'collaborative learning' refers to an instruction method in which students at various performance levels work together in small groups toward a common goal. The students are responsible for one another's learning as well as their own. Thus, the

success of one student helps other students to be successful (Gokhale, 1995). Gokhale's research led him to conclude that the active exchange of ideas within small groups not only increases interest among the participants but also promotes critical thinking. The shared learning gives students an opportunity to engage in discussion, take responsibility for their own learning, and thus become critical thinkers. This methodology is effective in distance education particularly geared toward higher education, being that it promotes higher order learning as categorized by Bloom's taxonomy (i.e. analysis, evaluation and synthesis). In their group discussions leading to problem solving analysis of the facts, each other's ideas, evaluation of the problem given and the synthesis of the information are important tools for higher order learning.

2.3 New Concept

The concepts that are being promoted more in distance education are constructivism and collaborative learning approach. These concepts place the responsibility of learning more on the student and foster extensive interrelationship among learners through communication.

The use of CMC as a working platform, the constructivist approach and collaborative learning techniques are as appropriate tools for offering distance education for maritime education and training (MET) courses. Being that there is no large scale offering of MET via distance education, then CMC in tandem with constructivism and collaborative learning would become new concepts for MET.

The new paradigm being promoted in MET courses, where appropriate, is the use of simulators through which competence can be more readily demonstrated. The demonstration of competence is one of the hallmarks of the revised STCW convention. A challenge that developers of MET courses would face is providing simulation via distance education in a manner through which the students would gain useful experience and not see it as another video game. Setting up briefings and

debriefing sessions would further add to the challenge. If these can be successfully done then there would be no limit to the MET courses that could be offered.

2.4 Positioning Maritime Education and Training: Focus on MET portfolio of courses that are suitable for distance learning

The delivery of maritime education and training (MET) courses via distance education is not popular. It is unknown if any MET institution that delivers the entire International Convention for Standards of Training Certification and Watchkeeping for Seafarers (STCW 78 as amended '95) courses via distance education exists. Seagull AS is a company produces CBT modules based on STCW courses and this can be in cooperated into distance learning programmes.

With the emergence of the new technology a number of STCW courses could be offered via distance education and proposes the following portfolio proposal in Chapter 5. The success of these courses via distance education will be very dependent on how well the courses are developed for the distance education platform. Extensive work will have to be focused on a curriculum based instructional design in the developmental process.

2.5 Onboard Potential

The proliferation of technology and its application in just about every sphere worldwide has made the old cliché 'it's a small world' ring true. The various possibilities that have opened up as it relates to communication, the transfer of information and data are tremendous. In the maritime arena, the shipping industry is taking great advantage of the technological phenomenon in the way ships are operated and managed. The growing concept of electronic data interchange (EDI) is an emerging paradigm in shipping business. EDI has made the transfer of mind-boggling amounts of information between shipyards, naval architects, suppliers,

owners and other interests possible, resulting in economic efficiency. Kockums Computer Systems is one such company that has used the concept of EDI through its software TRIBON (Kockums Computer Services, 1999). This software provides capabilities that can allow an owner to watch the progress of vessel design, through a virtual walk through, and to suggest changes in design as it progresses. A key question here is: are the ship owners, companies, shipyards and other interests intimately involved with shipping willing to invest heavily in software systems for education and training as they are for systems like TRIBON? For the shipping industry to achieve economic efficiency, maritime education and training cannot be ignored. Software like TRIBON, developed for MET to deliver distance education with simulation capabilities, would be a maritime educator's dream come true.

MET should not be limited to academies but should lie within the reach of every seafarer irrespective of his/her geographic location. Hence if geographic location is no barrier then the onboard environment has no limits. The shipowner should not only view the vessel as a place of work but as an environment for continuing education. It is only through upgrading one's skill continually that human error will be reduced, the factor that research indicates to be dominant in over 80% of all maritime casualties.

Muirhead (1995) suggests "Technology today is providing the innovative vessel operator with a window of opportunity to transfer much of the training for operational skills to the on-board environment". It is now time for shipowners to visualise the benefits to be derived from MET onboard through distance education and to bring MET within the reach of every serving seafarer on board. MET institutions would have to respond to the demand by offering STCW, upgrading and refresher courses for seafarers afloat.

In today's shipboard environment minimum manning is the order of the day, which limits the officers to be able to adequately provide the requisite guidance on training and assessment for the trainees. Credit must be given to some companies that have

CBT and CAL libraries on board which enable trainees to do self-study and allow both trainees and companies to monitor progress with the appropriate administrative tools. However the ideal solution would be a distance education facility through the power of the Internet, affording them the opportunity to continue their education with their MET institutions and monitoring their progress while gaining experience onboard. Distance education in this regard could reduce the time spent in MET institutions.

If simulation becomes a possibility via distance learning it would be a motivator and confidence builder for the trainee. The trainee would be able to apply the simulation training onboard directly to the real world. What would this mean to the professional crew? It would mean that a Master going to a port for the first time could train and become familiar with handling of the vessel for any unique characteristic of that port. Therefore the possibilities of any mishap would be greatly reduced as more strategic planning could be done.

The advantage of having distance education available onboard at the fingertips of crews, which affords them the opportunity of continued education, upgrading, refreshing knowledge and skills is only a step in the right direction. The availability of the requisite technology is not lacking. The only mask to retard distance learning onboard is probably the associated cost, but as technology evolves and the volume of users increases cost decreases. Therefore cost will soon cease to be a prohibitive factor and the industry can foresee a very favourable potential of distance education onboard in the future.

CHAPTER 3

THE ROLE OF TECHNOLOGY IN THE 21ST CENTURY AND BEYOND

3.1 Current Technologies

The communication platform that information technology provides has ballooned tremendously within the past two and a half decades. The rate of evolution of this technology is growing exponentially and its application appears to be limitless. In today's environment, passive communication styles are rapidly becoming outdated; the new order is for active and interactive means of communication. The ability to transfer vast amounts of information to a single or multiple point destination is becoming more and more commonplace. So what are the communication platforms available to support this new order of communication and the ability to transfer vast amounts of information? Current communication platforms include:

- Integrated Services Digital Network (ISDN)
- Asymmetric Digital Subscriber Line (ADSL)
- Very Small Aperture Terminal (VSAT)
- Teledesic (Broad Internet In The Skies)
- Fibre optics
- Wireless Application Protocol (WAP).

The reader might ponder as to why these forms of technology are often referred to as platforms. These are seen as stages, launching pads, or hosting environments for communication applications. The communication applications referred to include but are in no way limited to the Internet, World Wide Web (WWW) interactive video, online video, e-mail and Internet relay chat. These forms of technology have drastically reshaped the way businesses are conducted today. Their current applications have impacted education in general and, in particular, higher education through distance learning. The following is a brief explanation of the various communication platforms.

Integrated Services Digital Network (ISDN)

Integrated Services Digital Network (ISDN) emerged in the 1970's, as user demands on telecommunication networks began to include (in addition to voice) the transmission of data, video, video image, text, facsimile, and graphics information (Williams et al, 1999 p. 42). They ascribe the evolution of ISDN mainly because those services mentioned previously are not suitable for analogue networks. The introduction of an ISDN by the telecommunications industry has revolutionised many business activities throughout the world. What was once impossible is now made possible by direct access to dial-up digital lines. Oliver (2001) states that the range of applications is constantly growing but already includes:

- High quality audio - broadcasters can establish their own digital quality audio links without having to book expensive analogue music circuits in advance.
- Internet access - surf the Internet up to four times faster than traditional modems.

- Data transfer - move anything from simple data to large video or image files.
- Desktop conferencing - real time on-line document discussion.
- Group 4 fax - transmit an A4 sheet in just three seconds with laser print quality.
- LAN to LAN bridging - establish fast, reliable inter-connection between small Local Area Networks.
- Newspapers - press photographers can instantly relay their pictures around the world.
- Home/remote working - remote access is possible to your LAN or computer network from any ISDN line, be this at home or in one of the increasing number of hotels offering ISDN lines.
- Video conferencing and video telephony - opening a new world of opportunity - distance learning, business meetings and access to remote expertise.
- Video surveillance - allowing police and security firms to monitor live pictures from remote surveillance cameras using video codecs.

Interestingly, ISDN technology allows multiple digital channels to be operated simultaneously through the same regular phone wiring used for analogue lines. The change comes about when the telephone company's switches can support digital connections. Therefore, the same physical wiring can be used, but a digital signal instead

of an analogue signal is transmitted across the line (Becker, 2000). There are 3 basic ISDN services in use:

- 2B + D “S” interface is called the basic rate interface (BRI) that uses two twisted pairs of plain old telephone (POT) wires to deliver two 64Kbps (kilo-bits per second) and one 16 kbps data signalling channel. Each of the two 64Kbps bearer or B channels can carry voice conversation, one high speed data transmission or several separate data channels; these channels are multiplexed into one 64 Kbps high speed data line.
- 2B + D “T” Interface delivers the same two 64 kbps bearer channels and one 16 Kbps data channel, except that it uses two wires (one pair) and can work at 5 to 10 kilometres.
- 23B + D (30B + D) – This is called primary rate interface (PRI). At 23B + D, the channel is 1.5444Mbps (Mega bits per second). It is the standard T1 line in the United States. The 23B + D operates on two twisted wire pairs. At 30B + D, the channel is 2.048 Mbps. It is the standard E1 line in Europe. The 30B + D also operates on two twisted pairs (Williams et al 1999, pp. 42-43).

In 1998, the ISDN technology further evolved with a new flexible bandwidth feature called Always On Dynamic ISDN (AO/DI), which lets you maintain a constant connection to your Internet service provider while minimizing line charges by only bringing up bandwidth when you need it. The significant benefit to be derived from AO/DI is cost savings to the subscriber.

ISDN technology would be a possible solution to developing countries' needs in offering PC-based distance learning. Williams et al (1999) explains the advantages of ISDN as follows:

- It can integrate several applications (data, voice, fax video etc.) simultaneously over one line.
- It can run over plain old telephone (POT) lines (existing twisted pairs).
- It does not require fibre optics.
- It provides clear channel capabilities, so it's not necessary to pay additional access lines.

Williams et al (1999, pp 43-44) states the applications of ISDN as follows:

- Simultaneous data calls: Two end users can talk over the B channel and at the same time exchange information over the D channel.
- E-mail: It can carry information to and from unattended phones and PC modems.
- Collaborative shared-screen capabilities: Switched data services provided via ISDN lets two or more remote locations, both equipped with computer/video terminals, view the same information on their screens and discuss its contents while making changes.
- Network access: It allows a person with a PC to gain access to virtually any database on a network.

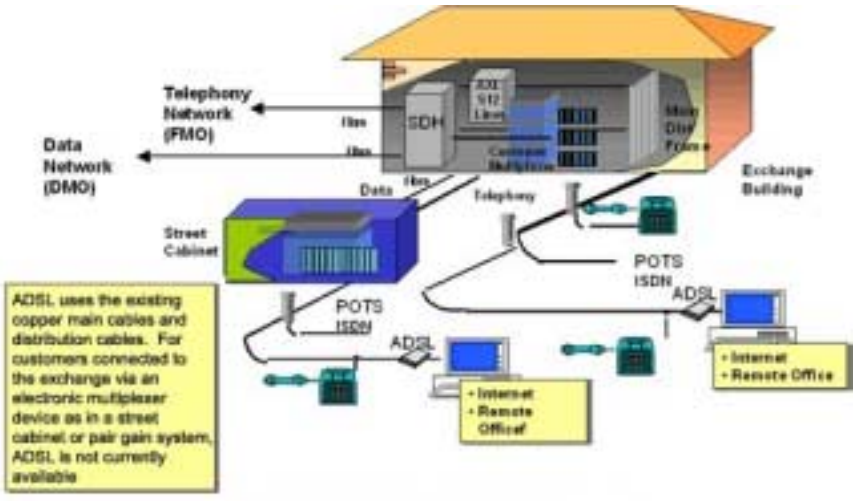
This type of technology will be more prevalent in developing countries as providers of telecommunication services will transform existing analogue communications networks to digital using the existing infrastructure in a more cost effective way. Hence, educational institutions can make better use of the technology to provide DE using high data applications without high technology investments. This provides a very favourable

starting point for the educational institutions in developing countries, including maritime academies. These services depend on the type of connection (e.g. EU 2) used in Europe to provide some broadband capabilities, which would be an economical way to expand broadband capabilities for developing countries.

Asymmetric Digital Subscriber line (ADSL)

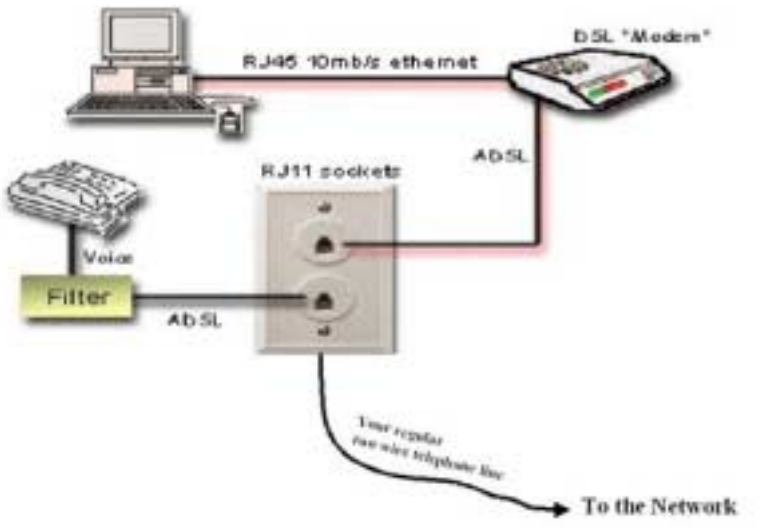
Asymmetric Digital Subscriber Lines (ADSL) are used to deliver high-rate digital data over existing plain old telephone (POT) lines like the ISDN service. A new modulation technology called Discrete Multitone (DMT) allows the transmission of high-speed data. ADSL facilitates the simultaneous use of normal telephone services, ISDN, and high-speed data transmission, (e.g. video). DMT-based ADSL can be seen as the transition from existing copper-lines to the future fibre-cables, making ADSL economically interesting for local telephone companies. They can offer customers high-speed data services even before switching to fibre-optics. The typical ADSL network is illustrated in figure 3.1, and figure 3.2 depicts the multi-connectivity of communication hardware on a single POT line.

Figure 3.1: ADSL in distribution network



Source: Telstra, 2001

Figure 3.2: Hardware connectivity on a ADSL line



Source: Telstra, (2001)

According to Telstra (2001), a company that offers the service in Australia, ADSL can host massive graphics and even interactive videos over the Internet at speeds up to 1.5 Mbps – which is 20 - 50 times faster than current analogue modems. The company alludes to some of ADSL advantages as:

- telephone conversation at the same time as receiving data, and the user will not notice any difference
- whenever the computer is on, the user will be connected to the Internet- to browse, email and download
- no need for an additional line or phone rental
- no waiting time for connection
- no engaged tone
- no line drop outs

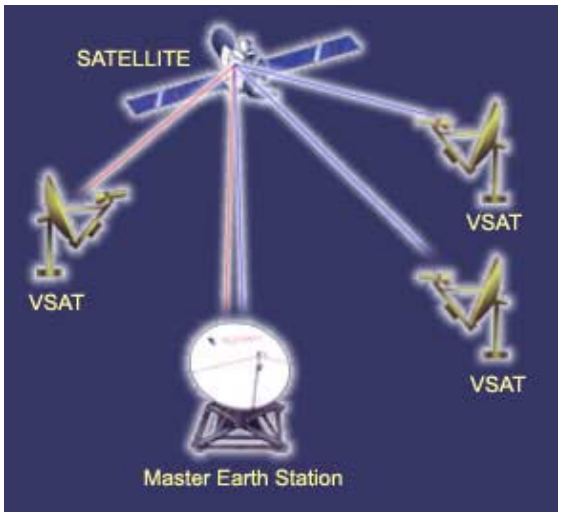
This technology is another economical solution for developing countries to take advantage of since the main infrastructure is already in place (i.e. the POT lines).

Very Small Aperture Terminal (VSAT)

The acronym VSAT means very small aperture terminal that is one form of satellite communications transmission media. Quantum Prime Communications (2000) located in Stafford, Virginia USA explains VSAT to be a receive/transmit terminal installed at dispersed sites which connect to a central hub via satellite using small diameter antenna dishes (0.6 to 3.8 meter).

There are three components in a VSAT network. The first is called a Master Earth Station, as depicted by figure 3.3 which is the network control centre for the entire VSAT network. The configuration, monitoring and management of the VSAT network are done at this location.

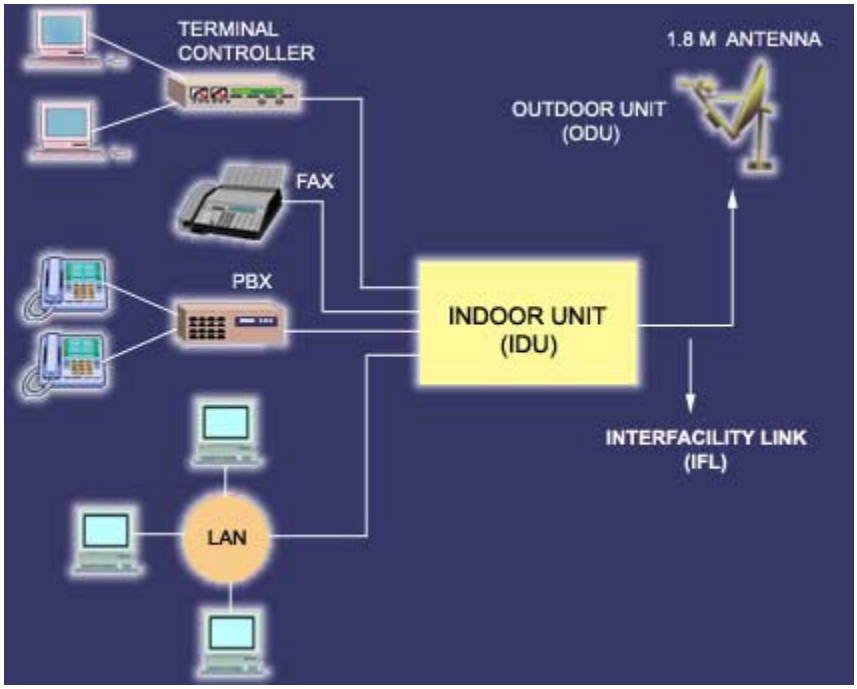
Figure 3.3: VSAT satelite & Master Earth Station



Source: PT. Telesindo Mulia (2000)

The second component is the VSAT remote earth station. This is the hardware installed at the customer's premises that includes the outdoor unit (ODU), the indoor unit (IDU) and the interfacility link (IFL) as illustrated by figure 3.4. The third component of a VSAT network is the satellite itself. All signals sent between the VSAT earth stations are beamed through the satellite. The VSAT system uses a geostationary satellite, which orbits at 36,000 km above the ground.

Figure 3.4: VSAT remote earth station with subscriber's hardware



Source: PT. Telesindo Mulia (2000)

VSAT technology represents a cost effective solution for users seeking an independent communications network connecting a large number of geographically dispersed sites. VSAT networks offer value-added satellite-based services capable of supporting the Internet, data, LAN, voice/fax communications, and can provide powerful, dependable private and public network communications solutions. This system works in

the Ku band and C band. The frequency range of the Ku band is from 10.9 to 17 Giga hertz (GHz), it is increasingly used by communications satellites, and it requires smaller ground antennas, usually (1.2 metres) in diameter. The C band are frequencies used for satellite and terrestrial communications, with a range of frequencies from four to six GHz, and is the band utilised by most communications satellites. According to Williams et al (1999) the main features of VSAT are:

- to provide technology to efficiently connect remote LANs by offering digital connectivity to all network sites
- to supply bandwidth to each site on demand
- to provide optimum solution for "brusty" LAN traffic
- to offer efficient broadcast capabilities for repetitive information (database update applications, compressed video applications).

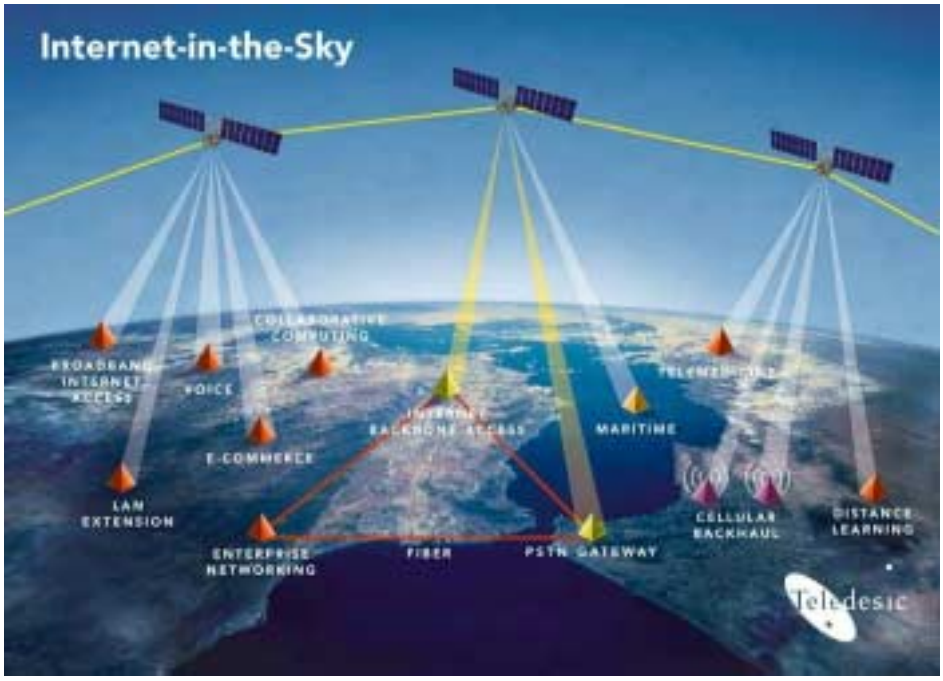
This communication transmission medium is ideal for colleges or universities that have several schools under its central administration that are remotely dispersed. The administration and delivery of courses among campuses would benefit from such a communication network. The system would be totally independent from the public telecommunication system and would have autonomy. Although it would require very large capital investment for installation, the operating and communicating costs are fairly constant. A possible hurdle that a potential user of the service might face is obtaining an operating license. Many countries have very strict regulatory regimes, which make getting a license very difficult.

Teledesic (Broadband Internet in the skies)

The word Teledesic denotes a global, broadband, high capacity 'Internet in the sky' network of 288 low earth orbiting (LEO) satellites. Internet-in-the-sky system, the Teledesic Network, brings affordable access to interactive broadband communication to all areas of the Earth, including those areas that could not be served economically by any

other means. The Teledesic network will serve as an access link between a user and a gateway into a terrestrial network, or as the means to link users or networks together. Teledesic terminals communicate directly with the satellite network and support a wide range of data rates. The terminals also interface with a wide range of standard network protocols, including Internet protocol (IP), ISDN, asynchronous transfer mode (ATM) and others. Although optimised for service to fixed-site terminals, the Teledesic Network is able to serve transportable and mobile terminals, such as those for maritime and aviation applications.

Figure 3.5: The Teledesic broadband market

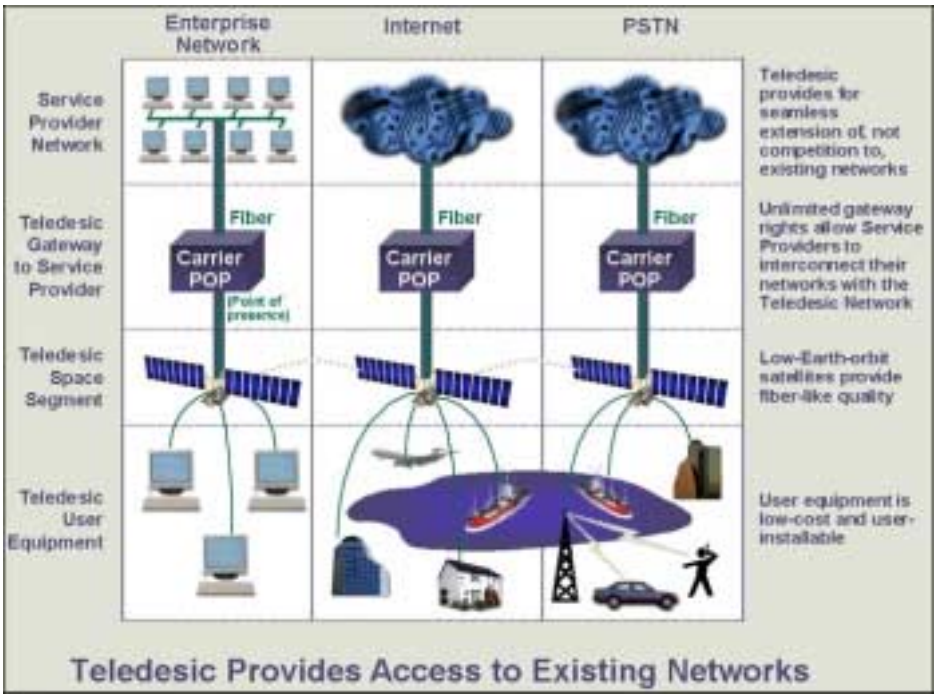


Source: Teledesic LLC. (2001)

Most users will have two-way connections that provide up to 64 Mbps on the downlink and up to 2 Mbps on the uplink. Broadband terminals will offer 64 Mbps of two-way capacity. This represents access speeds up to 2,000 times faster than today's standard analogue modems. The ability to handle multiple channel rates, protocols and service

priorities provides the flexibility to support a wide range of applications including the Internet, corporate intranets, multimedia communication, LAN interconnect and wireless backhaul. Flexibility is a critical network feature, since many of the applications and protocols Teledesic will serve in the future have not yet been developed.

Figure 3.6: The Teledesic network



Source: Teledesic LLC. (2000)

The company Teledesic (2001b) will enable a wide range of communication services from basic connectivity to high bandwidth, value added solutions like:

- Global Area Networking (GAN) – link data networks and provide corporations' branch offices, subsidiaries, and remote workers with high speed access to corporations intranet anywhere in the world.

- Supply Chain Networking - Teledesic will enable supply chain partners to achieve higher levels of integration, faster than ever before.
- Broadband Internet Access - Teledesic will provide broadband Internet access directly to businesses and organizations wishing to bypass local network bottlenecks.
- Maritime Connectivity - Teledesic maritime services will provide ocean liners, tankers and other international shipping vessels with secure, reliable and fast connections to terrestrial networks and enterprise data systems.
- New Applications - Telemedicine, distance learning, electronic commerce and videoconferencing are just a few of the new, bandwidth-dependent applications that are changing the way businesses and individuals interact. Teledesic will facilitate these and other applications with high levels of quality, security and reliability.

Fibre optics

The advent of laser as a source of coherent light and the interest in using light as a medium to carry information grew in the 1960s. The initial transmission distance was very short but as manufacturing techniques for very pure glass arrived in 1970, it became feasible to use optical fibres as a practical transmission medium. Developments in semi-conductor light sources and detectors meant that, by 1980, worldwide installation of fibre optic communication systems had been achieved.

Optical Fibres are fibres of glass, usually about 120 micrometres in diameter, which are used to carry signals in the form of pulses of light over distances up to 50 km without the need for repeaters. These signals may be coded voice communications or computer data (Reid, 1997).

The advantages of fibre optics as explained by Williams et al (1999, pp. 44-45) are:

- Fibre band width has a low error rate (1 bit in trillion) make it suitable for data rates like T1, (E1) and T3 and up
- Not affected by electromagnetic and radio frequency interference.
- Secure (emits very little radiation); cannot be tapped without detection.
- Easier to install than copper, thinner and weighs less.
- Safe in hazardous environment because it is free from electric current.

Fibre optics as a communication transmission pipeline, according to Reid (1997), has several applications:

- Telecommunications - Optical fibres are now the standard point-to-point cable link between telephone substations.
- Local Area Networks (LANs) - Multimode fibre is commonly used as the "backbone" to carry signals between the hubs of LAN's from where copper coaxial cable takes the data to the desktop. Fibre links to the desktop, however, are also common.
- Cable TV - As mentioned above domestic cable TV networks use optical fibre because of its very low power consumption.
- CCTV - Closed circuit television security systems use optical fibre because of its inherent security, as well as the other advantages mentioned above.
- Optical Fibre Sensors - Many advances have been made in recent years in the use of Optical Fibres as sensors. Gas concentration, chemical concentration, pressure, temperature, and rate of rotation can all be sensed using optical fibre.

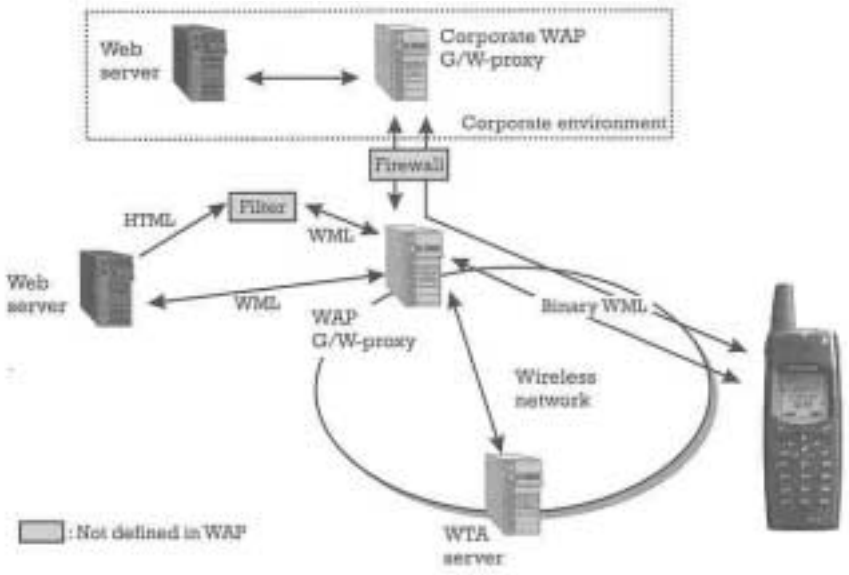
Wireless Application Protocol (WAP).

The newest buzz acronym in the communication sphere is WAP, which means wireless application protocol. It is an open, global standard that empowers mobile users with wireless devices to easily access and interact with information and services instantly (Goldson, 2000). According to Ocklind (2000), WAP has been designed for the economical use of the resources of the telecommunications network. However, Ocklind

(2000) cites some main disadvantages such as display size, number of keys and CPU capacity. This means that the applications will differ from the ones being used today for normal Internet surfing. One of the primary objectives of WAP is to make the mobile phone a 'first class' citizen of the Internet, therefore an Internet oriented approach was adapted. The mirco browser used by WAP can be compared to a standard Internet browser like Netscape Navigator or Microsoft Internet Explorer. The application used for accessing the Internet is written in a new language called wireless markup language (WML). It is structured similarly to hypertext markup language HTML and can be easily converted to it.

In order to reach the Internet world, the WAP-enabled phones must access the Internet via a WAP gateway (G/W). The WAP G/W acts as an intermediary, connecting the mobile network and the Internet by translating the hypertext transfer protocol (HTTP) to the wireless session protocol (WSP). An Internet service provider could be the host for the WAP gateway. Figure 3.7 gives a clear illustration of the WAP network configuration.

Figure 3.7: WAP network configuration



Source: Ocklind (2000) p. 7

A WAP user with a mobile phone supporting WAP will have access to information available on the Internet in WML and WMLScript format as well as telephone service. An interesting observation is that WAP encompasses almost the entire wireless community, making it ubiquitously available to mobile users. Therefore its applications are limited only to the imagination. Some possible applications are:

- information retrieval from the Internet
- notification application
- mobile e-commerce
- telephony
- e-mail access
- advertising
- data access

This new innovation is a gateway to distance learners for accessing information and collaborating with both tutor and peers in any geographic location. This could be a mariners' dream come true for personal communication.

3.2 Future Concepts

No one knows for sure what the future holds but current trends serve as a good indicator to what is possible. The vast need to communicate has generated a high demand in the movement of information, making communications technology very dynamic and is continuously evolving. The promise of 'broadband from above' through the Teledesic satellite network is one way of meeting the high demand in the movement of information. This system promises a data transfer rate of 64 Mbps when it becomes fully operational in the year 2005, accessible from any geographic location. Will this be the answer to the seafarers need to freely communicate independently from the ship's communication system? If so, does this mean that access to distance education will not

be a problem? Will MET institutions seize this opportunity to make distance education curriculum available to the seafarers? If real time streaming video becomes the norm, will this create the possibility for simulation onboard? These are only some of the questions communications technology poses as it relates to future concepts.

INMARSAT has a new initiative called the Mobile Data Packet Service (MDPS) Is a packet-based network that is a point to point protocol (PPP) based system thus able to run Internet Protocol (IP) or other protocols. User terminals can remain connected continuously and only charged for data packets sent or received. This service is air marked to commence in 2001, (August - for land users and in November – for maritime users).

Wireless application protocol (WAP) is another concept that could open up vast possibilities as a communication platform for distance education. This technology could be integrated into a PC desktop or laptop making connectivity convenient to any user. This technology could also be the answer in making communication more assessable to the seafarer, therefore bringing distance education within convenient reach of the seafarer.

These communication platforms will make the concept of the virtual classroom a reality in the near future. The major question here is, how ready is today's society for this challenge of change? The concept of the virtual classroom will change the way in which education presently is offered. Will MET be restricted only to the traditional MET institutions, or will other enterprising educational institutions take the opportunity to offer this education?

As simulation is an important aspect of MET, will these new communication platforms allow other MET institutions to share simulation facilities from a distance? If so, does this mean that simulation facilities can be centralised? If the centralisation of simulation

facilities becomes a reality, the developing countries' MET institutions will not need to make heavy capital investment into simulators but instead buy simulation time as needed.

3.3 Technology And Its Users

The word technology connotes fear, apprehension, and mystique to many people, while to others it invokes the zeal to explore and exploit new frontiers particularly in commerce and education. The vast ranges of applications that are possible with technology in general and information and communication technology (ICT) in particular bring about mixed reactions and emotions to the users. Distance education providers are tasked with the challenge of eliminating fear, apprehension and mystique by how they deploy the use of technology in their courses. Confounding a user or potential users with technology will only demotivate. Instead, creatively blending technology in the presentation of course material will not overpower the learner with the technology. The users must be comfortable, their focus must be centred on the material to be learned and not on the technology used to convey the material.

Being that tutors, course developers and designers are also users of technology, their primary concern is how to best utilise the available technology so as to create a comfort level with the end users, the learners. Traditional classroom teachers have slowly been drawn to use this technology and they, like the learner, experience fear, apprehension and mystique. Only through training and continuous exposure will they achieve a comfort level.

3.4 Choosing the Right Media

Media may be divided into two groups, namely media for transmission and media for course delivery. Media for transmission encompasses the availability of the technology

that will be the platform for the media for delivery. Media for transmission includes but is not limited to ISDN, ADSL, satellite technology, fibre optics, and WAP. The importance of the former is the influence it will have on methodology used to deliver courses to the distance learners. Prudence has to be exercised by course developers so as not to create courses that cannot be suitably transmitted through the available media for transmission. In developing countries, distance learning providers must have knowledge of the type of transmission technology that is available so as to structure courses to suit the appropriate media for transmission.

The media for delivery is the format in which the course material will be delivered to the distant learner. The format of the course material will be heavily dependent on the transmission technology available. An important consideration is to which technology the learners have access in order to retrieve their course materials. It would be imprudent to offer web-based courses when the learners have no access to computers; teleconferencing may be the more appropriate choice. Whichever delivery methodology is chosen, proper course planning and administration is vital. Student support, access a tutor and feedback in a timely manner are fundamental strategies upon which to build.

Choice of media is twofold; the availability of technology for the transmission aspect, and the presentation of course content, that is, how it has been delivered to the learner. Distance learning providers must consider these two areas carefully so that they can make the best of these resources. The media of transmission and the media of delivery are interrelated and interdependent.

3.5 Interfacing Technology With Its Users

Before discussing interfacing technology with its users, an analogic clarification of the concept ‘interface’ is extremely important. A binocular is an interface between the viewer and the scene, as is a steering wheel of a car is an interface between the driver

and the road. Similarly, a computer is an interface between its user and the information conveyed. In general terms, an interface is the locus of interaction between a person and its environment (Duchastel, 1996 p. 208). Offering more clarity to the purpose of an interface Duchastel (1996) aptly states:

> the purpose of an interface is essentially to facilitate access to the tool's functionality, no matter whether we are dealing with physical tools or with mind tools. Further, from a design perspective, an interface is itself a design artifact, built a certain way within constraints, with a view to best accomplishing its mission.

In analysing the statement of Duchastel, there are two important aspects of the interface, namely 'design' and 'accomplishment of its mission'. The 'accomplishment of mission' or outcome is very interdependent on the design of the interface. Hence, interfacing technology with its users is greatly related to how best the designers use information and communication technology (ICT) to achieve a positive learning outcome. If the interface is the link between the learner and the knowledge, then the interface should serve as a source for motivation by its ergonomic design and not an agent of frustration. The technological learning interface should not be an agent of frustration but a means to inspire learning. For this end to be achieved, system designers should have knowledge of learning psychology. It is only by exhibiting knowledge of learners' behaviour in general that the interface design will achieve its intended objective of facilitating learning.

The designers of distance learning interfacing tools must be aware that learning technology is a design theory that is prescriptive for learning environments. The inference is that learning technology is considered as a design discipline that is a repository for the best methods and practices for the development of specific learning technologies.

In chapter 2 reference was made to computer mediated collaboration (CMC) as an effective methodology for distance education that is supported on a web based platform. The platform must therefore have an effective system that properly and effectively manages the web-based activity of CMC. Learning management systems (LMS) are interfaces for CMC that are dependent on design experience, the 'how to' that forms the basis for the professional side of the field. To become a professional, one must be trained and experienced. Designers of learning technology interfaces must be trained and experienced particularly in understanding the learners' psychic to create effective, simple and ergonomic motivating systems. Importantly, if the interface is perceived as a link between the knowledge and the learner, and the lecturer as a facilitator of the knowledge, designers are tasked to harmonise knowledge, learner and lecturer. Harmony can only be achieved through communication. All learning management systems (LMS) must have embedded within them good communication systems to support learner to learner, or groups of learners and the lecturer. The interaction created will be a motivation in itself whether the communication is done synchronously or asynchronously, but importantly, the feedback process must be timely.

3.6 Technology and the Challenge of Change

As technology continues to reshape the educational landscape we in the developing countries have to ask ourselves if we are ready for the changes. The rate at which technology is evolving in the developed countries bears no similarity to the rate of technological evolution in the developing countries. Hence both groups, that is, developed and developing countries, are operating in an unevenly balanced situation. Governments in developed countries like Sweden can set national policy to provide every household with broadband capabilities by 2002 (Muirhead, 2000). Such national policies will have far reaching implications on the countries' development. With technological capabilities aforementioned, educational institutions will be able to deliver high quality distance education programmes. Such programmes can incorporate

advanced multimedia educational tools like video conferencing to promote interaction and to enhance learning outcome. This broadband technology will, if exploited by developed countries' MET institutions provide the capability to deliver distance learning courses to seafarers onboard.

Next Generation Internet (NGI) is an emerging concept that, when coupled with broadband, will allow access from anywhere. Wireless local area network will bring broadband access to laptops at rates of 11Mbps to 38Mbps and allow connectivity from anywhere (Nokia, 2001). This will redefine distance education and be the answer to seafarers that needs to communicate and continue education. Seafarers will no longer be dependent on ships' communication systems for their private communication needs.
How long will developing countries take to adapt to these changes in their communication infrastructure? Will these governments see the need to prioritise ICT and make bold national policies like the developed nations? Or will industry put pressure on them to formulate national policies or ICT in the name of development? Will the people see this a necessity when basic needs such as having a reliable water system or good roads or good health care need to be addressed? Technology and the challenges it brings to developing nations is not easy to affect change. But is there another way out?

Technology and the challenges it brings can render changes to how MET institution operate. Alliances could be formed between developed and developing countries MET institutions through distance education programmes. As it becomes more difficult to recruit young school leavers for a career at sea in developed countries then the developing countries personnel could be the answer to new crew. Through alliance by distance education developed countries MET institutions could assist in the training, particularly in areas of simulation. With the emerging technology simulation training will be possible through distance education. The aforementioned could be one of the challenges of change that the new emerging ICT can possibly bring.

CHAPTER 4

COST ANALYSIS OF DISTANCE LEARNING

4.1 Putting A Cost On Distance Learning

In addressing distance learning as an alternative means of course delivery for developing countries' MET institutions, the viability of it will hinge on cost issues. MET institutions are usually operated, either as cost centres or profit centres. As cost centres they are usually state owned and operated. The ministry of which they are a part usually finances their operating budget. On the other hand, profit centres are usually private or semi-private institutions. These institutions have to generate their own income to finance their operations. However, irrespective of operating style (cost or profit centres) sound financial management must be practiced.

Any MET institutions establishing a distance learning project will need additional capital investment resources for funding. In procuring such funds, the prospective financial agency must be adequately convinced of the project's viability. Developing a business plan is the best way of convincing a financial institution of the project's viability. A good business plan which takes into consideration long-term macro, strategic issues as well as medium and short term challenges is indicative of proper strategic planning. The business plan according to Angas (2001), should at least include the following elements:

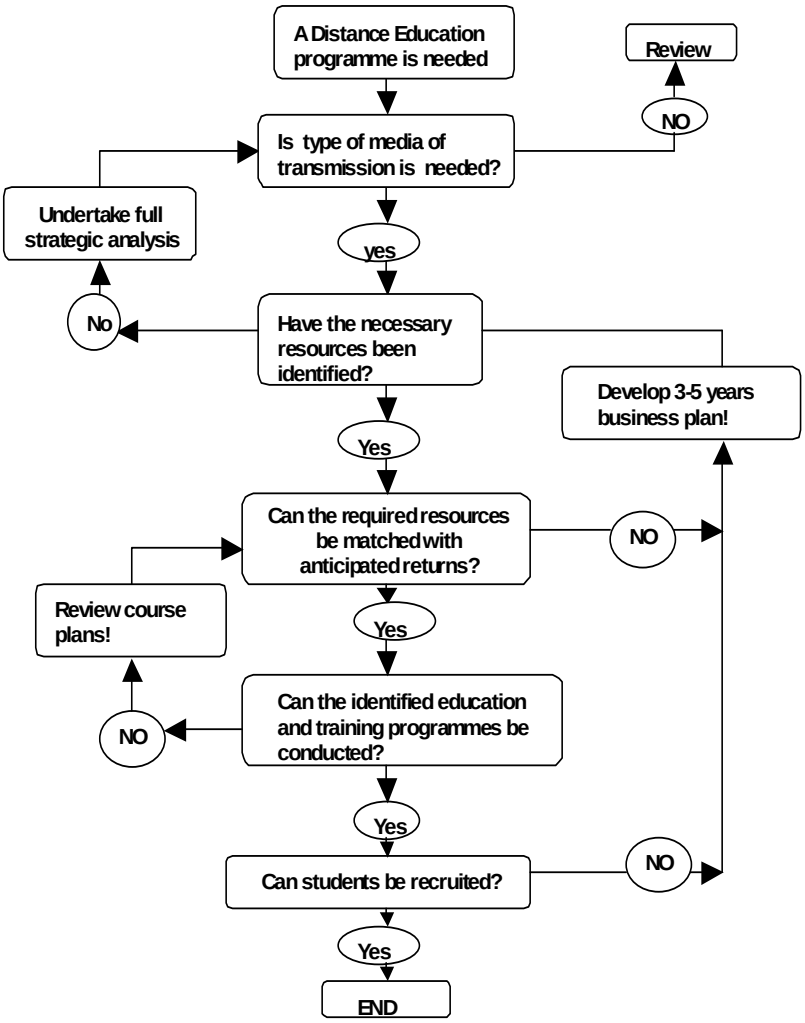
- Introduction
- Mission statement
- Vision
- Enabling strategies
- Objectives
- Income analysis – (projected total income over 3-5 years)
- Expenditure analysis – (projected total expenditure over 3-5 years)
- Capital expenditure
- Financial summary

In setting up the distance learning project a flow chart as illustrated in figure 4.1 would be helpful to ensure all steps are covered during the planning process. In looking at this flow chart 1 two important questions arise: Have the required resources been identified and can resources required be matched with anticipated return? Both questions have cost implications; before the sources for funding can be identified or procured, the cost of the DL project must be known. Similarly, before a price can be affixed to the course its cost per student must be deciphered. The important costs that have to be rationalised by the MET institution in creating a distance learning project, according to Bartoloc-Zlomislic and Bates (1999), are:

- capital - i.e. cost for the purchase of equipment and materials.
- recurrent or operating cost – cost that occur on an ongoing basis, i.e. the cost of computer support.
- production cost – costs that are associated with the development of a course or programme.
- delivery cost – costs associated with the delivery or teaching of course materials.
- fixed cost – costs that do not change with output.

- variable cost – cost that change with the level of output.

Figure 4.1: Distance edcation project flow chart



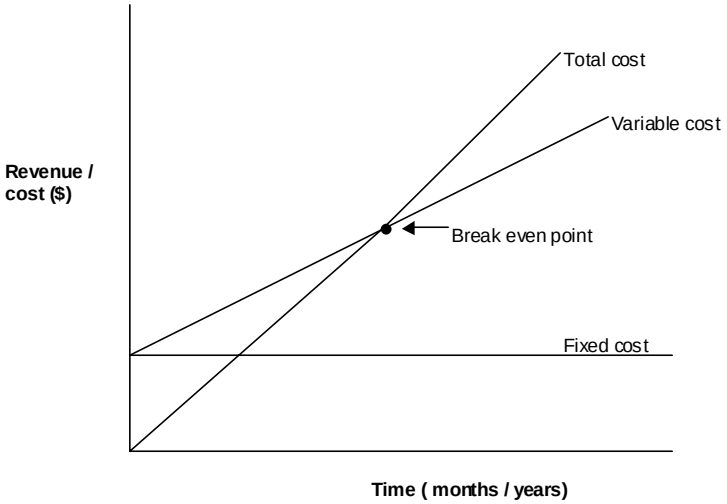
Adapted from: Angas, 2001

In order to justify some of the costs (like the use of technology) that may initially appear to be high, the benefits to be derived must be analysed. Bates (1999) analysed benefits to be derived by using some technologies that could justify their costs as accessibility, interaction, novelty and speed. Return on investment (ROI) is another benefit Cukier (1997 p. 144) considers for cost justification, suggesting that ROI is a cost benefit

methodology, predominantly characterised by costs saved. Benefits in this method are expressed as 'economic value-added' benefits and are usually used in training situations. High ROI is crucially dependent on a large number of users; the greater number of users, the more cost effective the technology becomes. Similarly, the ability to add more courses that can be developed using the same technology also adds to the cost effectiveness. Thus the later points are based on economies of scale.

To affect good cost control for a distance learning programme a separate accounting regime should be implemented. In the business plan the projected break-even point should be forecasted by examining the fixed, variable and total cost against the expected revenue as illustrated in figure 4.2. The break-even point is the point at which course will recover its costs.

Figure 4.2: Break-even point.



Source: Angas, (2001)

In appropriating the cost to the students (i.e. the tuition that the students will pay to access the course) it must be at a level that they can afford. It must be decided if students will be paying the full cost. If not, a subsidy has to be included, but who will exactly

contribute to the subsidy must be rationalised. The number of students that will participate in the course will also impact the price. Therefore the more students enrol the cheaper the course can be sold. Hence, offering courses that will be well subscribed will bring down the price and the breakeven point can be achieved in a shorter, time thus giving some guarantee for total cost recovery.

4.2 Costing Web-Based Learning

A developing country's MET institution like Caribbean Maritime Institute (CMI) transition from traditional teaching to distance learning or from one media of delivery to another (e.g. from teleconferencing to web-based learning) can create a cost range anywhere from questionably low to unbelievably high. If web-based learning is the chosen delivery alternative, the task is to convince the decision makers. In so doing, it is prudent to know what is important to these decision makers and to emphasise those perspectives. In building a case to favour web-based training, IT Cetera (2001), a company experienced in interactive training design and performance, suggests four important perspectives which can be used to convince decision makers. These perspectives are:

- to achieve a competitive advantage.
- to demonstrate support of trends and statistics.
- to provide evidence of effectiveness.
- to show a bottom line cost/benefit.

According to IT Cetera (2001), for some decision makers only a bottom line cost benefit analysis will provide appropriate evidence necessary before initiating web-based learning. These decision makers need facts on cost and an understanding of what savings will be gained by using web-based learning. The costs for web-based learning can be broken down into four categories, which are:

- Web access cost – computer hardware, web browser software, networking access to the learners, purchasing and establishing a web server or cost of leasing server space.
- Design and project management cost.
- Production cost.
- Ongoing support.

IN the rationalisation of cost benefit in implementing web-based learning, tangible savings need to be assessed against current training or alternative training costs.

Small MET institutions like CMI must be very frugal with their cost budget. Employing the services of experts can be very expensive. In developing web-based learning, the learning platform software or learning management system (LMS) that can be easily manipulated should be sought after. With such easy to use software staff can be easily trained to maintain course content. Only the cost to initially train staff is expended.

An interesting development taking place which could prove very cost effective for small MET institution is Open Knowledge Initiative (OKI) being implemented by Massachusetts Institute of Technology (MIT) and Stanford University. OKI is a free Open Course Ware which is perceived by many in Higher Education as a critical need: meaningful, coherent, modular, easy to use web-based environments, for assembling, delivering and accessing educational resources. OKI is building a scalable, sustainable open source reference system for Web enabled education (Massachusetts Institute of Technology, 2001). This product opens up opportunities for small MET institutions in providing web-based distance education by using a free learning management system that can be manipulated for their own needs.

4.3 What Does it Cost the Host?

A developing country's MET institution wanting to expand its course offerings through distance learning must analyse the cost of doing so in its business plan. So what are the costs they will face? Should their cost analysis be done on a comparison basis i.e. comparing the cost of types media of transmission and similarly cost of types of media of delivery? Should they adapt a cost/benefit analysis used by an institution experienced in distance learning having a similar model to the one being developed? Irrespective of the method for cost analysis used, the important cost considerations must be taken into account.

Computer mediated communication is a favoured media of delivery owing to its high interactivity. So if CMI were desirous of offering courses via this means, then what are the associated costs? Before looking in depth at the costs a decision must be made on what student / teacher interface will be used. Will they pay for the development of their own learning management system (LMS) or will they use an existing one? The latter would be a more cost effective solution. Costs of existing LSM are, for example (Telelearning Network of Centres of Excellence, 2000; Siekmann, 2000; Gudmundsson, 2001):

- WebCT US$ 2,000
- Mentys $ 98,700
- Pebblesoft $115,150
- Symposium $ 23,030

Cost of software

- Blackboard $ 5,000 – 60,000/server/year
- Lecando $ 3,276/year & $28/student/year

Leasing cost

Small MET institutions like CMI should use LMS providers that allow them to host courses on their servers. In this way there is no need to invest in their own server and its

maintenance. Cost of supporting material like CBT libraries and video clips to enhance presentation can be purchased/leased from companies like Seagull AS and Videotel Ltd. Seagull offer their CBT CD-ROMs to MET institutions at a cost of US$190 per annum per CD-ROM on a lease basis according to R. Ringstad (personal communication, July 12, 2001).

In an interview with Muirhead (2001) he explained the cost of a programme by the comparison method, making reference to the Australian experience. This approach may be adapted by other developing countries' MET institutions. Comparison was made with developing a four-credit, 60-hour distance-learning unit. In developing such a programme a lecturer may be taken out of regular teaching to develop, draft and collate source material. This, he explained, would include unit information, study guide, readings and/or video or, depending on the module, a computer programme and/or textbooks. A professional instructional designer is employed to rewrite the drafted material in a self-learning format and style. He explained that akin to the development stage is the administration and support aspect. This includes a faculty assistant, enrolment, mail out process, keeping track of assignments, marking recording and feedback, examination and teleconferencing. Communication occurs by email, telephone, fax, etc. All of this bears a cost. The cost of the tutor can be treated as a marginal cost, being that the tutor already is on the pay roll. Another approach is to cost the tutors time at full cost so that the price of the course reflects this cost. These are considerations that must be addressed by the decision makers. A basic proforma, he suggested, would include as indicated by figure 4.3. Important questions decision makers must answer are: What is the minimum number of students for enrolment? What time must be allowed to reach the break-even point? What price can the market bear?

Structuring a similar programme for online delivery, Muirhead pointed out is very similar to the mail out version. Fundamentally, it must be clear as to the objectives of the unit, the media and level of interactivity and what the students shall access online and

offline. In the developmental phase, the cost of a web-based learning management system, either to purchase or to lease, must be defined.

Figure 4.3: Costing and Pricing Profoma

Development/Administrative/start up & Marketing	Days/hours	Rate	Cost	
			Marginal	Full
Developmental tutor				
Developmental instructional designer				
Material (textbooks, etc.)				
Material (PC program)				
Mailing				
Communication (telephone , fax etc.)				
Tutor				
Administrative support				
Marketing				
TOTAL				

Unit guide and study guide material should be formatted in a self-study style similar to the mail out program, which will require the services of an expert instructional designer. Graphics, pictures that will accompany the material, costs for video or CD-ROM and communication costs must also be factored. The cost for the leasing of material must also be considered if applicable. The use of a proforma similar to the previous one would be applicable for collating the various costs.

These costs are analysed to determine the cost per course, cost per phase of development, cost per student and cost per mode of delivery. To verify the cost methodology it is necessary to determine whether some of these expenses are more important than others. In other words, do some elements dominate over the others, or are

some elements insignificant? In the final analysis, the costing must be used as a tool to convince the decision makers that it is worthwhile to invest in the new mode of course delivery.

4.4 How Economical is it for the Users?

Concerns of cost are as important to users as it is to the hosts. Therefore, providers of distance learning must offer their courses at affordable fees. Affordable tuition is not the only parameter upon which to base cost effectiveness to the users. There are other hidden costs to the user in accessing distance education depending on the format delivery. For example, a distance learner accessing web-based learning will have to pay their local Internet service providers (ISP) for the access time. This is one hidden cost that the user must face or may not budget for. Over time, this cost can become expensive. The average cost of Internet access in Jamaica for example, is a one time deposit of US$45, US$10 monthly, and US$1.90 per hour and in addition to this cost is the telephone connection time (Cable & Wireless Jamaica, 2001). ISP offers flat rates at an average US$55 per month. These costs to the user may be categorised as operating costs. The user also has to make the capital investment in purchasing a computer.

Reviewing the cost benefits derived by the user in accessing web-based learning will strongly outweigh the operating costs. For example, students from the rest of the Caribbean, desirous of studying at CMI, Jamaica will incur cost like:

- Airfare - US$650
- Accommodation - $400/month
- Food - $150/month
- Miscellaneous expenses - $150/month

These expenses incurred are in addition to the tuition fee. The major cost savings for the web-based learner are no airfare, accommodation, no food and no miscellaneous costs.

The savings gained can contribute towards investing in a personal computer. The Internet access time paid hourly for an average of fourteen hours per week would be even more economical. Better savings would be gained if the user opted for flat rate access, which is offered by some ISPs. An economical advantage for users accessing the Internet would be using the service called Mobile Packet Data (soon to be offered by INMARSAT) where users only pay for the actual downloading or uploading of data on the Internet. A user spends most time reading information therefore one would not have to pay for that dead time. This service hopefully will be a part of ISP service packages in the future. It would be very important for prospective users to investigate and find out all the associated costs that they will face, as this could determine if they can afford the programme by the host's media of delivery.

CHAPTER 5

THE MET MODEL

5.1 Programme Structure

A novel MET distance education model would be one that enables STCW courses to give prospective learners the option to complete a portion of the course away from the institution. By the nature of some of the courses, it would be very challenging to cover the entirety of STCW courses as proposed in the IMO Model Course 7.03 through distance learning, but many of them can easily be formatted for distance learning. This is a challenge that developing countries could pursue to expand their offerings and increase student numbers without having to consider expanding their physical plants.

Another concept for a distance education programme model would be to offer courses that would be beneficial to the shore-based shipping and allied industry. In developing countries like Jamaica, for example, personnel in the allied industry need training, and short courses could be delivered by this means. Companies would not have to consider losing precious work hours to facilitate upgrading their staff.

Citing CMI as a developing country's MET institution, a challenge for them would be to offer STCW courses as proposed by the IMO Model Course 7.03 manual, Officer in Charge of a Navigational Watch at the Operational Level. In the embryonic stages it

would be good to develop a portfolio of courses that does not require simulation, laboratory or practical work. As experience is gained and the media of transmission and delivery system becomes more sophisticated, then more complex courses could be developed. The proposed portfolio is as follows:

Function 1: Navigating at the operational level

- Electronic systems of position fixing
- Echo sounders and speed measurement
- Compass
- Steering and control systems
- Meteorology
- Maintenance of a safe navigational watch
- Response to emergencies
- Response to emergencies at sea
- English language
- Manoeuvring the ship

Function 2: Monitoring the loading, stowage, securing and unloading of cargoes, and their care during the voyage.

- The effect of cargo, including heavy lifts, the sea worthiness and stability of the ship.
- Safe handling, stowage and securing of cargoes.

Function 3: Controlling the operation of the ship and care for persons on board at the operational level.

- Maintain the seaworthiness of the ship.
    - Ship stability
    - Ship construction
- Monitor the compliance with legislative requirements.

These courses could be developed and delivered via distance learning methodology and technology. The onerous task here is developing and formatting of the course material. The success of the delivery would be hinged on how well the programme modules are designed and the supporting materials are correlated. The progression rules for advancing through each module must be adequately structured. These progression rules must be clear. For example, one can only progress further if the associated tasks or assignments are completed, or on attaining a prescribed score in a computerized self test to show mastery of that section. The progression format would be a source of feedback to the students on how much they are assimilating, as well as a source of information to the professors as to the comprehensibility of the course materials and, monitoring scores achieved, whether or not any modification of modules must be considered. Other subjects not listed here, as well as simulation, laboratory and practical work, would be done in residence. These courses would have to get the approval of the maritime administration, being courses leading towards a certificate of competency.

5.2 Design Considerations

Primary importance must be given to the instructional design because the final outcome must be meaningful learning. Williams et al (1999) aptly defines 'meaningful learning' as "learning in which individuals are helped to acquire needed knowledge, attitudes, and skills to help solve real life problems". The profoundness of this definition is in keeping with the ambitions of the revised STCW 95 convention. The key words of the definition are knowledge, and particularly 'attitudes and skills', which correlate exceedingly well with competence, one of the main foci of the revised STCW 95 convention.

Instructional design underpins all training provisions, as Christian-Carter (2001, p. 1) states:

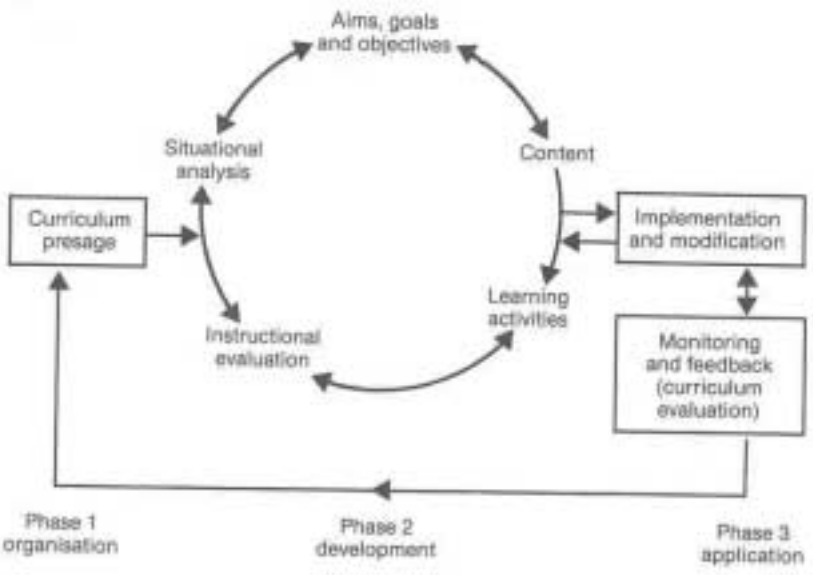
> "Is all about the way in which training is structured and sequenced and then developed to support not only the needs of the organisation, but also the identified

learning needs of the learners and the learning objectives or outcomes. In addition, it needs to take into account the means by which the training is going to be delivered so that it makes the most of the selected media".

So how will meaningful learning be achieved through instructional design? Christian-Carter (2001, p.2) provides a clear answer by suggesting, "the design must be linked directly to what needs to be learned in terms of knowledge and skills". The design must take every step to assist people to apply their education to their workplace performance. It must support the learning benefits and features of the media by which the training will be delivered, while taking into account what is known about the target group and relating to the ways in which adults best learn.

The instructional design must be in tandem with the curriculum of the courses to be delivered. All aspects of a curriculum as depicted by figure 5.1 must be embedded into the design.

Figure 5.1: Curriculum development model



Source: Print (1993), p. 84

Particularly for MET institutions where quality assurance is an obligation, a curriculum-oriented design will be indicative of quality. MET institutions which are providing distance education must ensure that their instructional design is characterised by the following:

- The content is structured and sequenced in a way that makes it easy to learn.
- The content is presented in a way conducive to the ways in which most adults prefer to learn.
- The content can be seen as relating directly to explicit objectives which, in turn, relate to what is required in the workplace.
- The means by which the learning is delivered is an effective way of learning the content.
- The learning is delivered in small, comprehensive chunks.
- Appropriate levels and types of support are available on an individual basis.
- Learners have some say in the learning process, whether with regard to the pace, time, place, support or progress of their learning.
- Learners are provided with appropriate levels of feedback in relation to their learning.
- Learners are allowed at some point to find out what they have learned (Christian-Carter, 2001).

Williams et al (1999, p.11) summarises the design process by alluding to the ARCS Model, which describes distinct sets of strategies. The ARCS Model corresponds to:

Attention – Learners' curiosity and interest are aroused and sustained through external stimulation (organisation and relevancy markers, change, variety, interaction).

Relevance – Learners perceive a relationship between the learning task and the personal value of learning.

Confidence – Learners believe they can successfully accomplish goals.

Satisfaction – Learners experience satisfaction when they are given feedback information confirming expectations regarding the outcome of learning.

Particularly for MET institutions where meaningful learning is to be viewed synonymously with the ability to demonstrate competence, the tasks, assignments and assessments must be of such that not only mastery through knowledge but also through skills developed is evident. Special multi-media interactive exercises would prove beneficial in this area. This could be achieved through incorporating special interactive computer-based training (CBT) into both task and assessment activities.

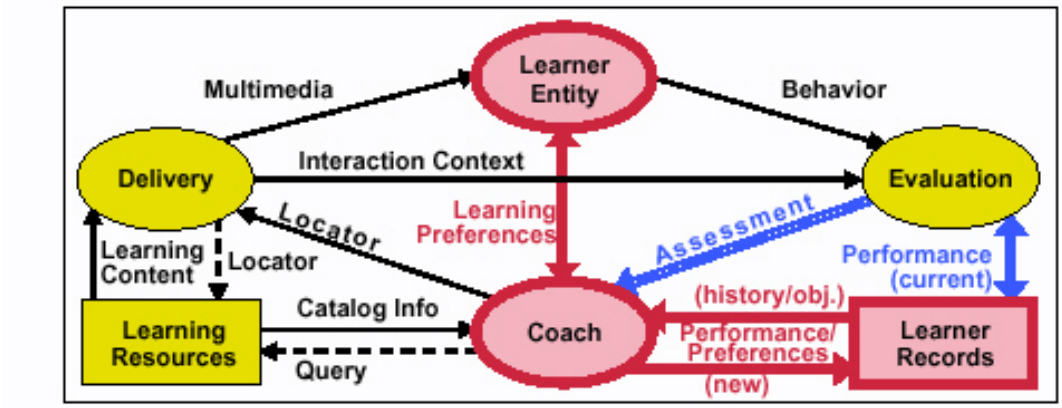
5.3 The Teaching/Learning Platform

The teaching/learning platform in this context shall be the interface, environment, or LMS that allows both tutor and learner to interact with the course content so meaningful learning can occur. In the paradigm shift from the traditional face-to-face teaching that is teacher-focused, to technology-based distance learning that is student-centred, the onus is on the student, and hence the platform must be designed to support this onus.

CMC is a student-centred teaching tool that allows learners the freedom to explore alternative pathways to find and develop their own styles of learning. In promoting online web-based teaching for MET courses, CMC would be the most formidable delivery methodology. Berge (1995) praises the CMC application for its predominant communication paradigm: one-alone, one-to-one, one-to-many, and many-to-many. One-alone application allows the utilisation of online resources like information (online databases and online journals), software (online applications and software libraries) and people (online interest groups and individual experts). One-to-one application promotes learning contracts, mentorship, apprenticeship and correspondence study. This

application is ideal for one-to-one relationships and for individualized learning. One-to-many application can be used for lectures and general presentations. In differentiating this form from other forms of CMC the presentation technique does not usually invite interaction. Within many-to-many CMC applications, all participants have the opportunity to take part in the kind of interaction that can be facilitated in computer conferencing systems. With this application such techniques like debate, simulation, role-play, discussion groups, transcript-based assignments, brainstorming and project groups can be hosted, making it usable for a myriad of MET courses.

Figure 5.2: Teacher/learner platform

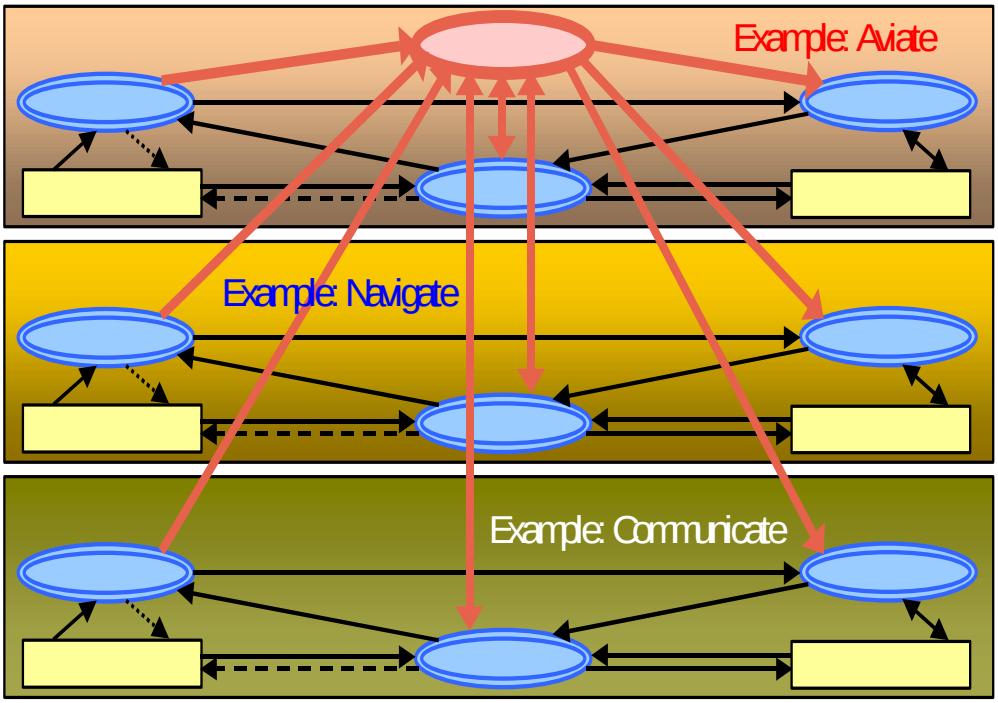


Source: Institute of Electrical and Electronic Engineering (2001) p. 111

In analysing the teacher/learner platform in figure 5.2 proposed by the Institute of Electronic and Electrical Engineers (IEEE), which they call Learning Technology Systems Architecture (LTSA), integration, interaction and information between each component is well supported, reinforcing Berge's concepts. This system supports parallel sessions for the same learner, as depicted by figure 5.3, illustrating the capability for the integration of multiple behaviours, interaction, learner preferences and multimedia components. This learner entity interface seems as if it would be able to support single, partial tasks or multi-task simulation exercises. It is interesting to note

that a platform designed and developed to the standards of IEEE's LTSA would be able to handle full mission simulations. The illustration in figure 5.5 is indicative of that possibility. Because this is very advanced, a developing country's MET institution in its fledgling stages of distance education would not opt to begin at this point for a variety of reasons. First, the cost of development and research in this area would possibly exceed their budgets. Secondly, the lack of technological resources would also be a hindrance, because the ability to handle simulation via web-based learning requires broadband technology, which is widely lacking in developing countries. However, knowing that platforms of this nature exist, over time they can develop courses that can be supported by a similar system as advanced technological resources becomes available. An appropriate starting point would be with the courses proposed in sub-part 5.1.

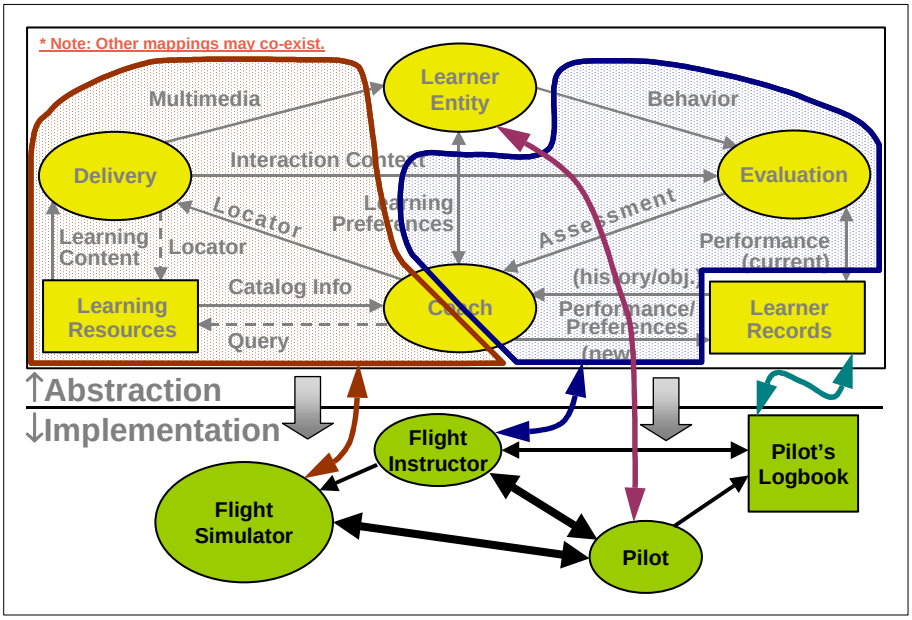
Figure 5.3: Parallel sessions for the same learner



Source: Institute of Electrical and Electronic Engineering (2001), p. 88

The ultimate MET distance education model would be to offer online courses with embedded simulation training. With platforms of this sophistication, the challenge would be to developing countries' MET institutions to offer, for example, the entire spectrum of IMO model courses online. This is indeed a rather ambitious challenge, but it is not impossible.

Figure 5.4: Integration of LTSA and Simulator



Source: Institute of Electrical and Electronic Engineering (2001) p. 118

5.4 Measuring Performance

A very important aspect of the proposed MET distance education model is performance assessment and evaluation. The importance is not only as a source for feedback to students on their progress but also as a requirement for MET institutions under STCW 95 convention. The assessment is based both on the cognitve areas and on skills, like the testing of competence which is absolutlely important under the revised STCW

convention. In accordance with Code A, Section A-I/6, 'Training and Assessment' on page 14, it emphatically states that:

"Each party shall ensure that all training and assessment of seafarers for certification under the convention is:

1. structured in accordance with written programmes, including such methods and media of delivery, procedures, course material as are necessary to achieve the prescribed standard of competence, and
2. conducted, monitored, evaluated and supported by persons qualified in accordance with…"

The challenge here is on the online assessment of competence. In this context, can online assessment ensure that sufficient, reliable and verifiable evidence is available to enable an assessor to be satisfied that a candidate has the ability to work in accordance with the standards required in employment? This question of online assessment is confounding the experienced providers of distance education. Hence there is a great deal of scepticism expressed in this area. Until proper research and development have convincingly solved this concern, assessment for certification of competence could be administered at special centres in the traditional settings. This option could be more costly, but cost should not compromise quality.

The measurement of performance would not be complete if the programme itself is not evaluated. A mechanism must be in place to collect data either from the total number of users or from a representative sample of the whole in order to see how far the programme has been effective. This programme evaluation can be formative (i.e. providing diagnostic data that can be used to improve the programme) and summative (i.e. at the end of the programme to prove that it has brought about the changes it was

designed to achieve) according to Christian-Carter (2001, p.69). This approach is in keeping with good quality management.

5.5 Quality Assurance

For the MET distance education model to be credible, there must be quality assurance, through either its own quality assurance mechanism or through the institution's quality assurance regime. Most importantly, in offering STCW courses, appropriate quality assurance measures must be in place, being that quality assurance is mandatory under the STCW 95 convention.

Fundamentally, transparency is a key component in any quality assurance system and to be transparent is to prove and show what you say you do. In so doing, proper record keeping and administration is vital. Being open to external scrutiny at any time is a virtue of transparency and an indication of quality. Hence, any institution that is operating in accordance with the aforementioned assurances is on the right path to guaranteeing quality. However, for quality affirmation the following also needs to be embedded within the quality system, according to Phipps et al (1998):

- Faculty credentials, selection, and training - Quality assurance in many programs and institutions focuses heavily on the review of faculty credentials, selection procedures for new faculty and faculty training.
- Course content and design - The course is consistent with the unit objectives and the course contains strategies that promote significant interaction between the faculty member(s) and students, and among the students.
- Students - Prerequisites are stated clearly describing the necessary technological skills required by a student to fully participate in the course and the supplemental resources (e.g. calibre of library, laboratory etc.) necessary for a student to fully participate in the course.

- Time-on-Task measures – The minimum time for courses and monitoring of course "log-ins" must be delineated. In addition to textbooks, courses are to be accompanied by a comprehensive study guide, which provides course objectives and key concepts. The minimum amount of time that students are expected to spend per week for study and homework assignments must also be documented.
- Student support services and consumer information - Rigorous reviews of student support services is necessary as one element of quality control. Focusing on adequate student support as an essential element of teaching and learning may be one of the most distinctive features of quality control in distance learning environments.
- Goals and Outcomes - Quality assurance in distance learning is distinguished by a strong emphasis on program goals, and assessment of results or outcomes must lie in the context of these goals.

A MET distance education model must be fortified with at least the above-mentioned quality assurance framework and have the maritime administration understanding the scopes of the programme for a resounding impact. Timely review of the entire system must be completed and adjustments made and recorded accordingly.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

Distance learning must be seen as a part of the globalisation phenomenon via education. Through this mode of delivery, geographical boundaries pose no obstacle and time no barrier. As information and communication technologies continue to evolve, more meaningful methodologies will also emerge and existing ones be improved upon. This dissertation, in its previous chapters, sought to:

1. Define and explain the various descriptors akin to distance education/learning.
2. Review distance learning trends and activities globally.
3. Examine how technology today is used to deliver learning materials to students and provide inter-communication with tutors and institutions.
4. Analyse the costs of preparation and delivery of distance learning programmes.
5. Review the development of an MET model of distance learning courses that could be utilised by developing countries' academies.

6.1 Conclusions

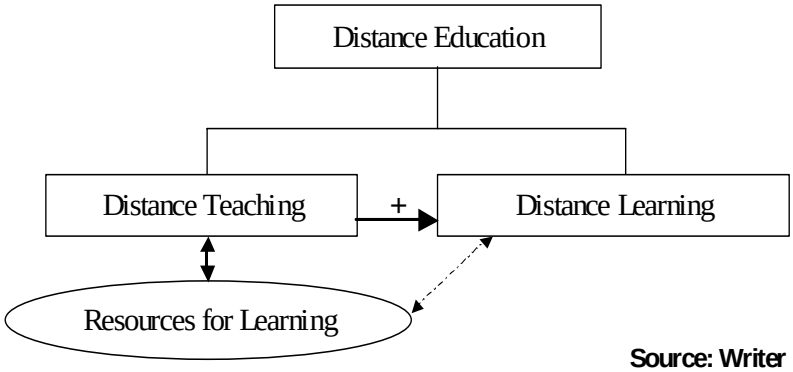
The need for standards

There are a wide number of descriptors that are being used in reference to distance learning, and one cannot be certain what to expect based only on the merits of names. The importance of having a standard name is that perceptions are built from names; just as in commerce, certain name brands are synonymous with quality.

Using a name like distance education conjures the notion of a teacher-centred method of delivery like that of the traditional classroom setting. Emphasis is placed on the

presence of a teacher when thinking of the term 'education.' Therefore, distance education implies distance teaching as well as distance learning where the teacher has more control over the learning resources as depicted by figure 6.1. The paradigm shift in distance education presently is not teacher-centred but learner-centred. The role of the teacher is that of a facilitator or a guide on the side. The new thrust is to make students lifelong learners

Figure 6.1: Distance education and its relationships

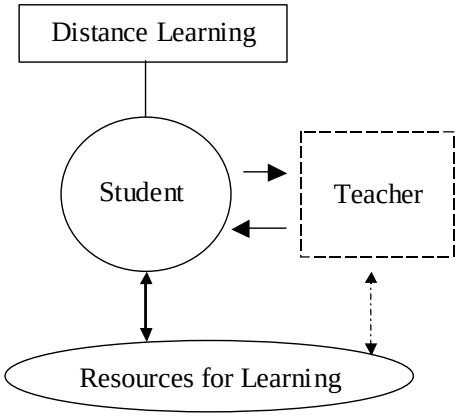


Source: Writer

and to be responsible for their learning, as advocated by Berge and Collins (1995). Teachers are now tasked particularly in distance learning to teach students to become lifelong learners by helping them locate the resources to continue learning as illustrated in figure 6.2. Therefore, if international standards were set simply for naming types of education, then it would be clear if a provider offers courses through distance education and a prospective student would know that it would be a teacher-centred learning environment. On the other hand, a provider offering courses through distance learning would let prospective students know that it will be a student-centred learning process.

Having an international organisation overseeing the operations of distance education providers would provide a positive step towards quality control. Such an organisation would be tasked with the responsibility of formulating regulations and guidelines to streamline distance learning/education.

Figure 6.2: Distance learning and its relationships



Source: Writer

Current trends and challenges

The new dynamism in higher learning institutions is distance education/learning, and information and communication technologies act as catalysts for the dynamism. There is a steady growth of universities and colleges that are offering distance learning. It is therefore only a matter of time that MET institutions will be sharing the same dynamism and offering STCW courses via distance education. The STCW 95 convention either intentionally or unintentionally made allowance for distance education/learning by using the phrase '…methods and media of delivery…' Therefore, if the contracting party approves the distance learning programme then the requirements of the convention would have been met under Code A, Section A-I/6, Training and Assessment.

Communication is a very important aspect of distance learning; the more channels of communication that are provided by a particular media of delivery, the more successful that methodology becomes as seen by the CMC or the constructivist methodology mentioned in chapter 2. Irrespective of the methodology used, it is fundamental that

major pedagogical skills are incorporated and that topic coverage, understanding and motivation are achieved.

MET institutions must be challenged to use the new emerging technologies to bring MET courses within the reach of seafarers on board. It is seen that, as the technology continues to evolve and number of users grow, the costs gradually decrease making such a challenge more affordable. Seafarers are faced with high communication costs, being that satellite is their main media of transmission. However, with new initiatives like that of IMARSAT's data packet service, seafarers can become more hopeful in cost savings.

Issues of cost

In the development of distance learning programmes the issue of cost cannot be ignored, being that cost is one of the most important determining factors for developmental success. A sound business plan as indicated in chapter 4 is a very useful management tool as it takes into account long-term macro strategic issues as well as medium- and short-term challenges, which is indicative of proper strategic planning. It is most probable that MET institutions, particularly those in developing countries, will need financial assistance to undertake distance learning initiatives such as programme development and delivery. The business plan will be a useful tool for convincing financial institutions to procure loans or provide financial aid.

It is essential that courses are developed and costs are such that good ROI are achieved. LMS that is selected must be suitable for many courses so that economy of scales can be achieved, which will in turn become a factor in maintaining cost effectiveness and will become a catalyst for attracting students.

The programme

In reviewing the IMO Model Course 7.03, the portfolio selected is a good starting point for any MET institution wanting to offer STCW courses via distance learning. For these courses to be successful, design considerations are important, particularly instructional design because meaningful learning is the final outcome that must be achieved. The instructional design must correlate and be in tandem with curriculum for the courses as mentioned in Chapter 5.

The credibility of any MET distance-learning model will be hinged on quality assurance. Quality assurance is an obligation under the STCW 95 convention, therefore all MET institutions must affix great importance to this area in having a good QSS.

6.2 Recommendations

From the results of this study, it is strongly recommended that the following actions be undertaken to remove scepticism and to promote distance education/learning particularly for MET:

1. There should be established standards for distance education providers through the establishment of an international secretariat or organisation to provide governance on issues of distance education.
2. In the standardisation process, a decision should be taken and agreed upon on naming this provision of education. For example, distance education is a teacher-centred mode of learning in which teacher is separated from student in time and location and the teacher is more in control of the resources of learning. Distance learning, on the other hand, should indicate a student-centred mode of learning in which student and teacher are separated by time and location and the student is in control of his/her learning with the teacher acting as a facilitator.
3. The IMO Standard of Training and Watchkeeping sub-committee should take a proactive stance and start looking into matters of distance education/learning.
4. Guidelines should be drafted to deal with aspects of instructional design, information interface, student support assessment, security, student identity, media of transmission and delivery as well as quality standards issues.
5. Governments in developing countries should incorporate distance learning/education as a part of their national education policies, thus increasing its worldwide acceptance.
6. MET institutions should piggyback on current ICT used in commerce to provide distance education/learning.
7. MET institutions, in developing countries in particular, should realise that making use of ISDN technology as a data pipeline is a good and economical starting point for offering distance education/learning online as it has a greater capacity for data flow.

8. Governments should grant educational institutions like licensed MET academies to operate VSAT stations for educational purposes, especially for the regional delivery of distance education/learning.
9. MET academies desirous of offering distance education/learning must endeavour to use LMS or LTSA that can be built upon to support more complex programmes like simulations.
10. MET institutions should endeavour to influence and educate their maritime administrations' decision makers on the paradigm shift towards distance education as an alternative means of providing education.
11. Shipping companies should recognise the importance of opening communication onboard to seafarers so they can continue their education if they so desire.
12. MET institutions should form alliances or consortiums with other distance learning institutions, thus taking advantage of some of their technological resources and expertise.

Growing upon these recommendations, MET institutions, particularly those in developing countries, can provide distance education/learning as a viable alternative for offering maritime professional education leading towards certificate of competence. Most importantly, however, MET institutions can ride the wave of technology to provide those with the desire to continue lifelong learning to pursue their education and maintain currency in their professions, creating an atmosphere conducive to continuing education and setting higher educational standards for seafarers around the world.

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