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Towards new technology : computerization for maritime education and training at the Philippine Merchant Marine Academy

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TOWARDS NEW TECHNOLOGY: COMPUTERIZATION FOR MARITIME EDUCATION AND TRAINING AT THE PHILIPPINE MERCHANT MARINE ACADEMY

By

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

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Dedicated to my loving family, my wife Olive and my two children Diana Rose and Julius Caesar

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Lastly, let this work be made an offering to the PHILIPPINE MERCHANT MARINE ACADEMY to which this endeavour is purposely conceptualized and be the guiding pattern of Maritime Education and Training in the whole Philippines.

ABSTRACT

The key to success of any maritime education and training programs in achieving its goals and objectives will depend upon how well various new technology is being used toward the learning process by every educator.

This dissertation looks at the use of new technology in maritime education and training such as computer aided learning, to provide basic knowledge and understanding of the functions of the different parameters of a computer systems.

The paper describes the potential use of computer technology in MET, particularly in a developing country. Some models of computer aided learning (CAL) and computer based training (CBT) are also examined. It describes the overall process of learning and the use of different high-technology instructional materials.

The dissertation also considers the integration of computers to new curricula and discusses the implementation of the same. The different models of CAL are studied to improve the system of teaching in the maritime field.

In addition, the dissertation evaluates two leading maritime training software programs currently available in the market. Other maritime software programs are also investigated and discussed.

In conclusion, proposals and recommendations are made to improve the training facilities and the teaching method at Philippine Merchant Marine Academy (PMMA) for every student in the field of maritime eduation and training. The use of computer technology at PMMA for education and training is a method of ensuring that the skills and ability of the trainees are vastly improved.

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LIST OF ABBREVIATIONS

AME	Associate in Marine Engineering
ARPA	Automatic Radar Plotting Acquisition
BASIC	Beginners All Purpose Sequential Instruction Code
BSC	Basic Seaman Course
BSMT	Bachelor of Science in Marine Transportation
CAI	Computer Assisted Instruction
CAL	Computer Aided/Assisted Learning
CBL	Computer based learning
CBT	Computer based training
CD-ROM	Compact disc- read only memory
CET	Council of Educational Technology
CML	Computer Managed Learning
COSCPO	Controlling the Operation of Ships and Care for Persons onboard
COLREG	Collision Regulation
CPU	Central Procesing Unit
CRT	Cathode Ray Tube
DOS	Disk Operating System
EBL	Electronic Bearing Line
ECDIS	Electronic chart display and information systems
FISYS	Fairplay information system
GMDSS	Global Maritime Distress Safety System
KBES	Knowledge Based Educational System
IBM	International Business Machines

IMO	International Maritime Organization
LAN	Local Area Network
NAME	Naval Architecture and Marine Engineering
NMP	National Maritime Polythenics
NTC	Norwegian Training Centre
MSAUs	Multistation Access Units
OOW	Officer of the Watch
PGS	Poseidon GMDSS Simulator
PC	Personal Computer
PMMA	Philippine Merchant Marine Academy
PNS	Philippine Nautical School
RADAR	Radio Direction and Ranging
RAM	Read Access Memory
ROM	Read Only Memory
RMC	Rauma Maritime College
ROP	Radar Observation and Plotting
RSC	Radar Simulator Course
STCW	Standards on Training, Certificates and Watchkeeping
TSO	Tanker Safety Course
UNDP	United Nation Development Program
USMMA	United States Merchant Marine Academy
VDT	Visual Display Terminal
VLCC	Very Large Crude Carrier
VET	Vocational Educational and Technology
WAN	Wide Area Network

Chapter 1
INTRODUCTION

1.1 The PMMA in Brief

The Philippine Merchant Marine Academy is the lone government institution offering a four year Nautical and Marine Engineering course leading to a Bachelor of Science degree in Marine Transportation. The degree includes one year of shipboard training as deck or engine cadets on oceangoing vessels. An automatic license as Third Mate or Fourth Marine Engineer as appropriate is given after graduation, if the student has passed the validating examination. The latter is considered at this time more rigid than what the Professional Regulations Commission in the Philippines requires for the same rank.

The existence of PMMA can be traced as far back as April 5, 1820 as the Escuela Nautica de Manila. This is one of the oldest educational institutions in the Philippines, which today is known as the PMMA. The evolution of its existence is as follows:

- 15 December 1899 -- Nautical School of the Philippine Islands was established
- 30 June 1900 - name changed to Philippine Nautical School (PNS)
- 1907 -- closed down due to lack of funds
- 1913 -- re-opened as a unit of the Philippine School of Arts and Trade
- 1963 -- Republic Act No. 3680 converted PNS to PMMA at Fort Bonifacio, Metro Manila.

In 1981 to 1984, the International Maritime Organization (IMO), represented by Capt. Mohammed Zakaullah and Engineer Jacob Rosenthal implemented a three-

year program to modernize the PMMA Maritime Education and Training in a joint venture under the auspices of the Philippine Government and the United Nations Development Program (UNDP).

In 1989 the President of PMMA Commodore Moreno died and Commodore Gil S. Fernandez (an ex-USMMA graduate) was appointed as the new PMMA President. One of his first actions in 1990 was to review the curriculum and subsequently revise it, placing the shipboard training in the second year.

The PMMA course is a four year residency consisting of three-years of academic studies (1st, 3rd and 4th year) and one year of apprenticeship training (2nd year) as deck or engine cadet onboard commercial vessels plying the International sea lanes. The course structure is designed in a manner that at the end of the second year of training, the cadet midshipman/midshipwoman has fulfilled the requirements of Regulation II/4 of the STCW Convention (minimum knowledge requirements for certification of officer-in-charge of a navigational watch on ships of 200 gross register tons or more) and would have gained knowledge to enable the students to absorb intelligently the professional subjects for third and fourth year. The study during the last two years is intended to equip cadet midshipmen/midshipwomen with additional knowledge and skills in Marine Transportation or Marine Engineering. The curriculum revision of 1990 was to comply with the department of Education, Culture and Sports requirements for the General Education Component.

Aside from addressing the academic requirements of deck or engine cadet midshipmen/midshipwomen, the curriculum also provides training for their leadership and discipline. The leadership and discipline training scheme is military oriented. Such an approach is necessary considering the uniqueness of the maritime degree for leadership, discipline and integrity.

1.2 Technology and Maritime Education and Training

Technology nowadays is very demanding specially in the field of training of seafarers such that the use of simulation today is very effective. The author has observed and realized that new technology is of growing importance in education and training of seafarers. The use of different training equipment using personal computers (PC's) or simulators for upgrading courses such as radar simulator, shiphandling simulator and the use of electronic charts is one way of developing the skills and knowledge of the seafarer.

1.2.1 Present trends in Maritime Education and Training

The educational potential of the use of computers worldwide in Maritime Education and Training has increased rapidly in recent years. The advent of technologies that introduce the use of CD-ROMs (compact disk-read only memory) and hardware in education may exacerbate an existing trend in the use of computers.

There is a fear that the use of computers in the classroom organization may change the role of teachers and cause their reduction in number. Using the CD-ROM, as a new system of technology, students may now easily access any search word or subject. CD-ROM introduces the use of the Electronic Encyclopedia, a version of Grolier's Academic American Encyclopedia. This comprises 20 volumes of encyclopedia that are stored in one disk but are occupying only one-tenth of the capacity of the disk. CD-ROM can be used on PC and UNIX-based computers, including laptop and notebook, equipped with CD drive. A new computer based system incorporates maritime rules and regulations into one CD-ROM. This allows the users to access data directly relevant to their particular needs.

1.2.2 Maritime Education and Training in the Philippines

The Philippine maritime education and training is striking a happy balance between the quantitative growth and quality improvement of the system. The problem is how to rein in the surplus production of graduates - in the pace of a strong social demand for education, which is accompanied by the mushrooming number of schools with marginal quality of instruction in attaining the standards in maintaining such demands.

For this reason, there is a great need for planning machinery to provide direction in which to allocate the available resources for maritime education to priority areas that would maximize the increase in economic productivity.

Training of the critically needed rating categories has been a most neglected area wherein, a need for policy decisions and planning mechanisms should be optimized. Maritime Education is partly triggered by a relatively lower cost of pursuing a maritime course, as evidenced by the socio-economic status of a great majority of students enrolled. Such growth has taken place without any direction from a planning body. The private institutions responded to this demand almost freely since the standards that they had to meet were low and based on a concept of profit-orientation.

At present, there are sixty five (65) maritime institutions nationwide offering courses leading to the degree of Bachelor of Science in Marine Transportation (BSMT) majoring in Nautical Studies or Marine Engineering, Basic Seaman Course (BSC); Naval Architecture and Marine Engineering (NAME); and Associate in Marine Engineering (AME). Only nine (9) among the sixty five (65) maritime institutions are owned by the government.

1.2.2.1 Special Training courses

Maritime schools in the Philippines offer several training courses, mostly located in Metro Manila, which meet the minimum standard requirements stipulated in domestic or international regulations, particularly the International Convention on Standards of Training, Certification, Watchkeeping for Seafarers (STCW) 1978 and those various resolutions of the International Maritime Organization (IMO).

Amongst these special courses that are offered by the maritime training or independent training centers are Radar Observation and Plotting (ROP), Automatic Radar Plotting Aids (ARPA), Radar Simulator Course (RSC), Tanker Safety and Operation (TSO) and various courses corresponding to upgrade the education and training and in specializing the present technology.

These training facilities for seafarers are evidently inadequate to meet the requirements of the indusrty's increasing demand for certain categories.

1.2.3 Maritime Education and Training at PMMA

The Mission of the Philippine Merchant Marine Academy is to articulate the common viewpoint of the philosophy of education in measuring and rationalizing the standard of teaching methods. Its main objective is to produce well trained marine officers for the merchant fleet and likewise for employment in shipping companies as managers or consultants. The paradigm of the educational program adopts liberal education to foster intellectual, social, moral, and physical development of the cadet midshipmen.

The PMMA system of education is a dualistic approach. The Department of Academics is the place where the educational program in the maritime profession is handled. The cadet midshipmen are acquainted with some information that they must fully understand the system of education in study research methods skills,

experimental methods, critical thinking and deliberative skills in group discussion. In addition, it is necessary for graduating cadet midshipmen/ midshipwomen to be fluent in the English language. In the Department of Cadet Midshipmen, the training of leadership and discipline is conducted. Aside from the educational and training program of the cadet midshipmen, it is mandatory to be a reservist in naval service.

The curriculum of education programs is divided into two different stages, preparatory and professional. In the preparatory stage, where the fundamentals of academics for the fourth class and the third class year is in the maritime professions, preparation for shipboard training and actual experience of life at sea. In professional stage, upon completion, a cadet midshipman / midshipwoman acquires his/her second class and 1st class year, in which they have further knowledge and skills in nautical science and marine engineering which includes other supportive courses like mathematics, sciences, humanities, and the ship management for further knowledge and new insights.

The Department of Marine Transportation introduces additional knowledge and skills in navigation, marine cargo operations, marine electronics, astronomy, meteorology and seamanship. As well, the department provides additional background in management theory, economics, laws, and labor relations. On the other hand, the Department of Marine Engineering provides studies in shipboard engineering, naval architecture engineering sciences such as mechanics, hydraulics thermodynamics, and strength of materials as well as steam, diesel, and electrical engineeering.

1.2.4 Identification of shortcomings in technology in the Philippines

The system of Maritime Education and Training in the Philippines is quite different with regard to modern technology because most maritime institutions in the country lack modern equipment (i.e. computers, simulators, and other navigational

aids) and textbooks (i.e. latest IMO publications including SOLAS and STCW) for the training of seafarers. Likewise, there is a lack of experienced instructors with knowledge of modern technology to train the student.

1.2.5 Current Simulator Training and Equipment

As a developing country, the Philippines is assured of at least one way of training the seafarers with modern technology. The National Maritime Polytechnic (NMP) based in Tacloban, is a joint venture with the Japan International Cooperation Agency, which trains and upgrades mariners in a wide range of disciplines. It offers four (4) practical training courses with twenty nine (29) modules with a duration ranging from five (5) to ten (10) days per course.

This upgrading course for seafarers consists of Radar observer's course simulation, (ROC), Radar Simulator course (RSC), Automatic Radar Plotting Aid (ARPA), and Electronic Navigation system(ENS).

Aside from the NMP training center, the Norwegian Training Centre-Manila is located inside the compound of PMMA at Fort Bonifacio, which has also the latest maritime technology. Apart from offering the widest possible upgrading courses for deck officers and engineers, the NTC launched a scheme for graduate officers, who will be then employed in the Norwegian fleet. Captain John B. Hough, director of the Norwegian Training Centre-Manila said in an interview in Lloyds list that the main objective of the programme was to enhance the quality of maritime students to be employed within their training vessels.

1.2.5.1 The need for simulator and computing resources

With the fast changing technology in shipping, appropriate changes have to be made. Just like the crew reduction concept that is an effect of automation, a multi-skilled seafarer is necessary to effectively perform his/her functions on board

ship and if not properly trained then, human failure can take place and cause a maritime accident. Therefore, the assessment of competence of shipboard personnel is very critical to meet the technical requirements of modern ships. This has caused a changed in the system of maritime training from the traditional knowledge-based into skill based or task oriented. How can this be realized?

The development of simulator systems can help bring maritime training closer to shipboard practices. Trainees/students are exposed to the different shipboard operational problems and learn to respond to emergency situations which are closer to real-life situation.

1.2.5.2 Application to Maritime Education and Training

One of the major steps to be taken in applying modern technology within Maritime Education and Training, is to develop the students' / teachers' ability and skills to use and handle the new systems of technology. The advent of modern technology means that each individual must be more highly trained in order to improve maritime training and safety.

Chapter 2

STCW REVIEW AND IMPACT ON MET METHODS

2.1 STCW Review

The Standards of Training, Certification and Watchkeeping convention (STCW 78), was adopted in 1978 and entered into force in April 28, 1984. It was the first attempt to establish a uniform international standard of competence for shipboard personnel. Although the convention describes the minimum standards of training and certification of all seafarers, governments may wish to impose higher standards and additional knowledge and skill requirements for their seafarers.

The main aims of the convention are to promote safety of life and property at sea and the protection of the marine environment. However, mixed reactions can be heard about the impact of STCW on the promotion of maritime safety. Some authorities claim that training and certification standards vary enormously throughout the international community.

The convention still provides great opportunities for wide interpretation of requirements, so that shipboard personnel are being trained to different standards. These issues, however, are now being considered in the revised STCW '78.

2.1.1 The Functional Approach

The revised STCW encourages changes in the maritime education and training system of concerned governments. More specifically, the introduction of the "functional approach" to certification is aimed at developing function-related

standards of competence. This will create a great challenge to maritime institutions to revise many of their instructional teaching methods, and implement new teaching techniques such as group discussions, role play (i.e. shipboard management training) and simulator training using computer aided instruction. It should be realised that the alternative certification scheme(encompassing the functional approach) as level down in Chapter VII is unlikely to be adopted by many countries at first. The revised STCW has seven functions that are covered at support, operational and management levels, viz:

- Navigation
- Cargowork
- Controlling the operation of ships and care for persons onboard (COSCPO)
- Marine engineering
- Electrical and electronic engineering
- Maintenance and repair
- Communications

The functional approach is designed to implement the safe operations of each function division and sub divisions in order to identify the elements of individual functions. For each function there are three levels of activity, management, operational and support level.

Management level means the level of responsibility which has the overall responsibility for the proper performance of certain functions on board the ship. The master is the person in charge of the cargo handling and stowage, navigation, and controlling the ship.

Operational level means the level of responsibility to serve as officer in charge of a navigational or engineering watch.

Support level means the level of responsibility to serve as a rating forming part of a watch and assist in cargo handling operations.

Therefore the revised STCW will now focus on the identification of skills, responsibilities and skill assessment, and issuance of the certificates for skills and not for the rank.

According to Capt. Agbakoba (1994), *effective implementation of the standards of maritime training requires well trained and qualified teaching staff and examiners supported with appropriate training aids and up-to-date publications.*

The STCW code covers the standards of competence for maritime education and training. Aside from these standards, it includes standards on the quality of teaching and training activities, and the qualification and experience of the lecturers and assessors.

2.1.2 Simulation and Computer technology

In the Convention, there will be a requirement for MET institutions to comply with performance standards for simulators when the latter are used in the following circumstances:

1. For all mandatory simulator based training.
2. Any assessment of competency by simulator when required under the code.
3. Any demonstration of continued proficiency under the code.

The performance standards relate not only to large full or part mission simulators, but are equally applicable where PC (Personal Computer) based simulation is used or is capable of being used in the above circumstances.

In addition, the new **Code A** recognises the measuring availability and use of computers for training and assessment for competency of mariners.

2.2 Computer assisted learning and training

Computer assisted or aided learning (CAL), represents the *largest single category of computer use in the field of education* (Coburn, Kelman, Roberts, Snyder, Watt and Weiner 1982, p. 21). It assists the learners in presenting different ways of instructional aids in monitoring the process of learning. In addition, the learners select different instructional aids that are often used as traditional educational methods.

The overall aspect in the educational field of learning using computers, is to distinguish the methods of using computers in managing the teaching/learning process. In this context, the distinction between computer assisted learning (CAL) and computer managed learning (CML) needs to be made. On the one hand, computer assisted learning is a learning/teaching aid for the learners. On the other hand, computer managed learning provides feedback on the ideas and understanding of the learner. CML does not directly contribute to the teaching/learning process, but it acts in a supportive and/or supervisory role (Percival & Ellington, 1988). In developing the skills and knowledge of the learners both CAL and CML are widely used in education and training.

According to Barker (1989, p. 13), the use of computer assisted learning has grown over the past few years. He mentioned that there are three major factors influencing this growth, namely:

- the relatively low cost of the terminals and other types of resource which need to be implemented;
- some degree of dissatisfaction with conventional approaches to computer assisted learning; and
- the effective use of the instructional strategies which are produced and used in computer assisted learning.

Learning and training situations involve the communication of knowledge, experience and skills either individually or as an organized group of learners (Barker, 1989). Therefore computer-assisted learning is adapting the use of the instructional aids in the teaching/learning process.

2.2.1 Models of CAL and Computer Based Training (CBT)

Figure 2.1, on page 14, shows the three models of CAL, namely informatory, exploratory and instructional (Barker, 1989). These three stages of levels of CAL are often referred to as realizations. In the informatory stage level, the program courseware has to present information to the learner in order to adapt both pre-knowledge and learning modes. The exploratory stage level, explains that the learner examines the computer based courseware in order to search for any new information, and therefore the learner will receive feedback from it.

On the other hand, the instructional stage level is more difficult to implement than any other form of learning. In other words, the instructional stage level uses the courseware in order to deliver the prepared and tested courseware materials. Therefore, the knowledge used by the learner is based on the modelling techniques.

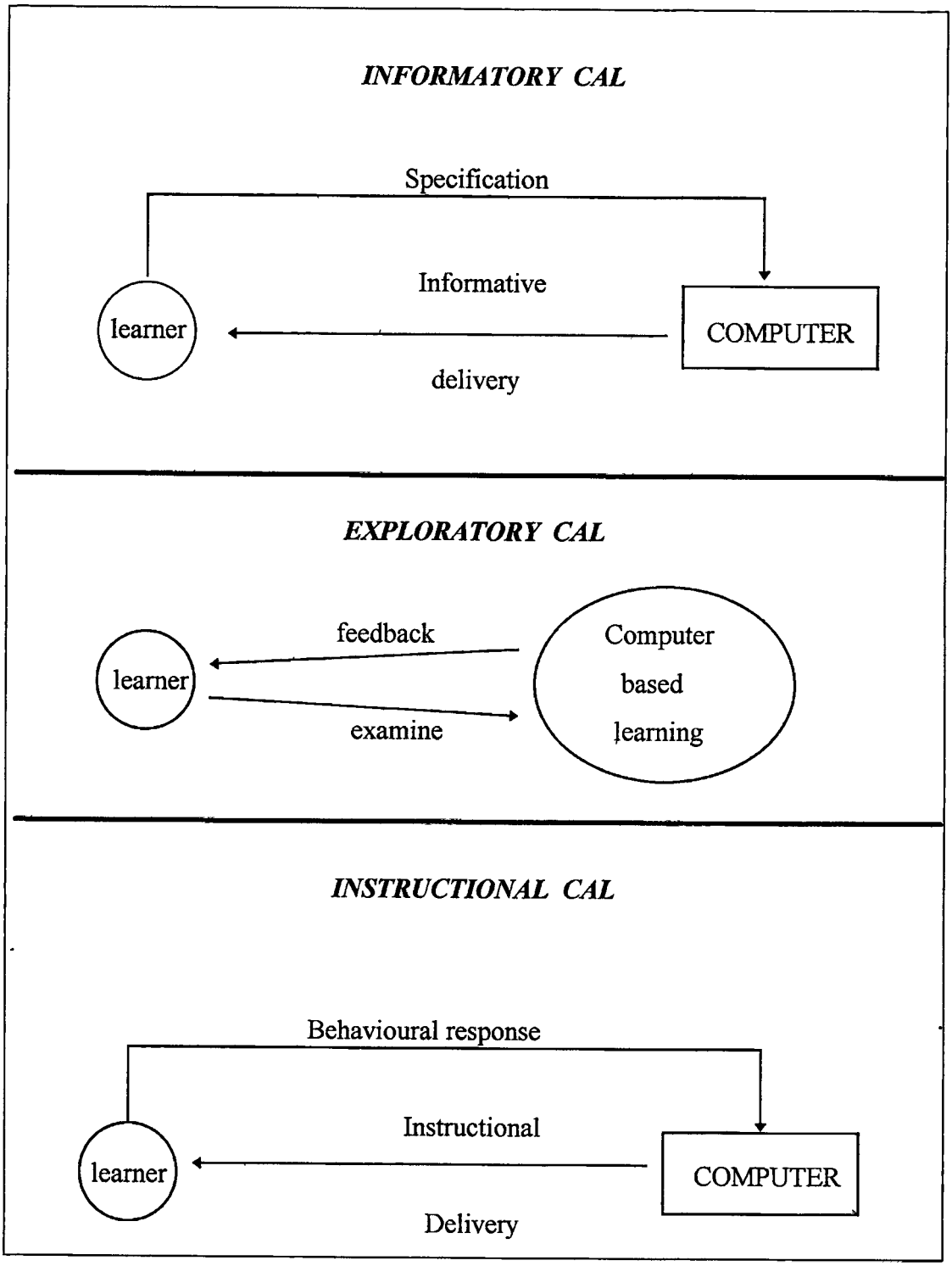


Figure 2.1: Models of computer assisted learning

Source: *(Barker, 1989 p 15) Multi-Media Computer Assisted Learning*

2.2.2 CAL as a learning process

Computer assisted learning is a major factor in contributing to the education and training by computer which plays a key role in the **teaching/learning process** (Percival & Ellington, 1988). The learning process of CAL is typically based on instructional / learning tools, that provide information to the learners in organizing their individual knowledge. Using instructional / learning tools in the process of learning can develop strengths and weaknesses. In essence, the weaknesses of the learning process can be overcome by the strengths of the other form of learning materials. The power of the computer in the learning process is in giving information quickly and accurately, a computer program giving information to the learner which will be manipulated, whether it is a simple instruction or a complex one. Videodiscs and slide projectors are used as other forms of materials. Furthermore the learning process of CAL may be analyzed in the different modes of learning.

2.2.2.1 Drill and Practice

Drill and Practice is the simplest and most common method of acquiring **educational learning in computers** (Coburn, 1982). The Teacher may conduct various exercises with the learners that they have to complete by giving responses. In this situation, the computer may then provide some educational learning information before the learner is required to respond again. If the learner makes the wrong answer, the program advises the learner to go back again to the previous question once more. It is more difficult for the learner if he/she makes too many mistakes, so it is necessary for the learner to be more accurate and improve his/her skills in doing the exercises.

Drill-and-practice provide an endless exercise that is appropriate to the ability level of the learners proceeding at their own pace. In other words, it is the

potential of the learner to arrange the sequence of the exercises that dictates their progress and learning ability. It is essential to use the drill program. For practice, it is necessary to know the basic factor in learning the skill sequence of the program software. Computer drill programs should be able to provide stimulus-response steps to make the necessary drill more effective and interesting. Figure 2.2 shows the basic structure of a drill-and-practice learning sequence.

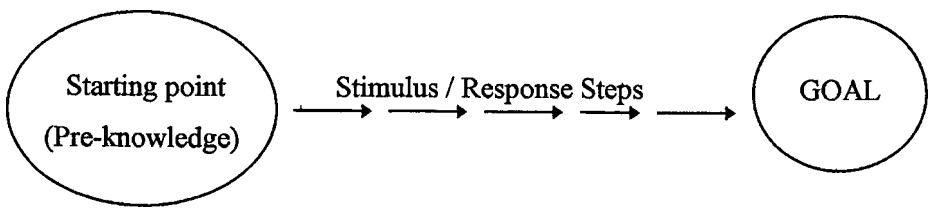


Figure 2.2 The basic structure of drill-and-practice learning sequence.

Source: (Percival & Ellington, 1988 p. 25) A Handbook of educational technology

2.2.2.2 Tutorial

Tutorial is another mode of learning process where the learners can work at their own learning pace. There is an assumption that each learner must participate in some sort of tutorial where he/she needs to go through the learning process. A tutorial dialogue is one in which information in the computer program is presented and then a series of questions will be asked of the learner with a corresponding response. In the late 60's the learning process of tutorial was found in a printed form of instruction and on teaching machines (Rushby, 1985). In drill-and-practice, the function of the computer is not only to present the learning process but to give information on what the student needs and to take them through the structured material. In constructing CAL tutorial material, the teachers must be able to understand the procedures of teaching, in order to determine the conditions of the learners that adapt the learning process.

Group tutorials can be in the form of working tutorials wherein the learners will represent the course task that was given by the teacher or tutor. Problem solving is another method of group tutorial where the learners have the opportunity to ask questions of the tutor regarding the course that they are taking. Class discussion, seminars and tutorials can be used to achieve a wide range of educational knowledge of the course and have high cognitive and non-cognitive strategies (Percival, et al., 1988).

2.2.2.3 Educational based simulation

Both tutorial and drill-and-practice operate by providing information in a structured way (Rushby, 1985). Computer simulation is an approach to the learning process that involves a real-life situation. A model of simulation represents a real or imaginary system of the operation. The programme itself can create an input in predictably "realistic" ways, during which it can process a large amount of data. Educational computer simulations are able to incorporate greater complexity and realism.

Computer based simulation used in education and training can provide adequate learning experiences in emulating a real-life situation. It is a processing machine that has advantages over the use of other equipment in the learning experiences. For many years educational schools have used computerised simulation. This educational computerised simulation can be promoted in the process of learning by which it achieves educational goals, and motivates the students' interest through the systems. Using the computer simulator is one excellent way of assigning the learner to perform in a cooperative learning group. Such cooperative learning groups have the potential to acquire from each other ideas and process skills.

2.2.2.4 Modeling

Modeling is another form of simulation (Rushby, 1985). In a model simulation an analogue is constructed by the learner, while the instructor demonstrate the analogue of the simulation. In this case, the student has to teach the computer, by setting-up the rules in order to imitate the real life systems or phenomena. In the process of learning, the learner has to learn by identifying a particular behaviour of the systems. In essence, the learner is be able to demonstrate his/her mastery of learning through the final process of modelling. The computer provides a convenient way of checking the model rules before performing the simulation.

2.2.2.5 Knowledge-Based Educational System (KBES)

According to Forcheri and Molfino (1995), an educational system is an instructional situation which induces the learner to gain knowledge and to solve problems. An instructional dialogue must be capable of making the learner and the teacher learn from each other. In other words, the learner should be able to learn from the teacher the topic that is being discussed, while the teacher in turn should be able to learn from the learner on how to regulate the instructional learning process. The Knowledge Based Educational Systems (KBES) is the keystone of the effective learning process; indeed, it is the system that is recognised as the prototype of system learning. There are some essential factors to be taken into account:

- epistemological aspects, concerning the nature and the framework of the domain;
- cognitive domain, concerned with the nature of the activity of the learning and the attitude of the learner;
- pedagogical problems, the analysis of the learner's knowledge of pre-requisites, the comprehension of the student's understanding of the object of learning, the teacher's capability of learning from interaction with the student;

- educational choices, with regards to the main topic of teaching, the style of teaching; and
- the instructional dialogue which represents the adaptation of the educational choices to previous pedagogics conditions.

Forcheri and Molfino state that the cognitive theory adopts the domain which is required to explain the causes of the learner's behaviour. Also in the teaching method the learners can be adept only if he/she was able to understand the basis of the cognitive theory and analyse the design of the central problem of the KBES. Figure 2.3 explains the analysis of epistemological and cognitive aspects which constitutes the basis of handling the pedagogical and educational problems.

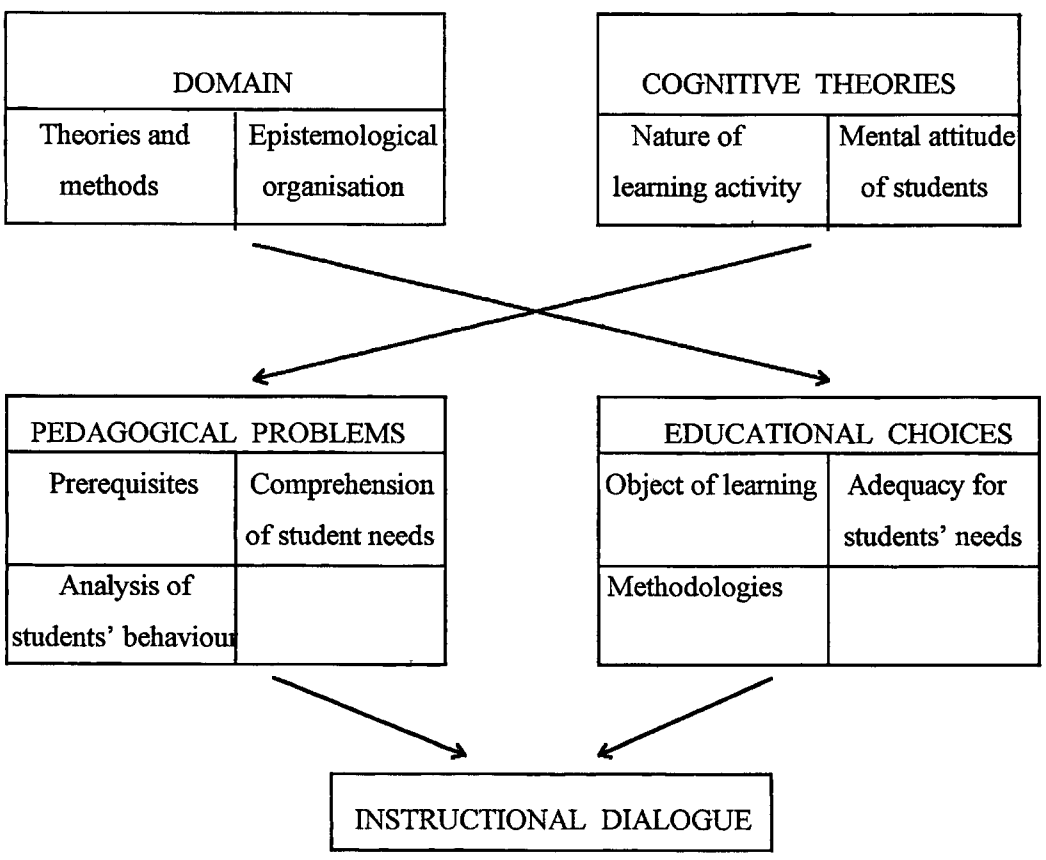


Figure 2.3 Conceptual framework of a KBES

Source: British Journal of Educational Technology, Vol. 26 No.1 1995.

2.2.2.6 Browsing

Browsing is another method of CAL, which guides the range of learning materials. The role of the computer is to store, retrieve, and process information to help the learner as he or she browses through the learning material. In responding to a question that relates to the given information, it is necessary to retrieve the items and to summarize the statistical data. The use of such programs is to go through the path sequence of frames, that includes the remedial loops in order to correct the possible error of the learners. Figure 2.4 shows the simple possible structure of browsing through the program.

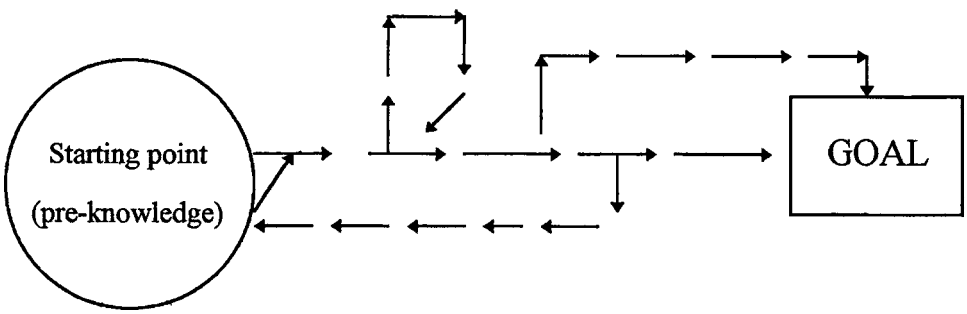


Figure 2.4 A simple structure of browsing programmed learning sequence.

Source: (Percival, et al., 1988 p. 26) A Handbook of Educational Technology

2.2.3 Instructional / Learning material

The application of computers in the **field of education** is widely used in the basic role of research. In education the growth of computers has been used as a means of instructional design to motivate the process of individual learners. Educational computing has continued to draw its inspirations from computing in the fields of learning (Coburn, et al., 1982). Further promising methods are being "borrowed" by other educators from a real world situation using the computer. Some computer programme software consists of word processors, numerical analysis, data processors, and high resolution computer graphics software.

Word processor

A word processor programme is essentially a text-editing software package that is used within computers. As a result, the teachers and the learners can now write, edit, organize, enter, format and print whatever they write through this system. In a simple text, it allows the learner or the user to edit the programme in a computer's video screen before they print the entire contents of the text. Word processing programs can be automatically formatted, setting the margins from top to bottom, and left to right, centered the title of text, placing footnotes properly and allowing the insertion of page numbers. The learner who uses this kind of program tends to write longer and to improve their knowledge of writing through more detailed stories and long essays.

Numerical Analysis

Numerical analysis is another learning tool. It is designed to input large amounts of data for numerical analysis. The accuracy of the program in the computer depends on the statistical analysis program. In practice the ability of the computer to solve and analyse statistical data is without limit.

Data processors

Along with word processing and numerical analysis, the data processor is a set of algorithms which manipulates the vast range of computerized information. It is necessary to supply all information required by a certain group of educational objectives and the learner is given a set of specific objectives to be achieved. Another potential application of the database used in the computer as far as education is concerned is the creation of computer based libraries and computer-based information.

High resolution computer graphics software

Ridder, (1985) states that computer graphics software constitutes a very powerful and direct interface between a simulation system and its operator. Aside from computer graphics simulation it consist of five main parts, namely:

- a mathematical model; which is necessary to describe the behaviour of the physical system of the simulation.
- sophisticated mathematical equations and algorithms used to perform the operations prescribed by the model.
- hardware and software forming the basis for implementing the algorithms under the prescribed timing and accuracy.
- an interface to the real world which is designed to be a real simulation using either direct or indirect interaction.
- finally, the operator who is considered to be the main source of the whole system.

2.3 USE OF CAL IN EDUCATION

2.3.1 General overview

The application of computer assisted learning (CAL) in Maritime Education and Training process is absolutely necessary for the learner to train and improve knowledge, skills and understanding using instructional aids or learning materials. Nowadays, microcomputers are available for the teaching/learning process. They are designed for use in schools, homes, and office settings. Within the home, they can serve both as a tool for home management and as a recreational device. College students can use microcomputers for doing their homework, and in fact many schools now employ the devices for programmed learning and computer-literacy courses.

In recent years, the use of Maritime Education and Training simulators has been a major step in overcoming the deficiency in the maritime field of practical training and experience in handling the dynamic situation (Short, 1989). For the training of students, Short has mentioned that there are five steps in using the systems technology.

1. The Simulator is safe and easy for the learners to undertake for the given exercises.
2. A Simulator is cheaper than buying a ship and much cheaper to run.
3. A Simulator saves time; it can directly train the learners in the training area without going on board ship.
4. The Simulator is under the control of the instructor, where he can manage as many ships as he wants either in fairway situations or in narrow channels.
5. Simulator training allows for repetition so that the exercise can be replayed at any chosen point in order to maintain and add to the skills of the learner.

In the maritime field of training, simulators are playing an important role in the process of learning. Particularly, Radar/ARPA simulators are used in the training in preventing collision at sea. Nowadays many other simulators have been introduced for such training purposes as cargo handling, machinery control room simulator and other electronic navigation instruments.

OOW - Officer Of the Watch

OOW is a PC-Based simulator that was developed by PC Maritime Ltd., and is a very effective and affordable training program for all seafarers with regard to training in collision avoidance and watchkeeping procedures. This program will be discussed in detail by the author in chapter 4. Also the program provides a course designer for the instructor where he can design his own exercises.

FINNSIM Ship Simulator

The ship simulator is another training simulator, a project of co-operation between the Board of Navigation, Board of Vocational Education and Technical Research Center of Finland (VET), which is under the management of the Rauma Maritime College (RMC). This kind of training simulator is a practical system with full ships bridge supported by a modern radar simulator.

Fishing and Navigation Simulators

This is another kind of simulator training program at Shanghai Fisheries University, equipped with full electronic aids for modern fishing vessels. The learners are able to learn the signals, and to manoeuvre the fishing gear to the position where they can catch fish being detected by the sonar.

2.4 Computer Based Training (CBT)

CBT, in computer science, is an acronym for computer-based training, which refers to the use of computers and specially developed tutorial programs for training. CBT uses color, graphics, and other attention getting aids to help maintain interest, and it has both simple and sophisticated applications. A software developer, for example, might include a series of CBT lessons with an application to give new users a hands-on feel for the program; a consultant might use a longer and more detailed CBT program as a tool in a management training program.

Computer-Assisted Teaching

A CBT package can be use to demonstrate to the whole class, the program being under the control of the teacher. Computer assisted teaching is somewhat similar to laboratory demonstrations or to the use of a videotape shown to the whole class. This kind of training may use the knowledge of the learners for discussion as a group. This method works best within simulation training. Ideally, the method of learning and training requires only one computer providing one or several displays

able to seen clearly and widely by the whole class. The computer program might be operated by the teacher or assigned student.

Individual Learning

A CBT program is a social aspect of learning and training where an individual learner should be able to learn through face to face methods in order to discuss the subject with others in the presence of the teacher. In essence, individual learning has three basic organizational systems where the student-centred approach can usually take place, namely: institution-based, local and distance-learning systems. The most common method used in individual learning is the unstructured reading, i.e. at home, in the classroom or in the library. Furthermore, the teaching staff should encourage the individual learner to read the entire subject at his own discretion and motivation, thus making the system self paced and fairly flexible.

Small Group Learning

The use of computer based training in a small group offers advantages and disadvantages over classroom teaching and individual teaching methods. In a group of two or three learners, they must be able to discuss the main topics in order to receive appropriate inputs and outputs. Unlike the classroom demonstration, each member of the class will have a good opportunity to participate in the learning process. Dialogue plays an important role in allowing the computer processes to be used to stimulate discussion and confirm the outcomes. However, computer based training has its own strengths and weaknesses and therefore, much care should be taken.

2.5 Computer Based Assessment (CBA)

This section will deal with the last component of computer assisted learning, in which the learners have gained their knowledge, skills and understanding in the

learning process. Where ever training or learning takes place there will be a need for a system to measure the results of the training or the learning process.

The main reason of the test or assessment is to find out the capability and knowledge of the learner. The evaluation or assessment results may lead to the standing of the learners in terms of their performance, the issuance of diplomas or even the securing of jobs. Perhaps it can be a great help for the instructor to use these results in evaluating his knowledge of teaching. As far as simulator training in the maritime industries is concerned the evaluation seems to be proceeding very slowly. The fact is, the unstructured assessment by the instructor or examiner based on their own previous experiences, simulator based or real life, have been used to assess a trainee's performance (Cross, 1993). In essence, a number of assessment procedures should be considered.

Validity

Validity in relation to a training program relates to the measurement of outcomes of training to ascertain whether the behavioural objectives specified in the program have been met. This process is further validated if training objectives are criterion-referenced. (Muirhead, Zade 1995).

Reliability

Reliability is an assessment procedure that measures the consistency of the question, test or examination that produces the same result but comparably not the same. A reliable assessment gives reproducible scores with similar numbers of students and therefore is as independent of the characteristics and vagaries of individual markers as possible (Percival, et al., 1988). In essence, a student should not garner a score of 70% from one marker and 30% from another, which thus reveals an unreliable and inconsistent set of examination questionnaires.

Fairness and Usefulness

To be fair to the students, the assessment should be done as accurately as possible. In other words it is necessary for the students to know how they are being assessed. The students could ask what type of examination they're going to have, the length of the examination, what form and structure of the examination and the value of each component of the assessment. The students will receive feedback after their examination, which can give a better understanding of where their strengths and weaknesses are.

2.5.1 Programming

A program is a sequence of instructions that tells the hardware of a computer what operations to perform on data. Programs can be built into the hardware itself, or they may exist independently in a form known as software. In some specialized, or dedicated computers the operating instructions are embedded in their circuitry. A general purpose computer, on the other hand, contains some built-in programs (ROM) read-only memory or instructions, but it depends on external programs to perform useful tasks. Once a computer has been programmed, it can do only as much or as little as the software controlling it at any given moment enables it to do. Programs in use include a wide range of software applications, providing instructions to the computer on how to perform various tasks.

In programming, the most common languages used are BASIC and 'C+' (Beginners All Purpose Sequential Instruction Code). BASIC was developed at Dartmouth College in the early 1960s for use by non-professional computer users. The use of this BASIC language is basically simple and easy to learn. The use of more structured languages such as Fortran, Pascal or Ada are also used as support for the structured analysis and design techniques in the making of many programs. BASIC language makes the learners learn very fast. In many institutions, students undertake introductory programming where this is included in the curriculum.

However, today much more emphasis is being placed on the use and application of software programs for science, business and research. However, educational programming is a concept of high level cognitive development and as such provides a high level of motivation in the learning process.

Chapter 3

COMPUTER LITERACY AND ITS INTEGRATION INTO THE LEARNING PROCESS

3.1 Introduction

In this Chapter, the author will discuss computer literacy and its integration into the learning process through a classroom system. Computer literacy implies knowledge and understanding of computers combined with the ability to use them effectively. Computers can do a variety of tasks and process a wide array of information. Information which computers can process includes numbers, names, addresses, codes and passages of writing. It involves knowing how to switch on a computer, start and stop simple application programs, and save and print information. In essence, these people should be aware, that they themselves should overcome this illiteracy. Therefore, in school, the instructors or teachers should be able to train the students who wish to learn and gain knowledge using a computer. At a higher level, computer literacy becomes more detailed when manipulating any complex applications using program language such as BASIC or C+. On the other hand, the highest level of computer literacy leads to the need for specialized and technical knowledge of topics concerning the use of electronic and assembly language. Coburn et al., (1982) explains that it is very important to teach language skills in school because it is a part of the curriculum in education. They also conclude that, in school/institutions, computer literacy should be practised, whereby, it is necessary for each and every individual to become literate. According to Muirhead (1995), computer aided learning is an effective method of acquiring

knowledge, understanding and skills that provides an opportunity to transfer training. In general, computer literacy includes a wide overview of different approaches i.e.,

1. To develop computer literate people who can make a variety of computer programs which concern personnel, academics, and vocational goals. The learner should also be able to assess, understand, and if necessary, modify the computer programs.

2. To develop computer literate people who can make use of programmed computer applications. They should be able to understand the assumption values and limitations inherent in some parts of the program software.

3. To develop computer literate people who may be able to understand the growing economic, social, and physchological impact of computers to individuals or to groups within the society.

4. To develop computer literate people who may be able to make use of ideas from the wide range of computer programming and computer applications as part of their strategies for information retrieval, communication and problem solving.

3.2 Components of computer literacy

Computer literacy has three components which introduces the different applications of the systems. Figure 3.1 illustrates this.

Competency	Components	Where Taught
1.Knowledge about computers	Basic operation • on /off • loading /using software • disk care • disk and file procedures	Taught where computers are first encountered in curriculum. Reinforced frequently as students use computers.
	Keyboarding	Proceeds teaching of word processing: late elementary. Reinforced whenever word processing is used.
	Use of printer	As needed for word processing
	Understanding of how a program works	Middle grades; when thinking and math skills are developed.
2. Knowledge of Applications	Word processing	Language Arts-late elementary or early junior high.
	Databases	Junior and Senior High - Social Studies, Science, Business Ed.
	Spreadsheets	Senior High -- Business, Math, Economics
	Graphic Arts-Drawing, Drafting, Desktop, Publishing	Junior and Senior High -- Art, Journalism, Business, Industrial Technology
	Robotics	Junior and Senior High -- Science, Industrial Technology
	Electronic Music	Junior and Senior High -- Music
	Computer Assisted Instructions	Where appropriate.
3. Knowledge about Social Issues Related to Computers	Copyright law	When computers are first used; reinforced at every level
	Right to privacy	Social studies classes
	Impact of technology on future life	Social studies, Science, Career education
	Information age awareness	Library media classes, Social studies

Figure 3.1: Computer literacy: An Integrated Approach

Source: (Langhorne et al., 1989, p. 9) Teaching with Computers - a new menu for the 90's.

3.2.1 Knowledge about computers

The Computer is an electronic device that can receive a set of intructions, or programs and can carry out any program by performing calculations on numerical data or by compiling and correlating other forms of information. Students must be able to know what the components of a system are, and how to turn the computer on and off, and how to load a program from a menu. Some instruction in basic keyboarding is necessary, and students should have a general understanding on how a computer program work.

The computer is a an essential tool in the field of research that applies technology in constructing and developing a future need of an individual. Databases and computer network make available a great variety of information services. Therefore, a student should be able to maintain and achieve the necessary skills to understand the basic principles of using a computer. Basically there are two types of computers, analog and digital computers. The analog computer is an electronic device designed to simulate the physical problem in operating on continuous variables rather than on discontinuous or discrete numbers. The digital computer on the other hand, operates on discrete data which performs arithmetic, logical and comparative functions upon any representation with the ability to determine the function of the on and off systems.

The first time a student should be required to take lessons on computers should be in his/her elementary stage where it is deemed more appropriate for him/her to learn and have a knowledge and understanding of the basic operations of the computer which include keyboarding instructions which should be logically followed in the introduction of word processing. A Math class is also needed to give the students a basic knowledge of the step-by-step sequence in building information through computers.

3.2.2 Knowledge about software applications

The knowledge of software applications refers to the software and hardware, designed to help people to perform a specific type of job. Depending on the work for which it was designed, an application is able to manipulate the text, numbers, graphics, or a combination of these elements. Nowadays, most schools use word processing as the most common application. . The use of database and spreadsheet programs helps manage and manipulate any information with important aspects dealing with a certain data or task to perform. Another type of software is system software which makes it easier for the learner to write a specific program into the system.

If system software is not available, applicable and very hard to use, only a few application packages thus will remain for use in the system. Thus most of the software application packages require modification. The operating system allows the users to run the programs and control the movement of the data back and forth in the computer memory. The disk operating system (DOS) allows the user to make files in the system and to copy files from one disk to another disk system. An Assembler is a primitive language translator that makes it easier for the central processing unit (CPU) to access data onto the program. CPU uses a binary code which provides a certain meaning from the data program and translates it by using the assembler. However, some software application packages still need to be developed. In addition, a social studies curriculum is essential to the application of computer software which is designed to give information and can manipulate the process of management and presentation. In essence, a word processing program, spreadsheet system, database management and graphing programs are all necessary elements of the social studies curriculum.

3.2.3 Social issues related to computers

Computer literacy integrates computers into the existing curriculum. It is essential that a student should be able to have a knowledge and understanding of pertinent social and ethical issues with the use of computers. There are three main elements of social issues related to computers, namely computer crime, right of privacy and impact of technology.

Computer crime

Computer crime is primarily a young person's crime (Langhorne, et al., 1989). It refers to a student copying different software programs belonging to other persons / students. The most critical part of computer crime is that it involves piracy of other program software where a user violates the copyright of the programmer or propriety rights of the purchaser. With the increasing number of sophisticated copies of different software, programmers will be no longer able to produce any software that can break the security systems of other programmers.

Right of privacy

The second element regards the computer and privacy. This is where the students start learning on using the database. An example is the collection of individual grades of students in a database, where it does not show any student names in order to protect the identity of individual students.

Impact of technology

The third element is that the student should be able to study the impact of technology on human life. Students should be able to know what a computer can and cannot do. They should be able to understand the time when the information was given, and its application using the computer program. It is wise to think that there are two extreme situations as far as technology is concerned - computerized or no computers at all. Therefore, these two situations are very important in dealing

with technology of the future and as far as the computer is concerned, it is necessary that technology could change the kind of work that is being performed by the students in the process of learning.

According to Langhorne, et al., (1989) computers can enhance the social studies curriculum in many ways. Demonstration and simulation programs can be used in improving existing teaching methods. The use of this application software, particularly the database program, provides students with a powerful idea for managing a large amount of information encountered in the social studies. The ethical use of a computer and the effect of technology will have an important role in the future.

3.3 Educational goals and curriculum material for computer literacy

The advent of using computers in the classroom has helped in finding a new way of making the process of learning easier. Nowadays, most of the schools, teach computing, as it relates to the integration of the new technology. The program includes both computer aided learning process as an effective method of acquiring knowledge, understanding and skills upon the capacity of the students' performance. It is thus important to know that the computer is one of the main *resources,* which integrate the process of learning and teaching.

3.3.1 Educational Computer Technology

Percival (1988) has provided a number of definitions covering the concepts of educational computer technology as follows.

Council of educational technology for the United Kingdom (CET)

Educational technology is the development, application and evaluation of the systems, techniques and aids in improving the process of human learning.

National Centre for programmed learning, UK

Educational technology is the application of scientific knowledge about learning and the conditions of learning, to improve the effectiveness and efficiency of teaching and training. In the absence of scientifically established principles, educational technology implements techniques of empirical testing to improve learning situations.

Commission on Instructional Technology, USA

Educational technology is a systematic way of designing, implementing and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication and employing a combination of human and non-human resources to bring about more effective instruction.

Since technology is being improved continuously, the educational capabilities increase tremendously. The advent of inexpensive computer technology and mass storage media has now led to the use of electronic devices, such as videodisks and compact disks e.g., CD-ROM and CD-1. These devices are used to store large amounts of data, e.g., encyclopedia or motion pictures. Educational computer technology first came into existence in the 1960s, and is still being used by many

people in their jobs and other activities concerning the process of educational teaching (Eraut, 1985). Many institutions offer educational training programs, i.e., instructional developments, educational communications, and educational resources, that are used in many fields of study. According to Ely (1985), educational technology was first recognized in North America as a field of study which was used to establishment the audiovisual education curriculum. In the United Kingdom, programmed instruction marked the inauguration of educational technology as a field of study.

The development of control technology is now an important part in the process of teaching. In the modern electronic computer, digital computers are used particularly for educational purposes. Digital computers are often subdivided into three types, namely the mainframe, minicomputers and microcomputers.

Mainframe computers

Mainframe computers are large highly expensive machines which normally require considerable floor space. They require highly-trained teaching staff who are able to operate the machines. Therefore, this kind of machine should be used for large organizations, such as universities or commercial bussiness offices.

Minicomputers

Minicomputers are basically simpler, cheaper versions of mainframe machines. This type of computer is used by small business entities or colleges.

Microcomputers

A microcomputer is a computing device that uses a microprocessor as its central processing unit or CPU. Microcomputers are also called personal computers, PCs, home computers, small business computers and micros. Laptops are the smallest compact computers. Since the first time they appeared, they were

considered already as single-user devices which are capable of handling four to sixteen bits of information. More recently, microcomputers have been made faster in their operation. They were also designed for use in homes, schools, and in office settings. Nowadays, many students use microcomputers for doing their assignments, and in the case of many institutions, employers send staff to programmed learning and computer-literacy courses.

All computers consist of three basic systems, the *input, processing* and *output.* Figure 3.2 shows the schematic form of a computer system.

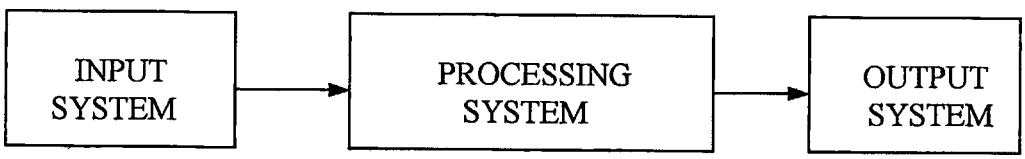


Figure 3.2 A simple schematic diagram of a computer system

Source: (Percival & Ellington, 1988, page 155) A handbook of Educational Technology

Input System

An input system describes how information is fed into the computer. This information is of two types, instruction and data. Both types of information can be fed through a wide range of systems. Keyboarding is another way of feeding information directly into the system.

Processing System

The central processing unit is the second major part of a computer system which deals with actual processing of the information that is fed into the computer. The CPU is the brain of the operation. It consists of three subsystems, namely, the memory system, arithmetic and logical unit, and control unit. In the memory system,

the instructions and data are stored in a coded form, while, arithmetic and logical units hold coded signals. The control unit, on the other hand, coordinates all the functions of the CPU by interpreting and executing information through computer memory.

Output System

There are three different ways in the processing of output system, namely, through hard copy, soft copy and coded signal. A hard copy is represented by an alphanumerical or graphical information which is actually printed on a paper using the line printer or graphical plotter. The soft copy is similar to the hard copy which is temporarily displayed on the screen video display unit. A coded signal, on the other hand, is used either directly or indirectly for quicker access to data stored in a storage system for future reference.

The use of the computer in education has rapidly increased. It is more likely to bring extreme changes in the delivery and absorption of education.

3.3.1.1 Education Technology

Technology in education is involve in the systematic analysis of the entire teaching and learning process in an attempt to maximize its effectiveness. As such, it is associated solely with the use of technical equipment and media of education which include among others, overhead projectors, televisions, tape slide programmes and computers. *Technology in education* embraces every possible means of presenting an information (Percival, 1988) and these means are in any form of teaching material that provide an individual learner the possible media requirements in the processes of training and education. Basically, audiovisual aids are the most popular. They are categorized in two areas, hardware and software. Hardware is concerned with the actual use of the equipment such as overhead projectors, slide projectors, tape recorders, videocassette recorders and microcomputers. Software,

on the other hand, is concerned with the use of different equipment such as overhead transparencies, slides, audiotapes, videorecordings and computer programs.

Educational technology improves the overall efficiency of the teaching / training process of education and training. At present there are many possible ways to make extreme changes in the scheme of education in the industrialized society. Figure 3.3 illustrates the four phases of educational technology, namely the purpose, design of learning , evaluation and improvement. There are, however, educational constraints which limit the control of the system. Rowntree (1982), explains that said constraints are imposed on the high level of education that includes the following categories:

- structure of schooling;
- the expectation of students, parents, employers and other educators;
- knowledge, skills, and attitudes in which the students reach a given point in education;
- power and influence of mass media;
- knowledge on how to facilitate the learning process;
- decision of the administration towards educational learning.

3.3.1.2 The use of Technology in Education

The use of technology in education is very useful in the fullfillment of the needs of every individual learner in the process of teaching and learning within the classroom organization. In education and training, the efficiency of classroom instruction improves its teaching method in such a way, that the learning quality and the efficiency of the teachers will be increased, the time taken by the learners in attaining a desired goals will be lessen, and reducing the costs without affecting the quality of teaching.

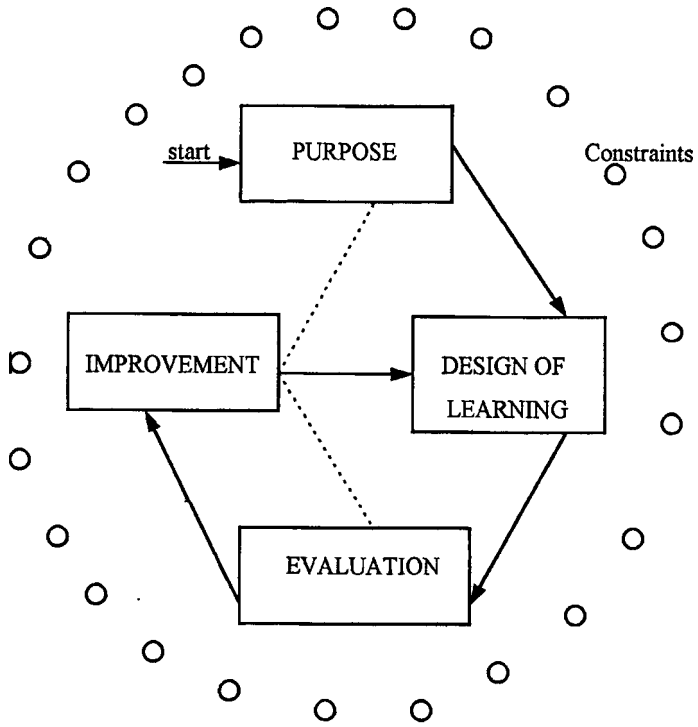


Figure 3.3: The four phases of Education Technology

Source: (Percival & Ellington, 1982, page 19) Educational Technology in Curriculum development

With the development and installation of increasingly sophisticated maritime technology, it demands a high level of knowledge and capable of understanding. The practical use of modern technology in education such as *computer based training (CBT), PC-based simulation, and interactive CD-I,* help an individual to acquire the necessary skills in the process of learning. Basically, the use of a PC-based simulation provides a simple but effective distance learning environment (Muirhead, 1995). Another method use of technology towards education is the use of the *computer in organizing examinations* with a higher degree of efficiency and integrity. This method helps the teacher in generating test programs. It develop a set of questions that the computer continuously selects and prints out in specific order. Computerised test-scoring machines are used in many institutions. This provide a special scanner that scans the examination result of every student.

A **computerized simulation** has augmented the method of teaching. It provides the students with an opportunity to practise and train by performing exercises. The simulation takes advantage of the powerful capability of the computer. In computer simulation students can possible build his/her own model in the processs of learning. In essence, students are allowed to work in cooperative groups in order that they are able to learn from each other, as they learn as a group skills process.

A **computerised database** is the main storage of information management. The use of library media program is essential for the students to be trained in selecting information through a database. In essence, the student must be able to acquire the available equipment so that he/she can understand the whole process of interacting with modern technology.

The CD-ROM is one of the products of modern technology. It is a laser disc of 4.72 inches in diameter and is capable of holding as much as 600,000 pages of information, or 2,000 books. Such material can provide students with a greater opportunity for learning when used in their training and education, aside from being very useful also on board the ship. It provides also easier access to any information needed which is contained on the disk. CD-ROMs have the ability to combine text, sound, graphics and film thus making the computer an ideal teaching tool.

3.3.1.3 Some educational applications

Educational software is used to provide effective training of students. The use of computer technology or PC-based hardware has proved to be very effective when used as a tool for teaching and learning. It gives an opportunity for the students to have adequate training and skills in using different maritime software. More modern maritime software is capable of high level of fidelity and is very effective in PC simulation system (Muirhead, 1995). The author is going to evaluate

some educational software programmes in chapter 4 (Officer of the Watch (OOW) from PC Maritime and Navi-Trainer from Transas Marine). OOW provides a very effective means of providing an individual learner with knowledge and skills on technical matters and maneouvering. Navi-trainer, on the other hand, is a versatile programme that is used as a navigational marine simulator with high level software designed for the beginners and experienced sea navigators. Aside from OOW and Navi-Trainer, another potential PC based simulator is "Portsim" from SSPA which develops basic knowledge on shiphandling.

3.3.2 Curriculum: classroom-computer integration

Today, the important use of technology is to develop a classroom-computer integration that provides the students with a high level of knowledge and understanding. The Classroom is still the normal learning environment. The advent of the very powerful desk top microcomputer, networking, colour graphics and interactive work stations has led as to a considerable growth in software for use in maritime education and training (Muirhead, 1994). Students can use the sophisticated computerized programs as design tools. Using microcomputers, students can possible update the programs, such as planning and designing, and develop graphics art. Many schools/institutions now update the knowledge of their students using such modern technology

Ideally, integrating the computer into the curriculum has been a great opportunity for it to contribute to pre-requisite learning of students. In essence, a lesson plan for computer-curriculum integration should face the new concept by using it in the classroom organization. A plan of an integrated computer curriculum should be effective and realistic in dealing with the use of computers in schools.

Students should be able to learn to use:

- the word processsing software as part of the writing process in a series of language arts and english lessons.
- the simulation software in order to develop their skills in a series of science lessons.
- the database management software to support the collection, organization, classification, and retrieval of information in a series of social studies lessons.
- the graphing software in order to develop their skills and analysing the data in a series of science and social studies lessons.
- the database in locating and evaluating information in a series of social studies and science lessons.
- the plotting software in order to develop their skills in finding the equation roots in a series of mathematical model.
- the radomization capabilities of the computer in a series of probability and statistics lessons.
- the spreadsheet software to develop problem-solving strategies in a series of mathematics lesson.
- the computer as the teaching tool and/or material.

The general idea behind the plan is that teachers should make use of the computer classroom. The lesson plan uses the basic application software, e.g., word-processing, spreadsheet, data base managment, graphing, and telecommunication. In essence, the use of an integrated curriculum is more effective in teaching and the acquisition of knowledge through the practice of students using their computer skills.

3.4 Computer configurations for Education

3.4.1 Types of computer systems

The computer is made up of both hardware and software systems. Computer systems basically run through the use of a central processing unit (CPU), that is linked to the peripheral devices for the storage of information and by means of input and output devices, data is fed by the user into the system. Figure 3.4 illustrates the basic diagram of a CPU.

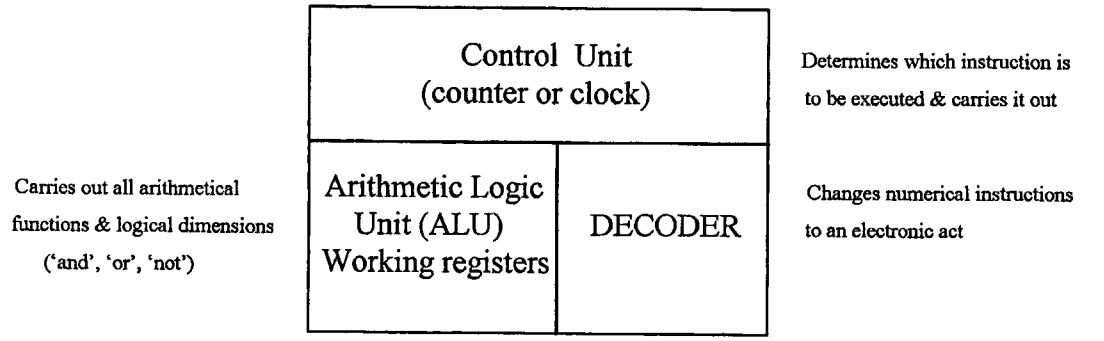


Figure 3.4: Central Processing Unit (CPU)
Adapted from Computers in MET 2 (Muirhead 1994)

The CPU is the brain of the computer system. Every CPU has a primary storage capacity that can hold an active program and the processed data. In addition, most CPUs have built in the specialized storage elements that are used for processing of the data.

The control unit of the CPU makes the system select, interpret, and execute the program instructions. However there are two types of program instructions, namely the operation and the address. The primary storage used is in the random access memory (RAM) where a computer programmer can select and retrieve the needed data. In addition, the Arithmetic-logic unit (ALU) of the CPU locates the

data or instruction so that it can be manipulated. In the working register the data is transferred for the purpose of placing into the primary storage.

Each CPU has an internal clock and counter. The clock produces a steady stream of pulses (clock cycles). The counter receives a pulse and passes a digital word to the control register. Therefore, when a pulse is being carried the system is on (represented by a binary 1) and if there is no pulse the system is off (represented by a binary 0). From the counter a message is passed to the address line (gate 1) to random access memory (RAM) which receives it and searches relevant cells for data. The cell contents are sent directly to the control register through line 3 where data is manipulated, passed to the decoder and sent to the ALU. If more data is needed a message goes back to RAM memory by passing gate 2 to acquire a new set of data and thus directly back to the control register via line 3 again. Otherwise it goes directly to the ALU passing through gate 4. When the ALU has an answer it sends signal directly to the memory storage through gate 5 towards the data bus line to the memory system. Figure 3.5 illustrates the basic diagram of a computer system.

In the process of an input the system enables the computer user to enter data, commands, and programs into the CPU, the keyboard being the most commonly used input device. Other input devices include light pens; (that transfer graphics information), the joystick and the mouse which are used to translate information by hand motion into the computer video display; and light scanners which read words or symbols on a printed page and translate them into electronic patterns.

Storing in the memory system can be done either internally (in memory) or externally (storage device). Read-Only Memory (ROM) is another type of internal memory device in which any program will not be erased or altered when the power of the computer is switched off. ROM is a fixed program and non-volatile,

whereas RAM is a volatile form of memory and data will be lost when the computer is switched off.

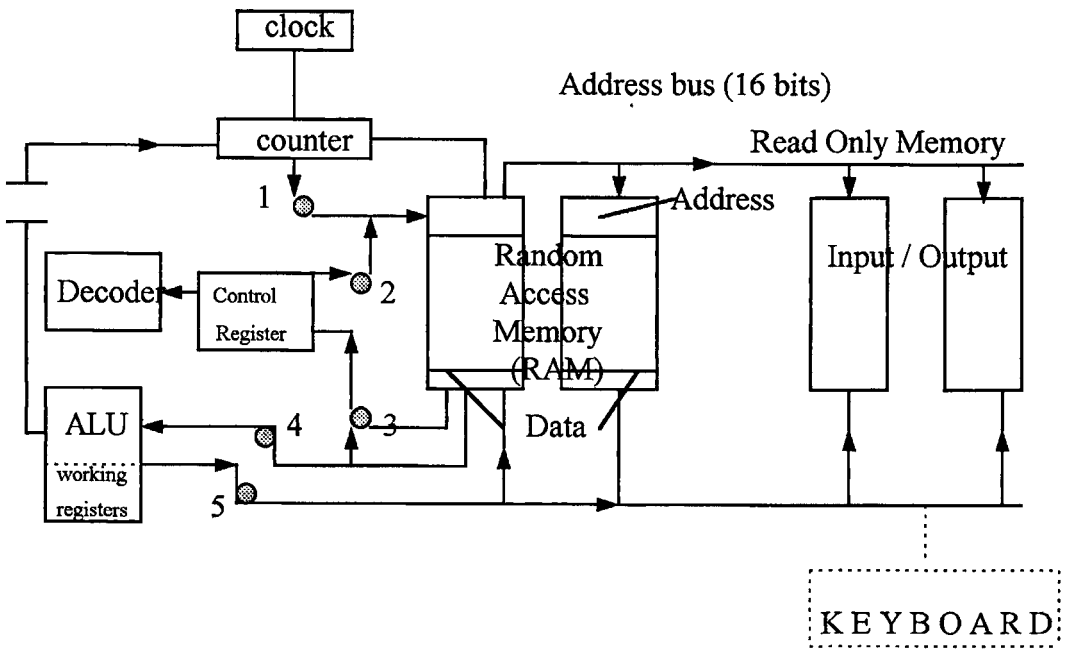


Figure 3.5: Layout of the micro-computer

Adapted from Computers in MET 2 (Muirhead, 1994)

The output process prints or displays the results of the data processing. The most common output device is the video display terminal (VDT) which monitors the displayed data and graphics on the screen. A VDT consist of a cathode-ray tube (CRT) which is like an ordinary television set. A Modem is an example of an output device, that provides links betweeen two computers, translating the data into digital to analog form.

3.4.2 PC Based

'Computer technology is capable of high levels of fidelity and effectiveness at the PC based simulaton level' (Muirhead, 1995). A PC based system is designed for use by one person. Personal computers do not need to share the processing, disk, and printer resources of another computer. It is a very essential tool for the student to access information and gives a wide application for gathering facts and data. Nowadays, most schools use a personal computer based system for teaching purposes.

The use of microcomputers for the training of students will be mainly focused only on PC-based simulation rather than on full mission simulators, which, due to their high capital and maintenance costs, cannot be afforded by many institutions.

3.4.3 Networking

A computer network is a group of computers that connect together to provide a wide range of information, which varies in the design and operation of the equipment. Networking can provide permanent connections, such as cables or temporary connections, through telephone and other communication links. It can be a small or as large as a local area network which consists of computers, printers, and other devices. A computer network provides computer users with the available means of communication and transmits the information through the system. Some types of communication are simple user-to-user messages, others are known as distributed processes which involves several computers and sharing of workloads that work together in performing a task. At the same time software may be distributed to all machines on the system. The exchange of information should always be agreed in the condition of *form* and *process* of communication (Harries, 1993). The devices used in networking are referred to as *nodes* connected to a cable that transmit any messages through the system. Networking has three broad

categories, namely resource-sharing, communications and distributed processing networks. Resource-sharing network is a device shared by two or several computers. Communication network is used by individual computers that sends information or messages back and forth between each nodes. The distributed processing network on the other hand, is a data processing system where a computer transmits information towards the main computer and perhaps, when the process of transmission is difficult to analyse the result, will be sent back to the previous node for the process of reviewing. Computer networks are consist of two elements, namely:

- the network nodes in the actual computing system, e.g., larger computer systems, personal workstations;
- the connections between each nodes.

In a local area network the transmitting of information will have a greater impact in controlling the communication into several nodes. Networking consist of several physical circuit-switching networks. There are three basic types of communication-switching networks, such as the circuit, message and the packet switching.

Circuit switching

A circuit switched system is an end-to-end connection that is linked to the information processing terminal. The transmitter will start to send the message to the other node without interruption and will remain communicating until the conversation between the two nodes has completed. However, there are three phases of circuit-switched communication, namely the call establishment, the information transfer, and the call release.

Message switching

Message switching is an agreement between two nodes to transmit and receive messages from the network The message is a group of information that passes through the network. Each node has its own switching mode, which is to agree with the receiving message either to accept or be ignored and later forwarded the message to the next node.

Packet switching

A packet-switched network is an electronic message that transmits message in a two way communication. The message is then transmitted packet by packet. Each packet that transmits in the network should be stored in buffers of the subsystem of the nodes and then forwarded to the next node. It is responsible for the safe delivery of messages coming in from the network system. Packet switching is the process of storing and forwarding of messages.

Figure 3.6 shows the typical multi-node system on how the data is transmitted from one station to another. In this case, station A transmits data or information to another station, with the first node which is closer to that station fixing the circuit to transmit the data to another station. The first node selects the next node to pass the circuit on, until it reaches the target station. Likewise, the data transfer depends on the movement level of the node and the cost of the data or information that is being transmitted to another station.

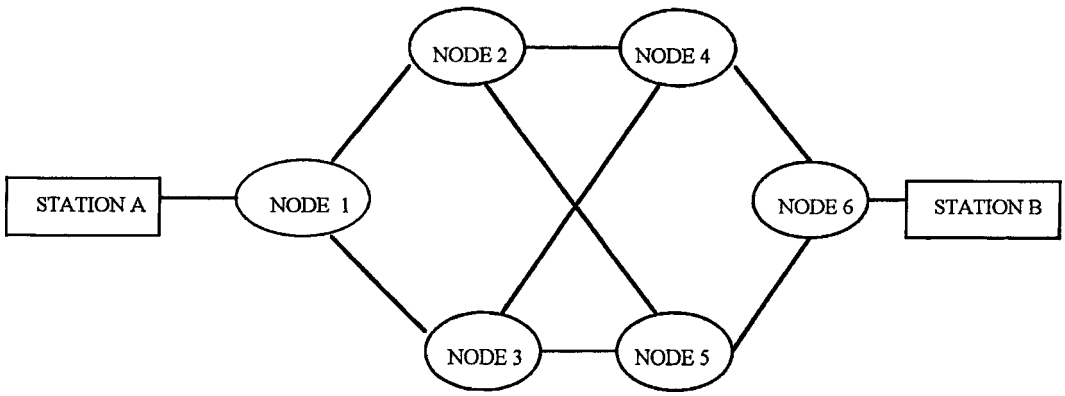


Figure 3.6: Typical multi-node network

Source: (Currie, 1988, page 19) LANs Explained - a guide to local area networks

The transmission facilities in networking is a constituting system that forms a switch which transmits information to the several nodes. Therefore, a communication network holds the node in a different way. There are different types of network, namely the token ring, bus, ring, star, mesh and tree network.

Token ring network

A Token ring network is a combination of elements of a ring and star network. The configuration consists of a ring that is connected to the multistation access units (MSAUs). A Token ring network uses a different approach for transmitting data and the International Business Machines (IBM), chose this system for their use in the local area network. The ring regulates the flow sequence of data passing through the token in which each node receives information and transmits it to the other nodes. The MSAUs operate similarly to a star network configuration in that many nodes are connected into one hub or switch.

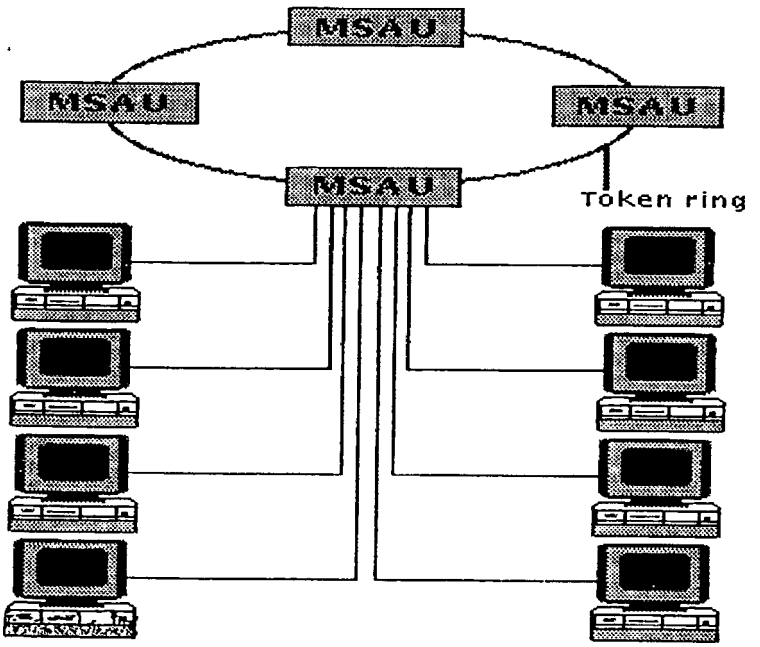


Figure 3.7: Token ring network

Adapted from Encarta Microsoft Corporation (Funk & Wagnall, 1993)

Bus network

Bus network is the most common local area network. Each node is connected to one main network for sharing and receiving data.

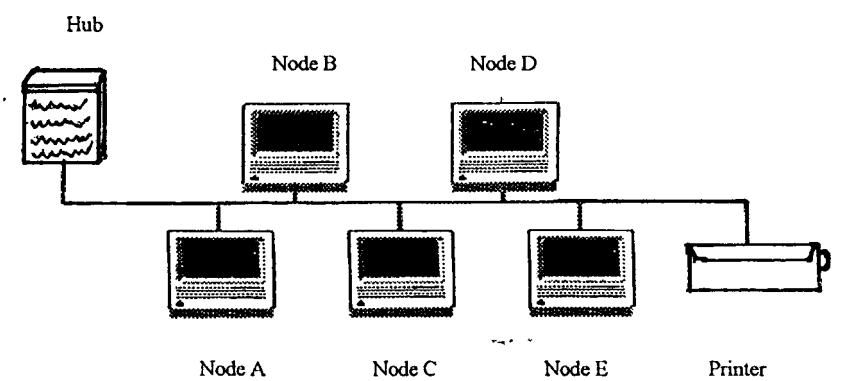


Figure 3.8: Bus network

Source: (Harries, 1993, page 29)Networking and Telecommunications for Information Systems

Ring network

In the process of a ring network, the message will circulate around the ring from each node to another. As each nodes receives a message, it checks the message address code. If the message is not for that particular node, then it will be ignored and forwarded to the other node.

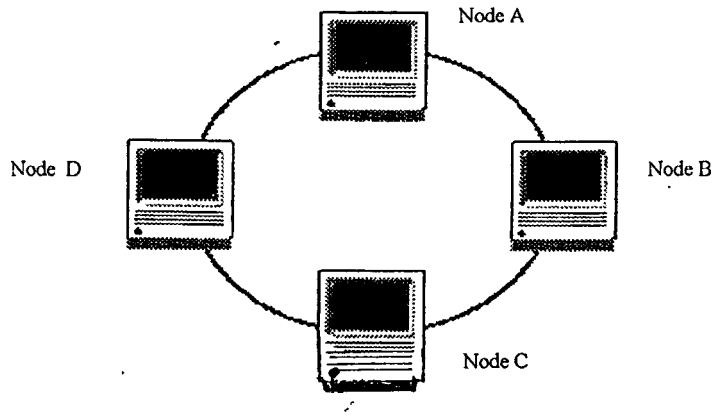


Figure 3.9: Ring network

Source: (Harries, 1993, page 29) Networking and Telecommunications for Information Systems

Star network

A star network consists of several nodes that are connected to a central hub(switch). Messages coming from the different nodes are fed directly feed to the hub.

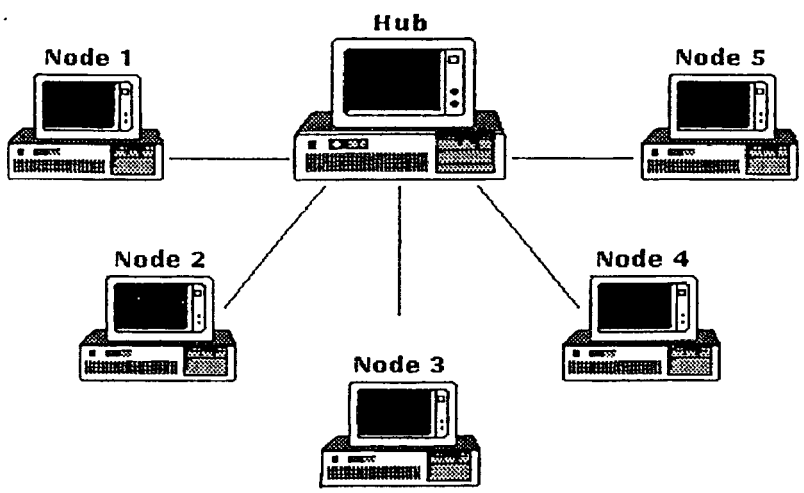


Figure 3.10: Star Network

Source: (Harries, 1993, page 29) Networking and Telecommunications for Information Systems

Figure 3.10: Star Network

Source: (Harries, 1993, page 29) Networking and Telecommunications for Information Systems

Mesh network

A Mesh network is the most commonly used, especially in the public networks. It uses all the branches of the nodes that can be reached in order to transmit the information.

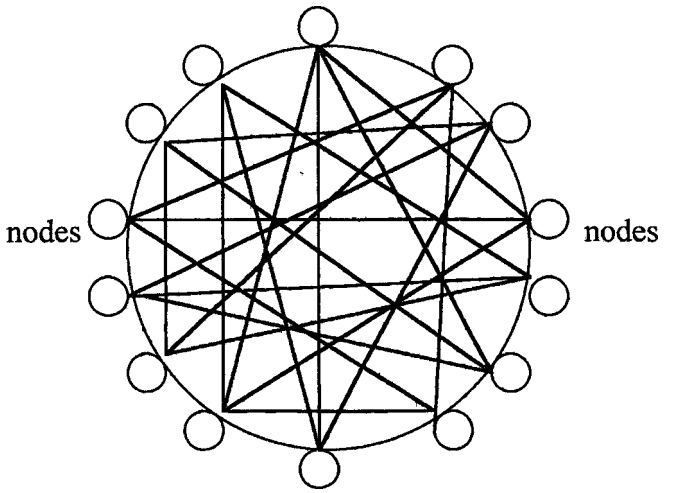


Figure 3.11: Mesh network

Source: (Lindberg, 1990, page 61) Trouble-Shooting Communications Facilities

Tree network

A tree network (figure 3.12) consists of a single primary and number of secondary nodes. Any message or information that is brought for transmission by a primary node is then received by all the secondary nodes. Hence, if there is more than one secondary node, the primary must be able to indicate the intended message and the secondary node should be able to determine whether the information received is to be ignored or to be accepted.

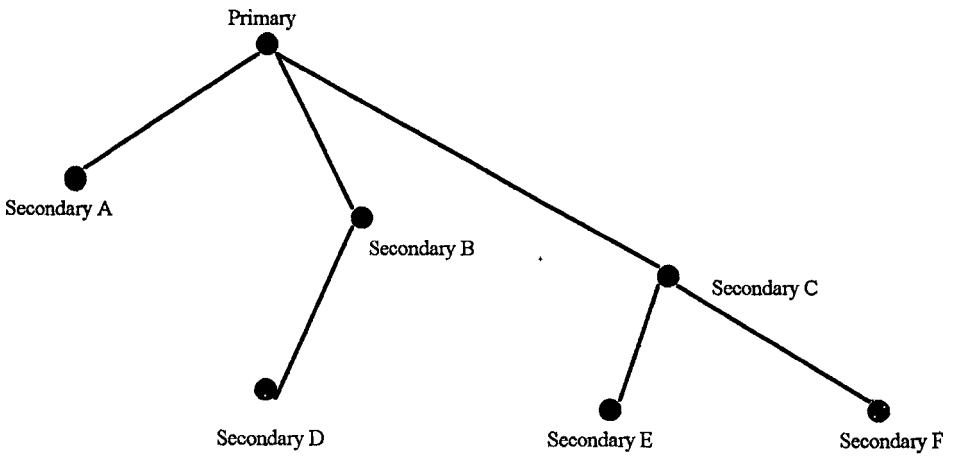


Figure 3.12: Tree network

Source: (Hardy, 1985, page 28) Introduction Data Communications Protocols

The characteristics of a computer network depends on the covered area and the size of the total number of nodes. A computer network can be classified into two, namely local area and wide area network. A local area network (LAN) is a transmission system that is linked together between computers within a single area. The wide area network (WAN) on the other hand, is not a geographically limited area, but capable of having national and global-level interconnections.

3.4.3.1 The Local Area Network

Referring to the Encyclopedia of microcomputer terminology (Christie, 1985).

> ***Local Area Network (LAN)*** *is a technology for connecting several computers that are within a few hundred feet of one another. Users can send messages (electronic mail) and share expensive data bases, software, and peripherals such as printers and hard disk systems. A substantial saving in computer equipment expenses can be realized through local area network.*

Accordingly, LAN is a communication system which is linked primarily by computer-based devices in a relatively limited area. It is different from a terminal-based network, as each of its computer system are independent and self reliant entities. There are two types of local area networks, namely proprietary and standard- based network.

Proprietary network - this system is used to interconnect a number of computers and other devices, e.g., laser printer, and scanner.

Standard-based network - is a computer system with attached devices that can interlink on any system of any type and specification through the use of the common network technology.

A Local area network produces other forms of communication, e.g., speech and video. Moreover, many LANs can combine any activity with the use of resource sharing. It also works on major factors, namely area covered, speed, connectivity, cost, and resource sharing.

Area covered

It is an area of networking which pertains to a certain location with a medium size area, e.g., a small office, a factory, or a common compound.

Speed

It is the rate that data are being transmitted to the network. As in the high speed local area network, it has developed from mainframe to mainframe communications within short distances. Usually, the speed is 1-100 Mbit / seconds.

Connectivity

Connectivity is a characteristics of an open system network. It has the potential to communicate with other devices within the network. Connectivity is a very important concept with regards to the design of a local area network.

Cost

Cost network is used to determine the inexpensive system. An IBM-PC with a 10 Mbit/seconds is an example of a network that is connected to a low cost area station.

Resource sharing

It is the process of sharing the devices in the network. Whereas on a traditional network, each machine has is own switching device.

3.4.3.2 Wide Area Network

The wide area network (WAN) is a computer network which extends to a wide geographical distance using nodes in relaying information. In the wide area environment, the communication process is seen as a multi-stage process. WAN was made into a point to point system that links different nodes. Wide area networking sometimes uses other sources of media for cost effective communications, e.g., microwave, infra-red and laser. Speaking of global networking, microcomputers are often regarded as the best terminals within the system. LANs and WANs do not meet each other in networking. LAN only covers an area with a high speed network and is not restricted for use in the wide area network as in the process of normal networking. The control and management of the WAN network is thoroughly distributed and therefore, is not located in a single central point of the network. Whereas, it can connect other nodes that make the systems updated. The use of protocols requires the system to know that the delivery of the data information will transmit correctly and without interruption within the

process of transmission. The protocol is a set of fixed rules that governs the procedures of transmission into the computer data and it is used in computer systems within the network as a common language communication.

3.4.3.3 Communication Network

A Computer communications network is a system which provides the media for inter-connection between the host and to one or several branched computers for the exchange of information or data. It is essentially for the extension of the use of communication systems to computers other than the host. To initiate the communication network, they are required to establish such connections between the computers. The communication includes recording, executing log-in procedures and repeatedly dialing telephone busy lines. Once a connection is made, the communications program can also be instructed to save incoming messages on the hardisk and transfer them to the file disk. A computer communication network is represented in figure 3.13.

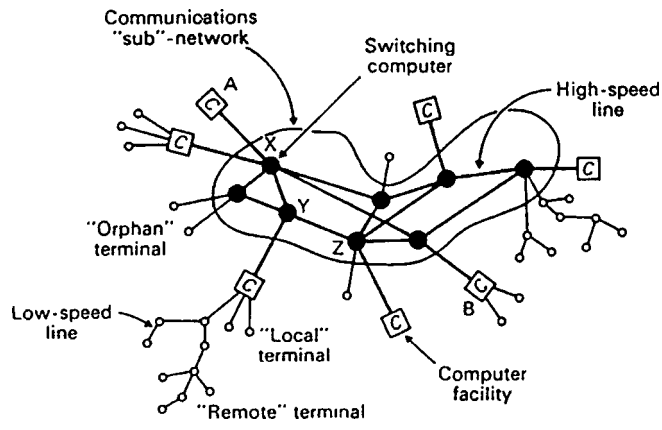


Figure 3.13: The structure of a computer-communication network

Source: (Herbert & Schilling, 1986, page 683) Principles of Commmunication Systems

The above figure shows that the square boxes are composed of computers. Those computers are in line with shaded circles which are the switching centers that

provide switching facilities needed to make a connection. The small open circles are the terminals which are connected to the computers as the main source of the transmitted information from the other station. The lines that are connected to the terminals are the local computer terminals which serve more than one terminal. A high rate of data transmitted is not required for communication as those lines that are connected to the terminals are low speed lines. In using high speed lines, the lines must be interconnected with the switching centers in order to have a very high speed in transmitting information.

There are three modes of transmission in a computer communication network, namely the simplex, half and full duplex.

Simplex

Simplex (figure 3.14) is a flow in one direction for one information of data, e.g., single keyboard and single printer.

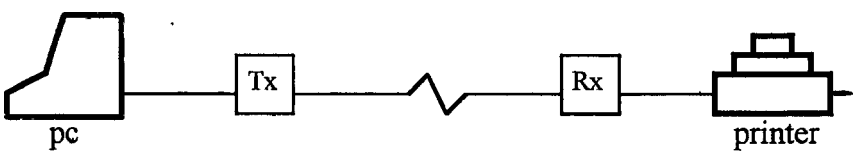


Figure 3.14: Simplex Transmission

Source: (Hardy, 1985, page 25) Introducing Data Communications Protocols

Half duplex

Half duplex (figure 3.15) is a transmission of information that flows in either direction but not at the same time, e.g., links between a two wire baseband modem.

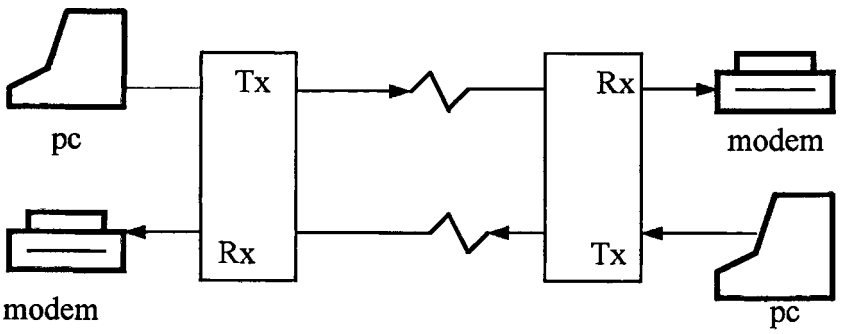


Figure 3.15: Half-Duplex Transmission

Source: (Hardy, 1985, page 25) Introducing Data Communications Protocols

Full duplex

Full duplex (figure 3.16) is simply the simultaneous transfer of information in dual direction that is essentially opposite, e.g., four wire circuit modem connecting a keyboard and printer.

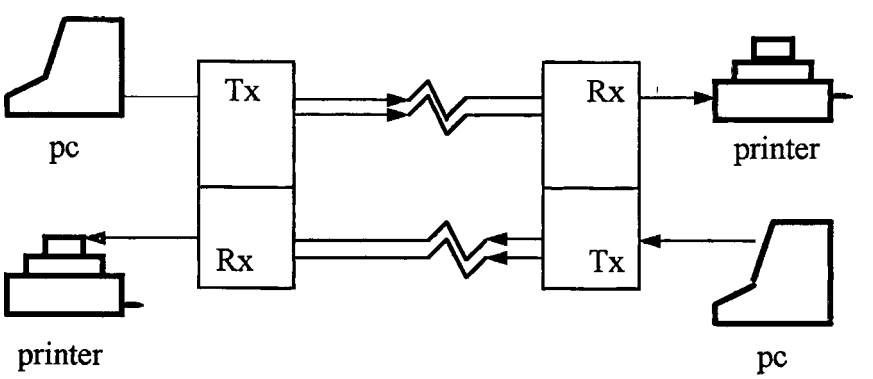


Figure 3.16: Full-Duplex Operation

Source: (Hardy, 1985, page 25) Introducing Data Communications Protocols

The Communication network is a worldwide network (Lindberg, 1990). In communicating with each other, most individual users can connect their network to other networks. The network can be separated from any other type of terminals that

are connected to the system (e.g., telegraph network with telegrams and cables sending message locally and/or worldwide).

A network communication is a medium type of system which is shared by many users making the management of the communication process more difficult compared to a simplified model. Harries (1993) states that the basic model of the communication process can identify the roles and entities. There are three main elements of the communication network, namely the sender, channel and the recipient.

- ***Sender*** - in the process of originating the message, it is responsible for representing the content of the message;

- ***Channel*** - it carries the message from sender to recipient through some physical medium;
- ***Recipient*** - in the process of receiving the message it is responsible for interpreting the format in order to extract the content of the information.

The computer communication network should be able to send and receive information in the process of communication through networking. The message can be sent in the process of external communication using coding and decoding systems by transmitting information into the computer. The communication program should be able to supervise and regulate all the elements of the process and it should be able to;

- establish and maintain the communication connection that runs across the network between the sender and the recepient,
- regulate the flow of information between the two nodes to prevent the overloading of data,

- control the quality of information that are received to prevent the errors on the system.

A Computer network is a form of communication that includes any connections from several individual computer users. Users can be both a human or a machine. Human users can be interfaced within the network through terminals such as telephone instrument, dials, push-button key sets, keyboards, computer terminal, computers, printers, fascimile machines and telex machines. In essence, computer networks use different types of terminals in transmitting informations. Figure 3.17 illustrates this.

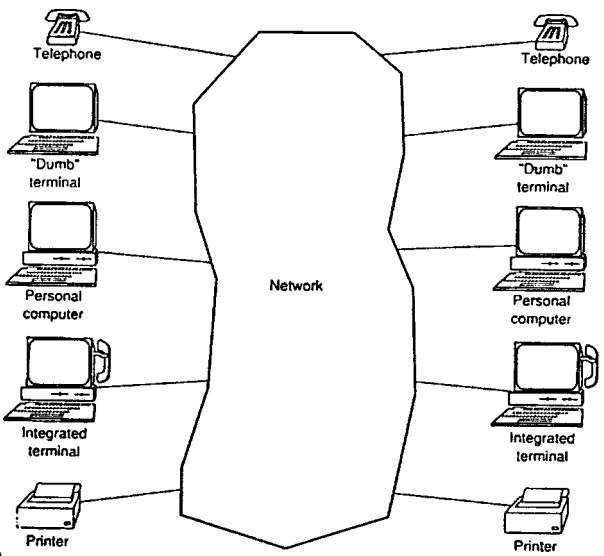


Figure 3.17: Terminals interfacing with network

Source: (Lindberg, 1990, page 59) Troubleshooting Communications Facilities

3.4.4 Costing

It is impractical to determine the relative costs and expenses in establishing a local area network. Costing is an important thing to know before building a local area network. This includes the cost of the equipment such as computers and cables, location of the installation and perhaps, the fees for the technician and instructor who will handle the computer network. The only way to get comparative costs is by

having an alternative system which is already completely installed and be able to get a full cost analysis. For a single micro-based LANs office, the cost is relatively not so much, but for a large system network, the installation and maintenance becomes a great concern for a local area.

3.4.4.1 Hardware for low PC networking

Purchase of Equipment represents a substantial part of the cost of instructional computing. The program software is the most usable in developing a program. It makes sense to choose the hardware in part, based on the software availability and its match with the applications identified as appropriate. Although manufacturers regard the most important things to know by the user in networking is a related-hardware programs, in principle, there are things to determine in hardware networking, such as the distances between each machine, the speed of data information travelled, and the number of PC's that can be connected into a single network.

In measuring the speed of a single network, its operates by a number of bits per second (bps) that transfer data from each machines. Many networks operate for example, at 1Mbps or 1 Million bits per second. The bus configuration is a type of network that is used in a low cost PC network. It is used only througha single cable to communicate with each other machine. In the low cost PC network, the bus network system is used to avoid expensive networks, therefore, more offices and schools use this kind of system. There are four types of cabling systems that are used by the bus network, namely Ethernet, Cheapernet, the twisted pair and the multi-core. Figure 3.18 illustrates this.

Figure 3.18: Bus network connection (schematic)

Source: (James, 1989, page 29) Low Cost PC networking

3.4.4.2 Software for low PC networking

For a low cost PC networking, it is essential to know and understand the procedures of having a software programme. In acquiring a computer system, the school should choose software which suits the needs of the school. The administration should decide as to what kind of software is aptly usable for the system. In essence, it is important to consider that in networking, the software programme is very important as it is responsible for the satisfying the needs of the user. The hardware network will determine the maximum rate at which the information could be transferred across the network . To select the best software application that should be used in the microcomputer, it is necessary for the administration of every school to be able to set-up a criteria regarding the kinds of program software that should be used.

3.4.5 Maintenance

Maintaining the computer is rarely seen as a problem by many people responsible for the computer facilities. The repair, damage-prevention and security protection are the main concerns that every school equipped with computers should understand.

Repair

Repairing a small computer is much less expensive. Portable computers, such as notebook and laptops are small enough to be carried or sent to the repair shop. In

the case of a desk top computer, the repair is done by an expensive technician who visits the user. A Personal computer is designed to allow necessary in-house maintenance. In buying a computer it is necessary to handle it properly and have knowledge of maintaining the equipment. A do-it-yourself computer repair kit is necessary for immediate and emergency repair. Brand new computers installed in schools, companies/stores are provided with valid warranty for a certain limited period.

Prevention

To repair the computer, it is necessary to fix it in-house rather than sending it to the repair shop. However, there are some steps to observe to protect the computer.

1. The computer and disk should be protected from dust. Cover the unit if not in use.
2. The computer should be protected from any static electricity, which may damage the computer, especially when the room is in carpeted.
3. The computer should be protected from heat. The computer room should be able to provide air ventilation in order to prevent overheating of the machine.
4. Provide extra care in transporting the computer from one place to another. The original packaging of the unit is necessary.

Security

It is understood that every school equipped with computer systems should have proper security to protect same from intruders or burglars. Likewise, a computer classroom should be provided with a locking device to secure the computers after being used. A time schedule is also necessary for the students to know when the computer is available for use. Every school should be able to provide a security alarm and guard systems. The World Maritime University, for example, which has a variety of computers that are used by students, adopted a

standard security system to protect its computers. It is provided with locking devices to control access to the computer rooms and also to the computer system using codes and passwords accordingly.

Hundreds of thousands of microcomputers are developed and used by many schools today. They are very effective and provide a high level of knowledge to students in managing information according to their needs.

Chapter 4

EDUCATIONAL SOFTWARE FOR MET

'Maritime education faces a tough challenge: producing enough properly qualified personnel to operate the sophisticated ships of tomorrow.'

Peter Muirhead
Professor of Maritime Education and Training

4.1 The use of Educational Software for MET and competency assessment

Maritime education and training (MET) today is a wide open system. It needs the support of modern software covering maritime education and training in order to provide students with the most realistic applications that can facilitate practical understanding, and provide an analysis of the on-the-job situation simulated by the software programs. The potential use of educational software in MET systems will provide a high level of situation presentation in terms of instruction (instructor's side) and increased level of absorption of knowledge and practical skills (on the student's side). The prevailing knowledge-based training needs to be assessed by a compatible computer-based software program which is designed to meet the specific needs of the overall curriculum. Educational software is under development everyday, and it is the idea of the producers to design various software programs to meet the needs of every individual learner. Different software programs are used to train people in manipulating text, graphics and even for calculating mathematical problems. Thus, software selection is a major concern in choosing programs relevant to the area and level of learning.

4.2 Overview of software applications in MET

Technology has finally touched on the need to use CBT for the improvement of safety in the shipping industry. The capability and effectiveness of a computer-based training tool is largely dependent on the design of the software. According to the statistical analysis, as reported by the Fairplay Marine Computing Guide 1994, more than 239 companies produced 743 software packages, an average increase of 16% over the last year. Software-based system are increasingly becoming more complex requiring more sophisticated hardware systems to run. In CAL most of the teaching and learning chores are assigned to software. Today, many schools and training centers use PC-based simulation that require students to learn on the proper used of the modern technology. Moreover, software products can be used in PC-based simulation with a minimum computer specification based on either on a 386 or 486 CPU, with speed 33 Mhz and up, at least 4 MB or more of RAM, and 100 MB capacity of hard disk.

In selecting computer software, it is necessary for the lecturer to choose the best and most affordable program software that can be easily used by students with a minimum of knowledge and understanding of computer operations, supplemented as necessary by referrals to the instruction manuals. It is important, therefore, that institutions create a set of criteria for choosing computer software that has a high potential as a learning tool, both during simulation exercises and post simulation evaluation. Figure 4.1 illustrates the components of software needed to meet all the criteria set for the school's needs.

4.2.1 Types of Software

As mentioned earlier, there are as many as 743 microcomputer maritime software packages produced by different companies available in the market today. However, microcomputer software programs can vary greatly in answering the training requirements of a particular course. Some are tailored for different

knowledge levels of maritime students in different course areas of study such as communications, navigation, shiphandling, pollution, cargo loading, naval architecture and other general applications. Such software represents the main computer training aids available to cater for maritime education and training requirements for students. Some examples are described below.

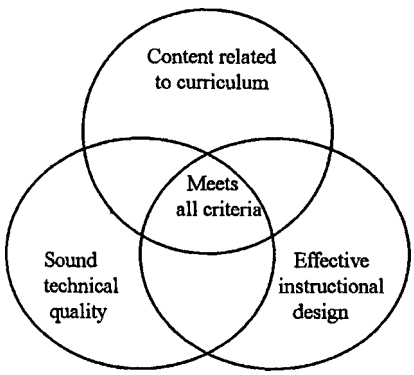


Figure 4.1: Software selection Criteria

Source: (Langhorne, et al., 1989, page 32) Teaching with Computers: a new menu for the 90's

Communication software refers to a radio communication system program which may be linked to the bridge or used as a stand alone system in full configuration that simplifies the use of the communication equipment. An example of communication software is the 'Poseidon GMDSS Simulator' (PGS) from Poseidon Simulation which is designed to simulate the operation of sending information to any vessel using advanced and sophisticated communication equipment.

Navigation software programs, on the other hand, can be used either on a stand alone basis or coupled to the use of Radar/ARPA equipment. 'OOW' is an example of navigation software from PC Maritime, which provides an individual learner with the knowledge and operational skill at the level of watchkeeper.

Shiphandling software programs are used to develop basic handling skills, either for maritime students or for practising seafarers concerning the manoeuvrability of the vessel. An example is the 'Portsim' shiphandling simulator from SSPA which is designed to simulate ship handling and manoeuvring conditions with the capability to provide up to four tugs in support.

Pollution software is designed to train personnel in relevant areas such as communications, logistics and stress management involving pollution calamities. 'Spillsim' from SSPA is an example of such software that was developed as an oil spill training simulator. It has a high level of system fidelity in order to familiarize personnel with the necessary training equipment such as skimmers, oil booms, and other resources.

Cargo loading software is designed to present realistic ship operations and control especially during loading, discharging or in ballast conditions. 'Mariner' and 'Crisis' from Baron & Dunworth are examples of cargo loading software which provide very effective training to students in real ship conditions when conducting ballasting operations and during loading and discharging of cargoes. Special needs such as damage stability can be quickly assessed.

Naval architecture software is designed to facilitate the optimum shape and formation of a ship's hull and to calculate conditions such as stability, trim, hydrostatics curves and movement of a specific vessel. An example of this is the Wolfson Unit from the University of Southampton, who have developed and designed a program that can be configured to a vessel's condition, motion and behaviour.

General software programs are designed for acquiring various categories of knowledge, and for developing skills needed by the ship officers to conduct such

operations and programs as ship management, maritime business, training and education, math/science and marine engineering. Videotel, ALDA and FISYS (Fairplay information system) are companies which design and develop such general software for use in different education and training learning programs.

4.2.2 Evaluation of selected softwares

The proper way of evaluating and selecting microcomputer software must be through proper procedures and based on certain guidelines. This is best conducted by a small group of evaluators. The evaluators may comprise teachers, library/media specialists and technical experts, who are familiar with computer-assisted learning and the process of instructional design. A comprehensive set of criteria is the main reference in evaluating the quality of a particular product. The major points to be considered are:

1. Does it have potential as a learning tool?
2. Does it have potential in developing and enhancing learning skills?
3. Is it easy to use?
4. Is the instructional manual easy to read and understand?
5. How can the software program be used in the different learning levels of the students?

In evaluating the different types of software the lecturers should check to see if it is constructive, systematic and if it will be an effective computer based tool for learning within the curriculum.

4.3 Navi-trainer

'Navi-Trainer' was developed by Transas Marine, being a PC based simulation program designed for use by both a beginner and an experienced

navigator as well. A visual scene in an actual port is reproduced using video-film and a detailed 3-D (3-dimension) scene which comprises the simulation presentation (a fully vector-digitised electronic chart system and a mimic of modern ARPA/RADAR is also capable of being presented on the screen). It is designed for day and night navigation, docking/undocking operations combined with variable weather effects fed into the simulated situation. Views are adjusted up to 360 degrees for sequential presentation on a single monitor or through a combination of views selected for simultaneous presentation of the simulation situation distributed in several monitors. Control and control indicators are also provided to the simulator participant, and includes the important features of recording and playback of the past exercise for review and debriefing. 'Navi-trainer' is a valuable computer based training simulator where participants benefit from the interactive environment of the training situation.

4.3.1 The layouts

The program opens with an instruction to users to register. Once the student-user has signed on, the main menu will be shown on the screen. Figure 4.2 shows the general view of the main menu.

The main menu is the principal control for the whole system. Any choice of menu or submenu elements is made by superimposing the cursor and pressing the enter key.

From the main menu the *register window* will open by logging-in the name of the user in order to run the program (see figure 4.3). In the *archive window*, the user will then open the tape selection which gives him a new set of exercise. He can also keep a record of the previously completed exercise and later analyse it for a necessary refinement. In essence, the user's archive contains up to seven tapes with assigned names for the sake of records (see figure 4.4).

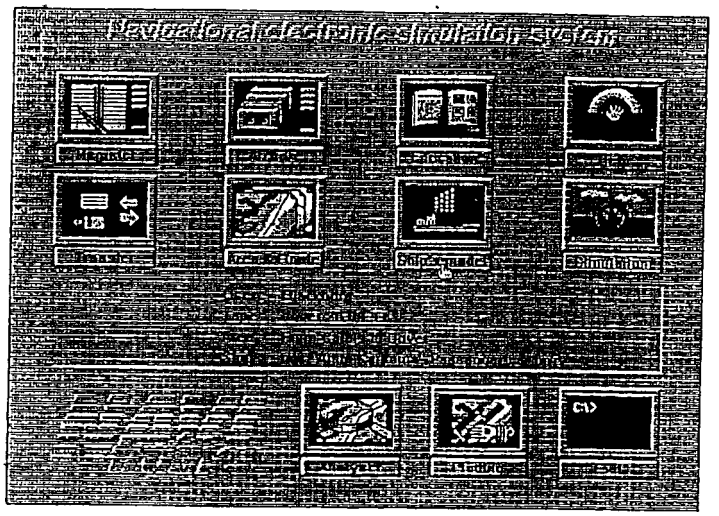


Figure 4.2: General view of NAVI-TRAINER SENIOR Main Menu

The *education window* provides the students with the manual (tutor) on the control of the vessel, use of the up-to-date digital Radar/ARPAs, and understanding on sailing and manoeuvre regulations. The *Help window* indicates how the main menu is fixed and is open for consultation on any problem encountered during the exercise. The *transfer window* enables the students to transfer the results of the exercise into an assigned diskette. The *Area and Route window* gives the list of exercises prepared by Transas Marine from which the learner can choose any route which is more convenient for him to run the simulation exercise. Moreover, the users can also replace the conditions of visibility and the time of either day or night, to make the exercise more realistic (see figure 4.5). The user can select from five own ship models designed by Transas Marine for a required ship's mathematical model that he intends to use for the exercise (see figure 4.6). The *simulation window* displays the program which can allow the selected vessel to start sailing in the selected area along the chosen route and at the time of day set by the user to fit the exercise objective. The button function cannot be activated unless the user has completed the loading of the exercise and the choice of the model of the ship, as well.

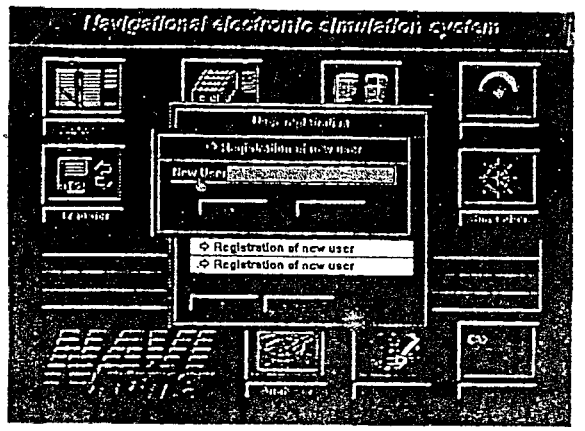


Figure 4.3: Input of new user's name

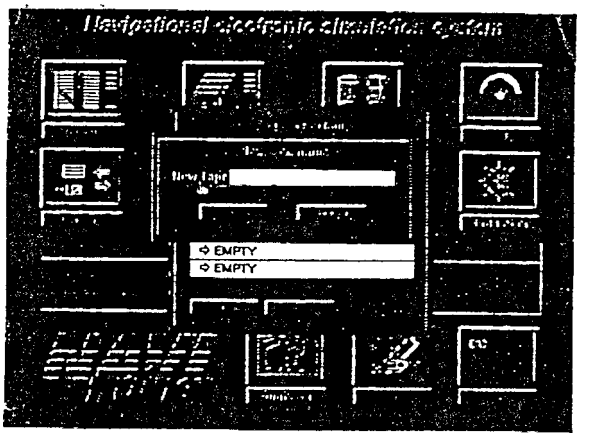


Figure 4.4: Input name of the new archive tape

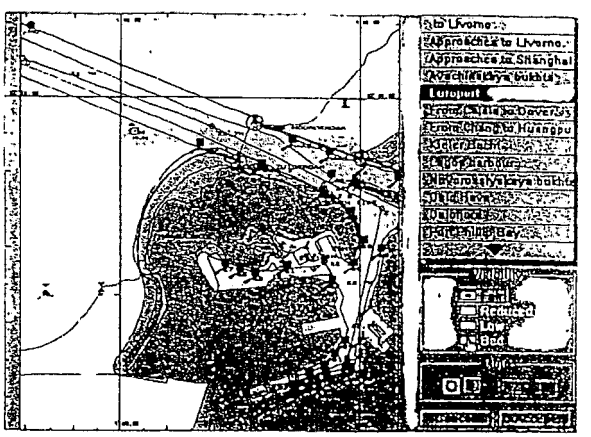


Figure 4.5: Selection of sailing area, setting the time for the beginning of exercise and visibility

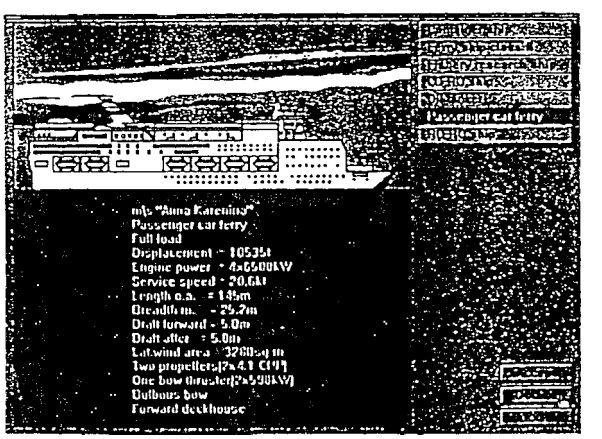


Figure 4.6: Selection of mathematical model to simulator voyage

4.3.2 Instructional characteristics

The program, NT-Senior Plus version is a personal marine navigational simulator that belongs to the first level and can be upgraded with the following versions: Navi-trainer multiscreen and Navi-trainer for workgroups. A ready made exercise is already established in order to perform the capabilities of the operational instruction of the program. The program requires the learners or the users to

undertake the familiarization program which includes ARPA/RADAR, the rules of the road, as well as knowledge on lights and shapes, the International code of signal, the maneuverability of the vessel by using sound and light signals and the ability to understand the proper procedure of signalling using flags and pennants, as well as the morse code signals. The Navitrainer senior plus will run on a computer specification; IBM PC/AT on a 386 or 486 system with a memory capacity of 2 MB or more and runs on MS DOS with 5.00 version or higher. A graphic VG adapter and colour monitor is also required. Mouse or trackerball manipulator is also being used as well as the printer.

4.3.3 Operational characteristics

The operation techniques developed by Transas Marine in the Navitrainer program introduces a great challenge toward the training of the seafarer or of the individual learner/user. The program produces different mathematical models for different classes of vessels. In addition, the learner can choose any vessel to be the own ship and the target vessel, ranging from a VLCC to a high speed craft type. There are three possible modes to choose from the control panel in the simulator's operation, namely visualisation, videoplotter, and the radar. Since the control panel consists of different functions, every student or learner can adjust the control at his/her own discretion. There are several points in adjusting the different functions on the radar display (see figure 4.7). The student can select the scale on the radar menu from one range to another to determine the existence of the vessel. The program also has the trial manoeuvre which is another useful utility that gives the learner the best possible way of taking action.

The engine power is very essential to the maneuvering of the vessel. Indeed, it gives the vessel's maneuverability more accuracy in diverting and controlling the movement of the vessel.

The capability of altering the course on either side of the vessel can be more or less very effective and efficient. Some delays may occur however, depending on the mathematical model of the given engine.

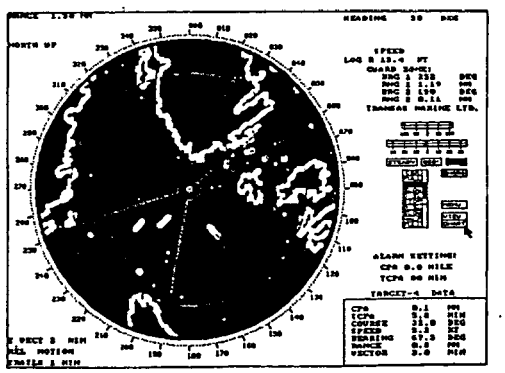


Figure 4.7: Arrangements of vessel's controls in the Radar mode

The student may freeze the course or session by pressing the interrupt button or by letting it be interrupted automatically by grounding or by collision with another vessel. The aspect from a binoculars view can be adjusted within a degree to 360° around the vessel. The learner can look at the surroundings of the vessel (i.e. a target from the port beam or opposite side; he can focus the magnifying binoculars on the target vessel or on a navigational mark. This helps the trainee to think of how to avoid any dangerous situation within the ship's vicinity.

While viewing on the videoplotter, the vessel's control and its menu are available. The program emphasizes the need for passage-route planning of the vessel. The electronic chart can display various types of scales ranging from 1:1000 to 1:200,000,000. Accordingly, the chart scale display can easily measure the distance to the place where the vessel is heading.

4.3.4 Assessing Performance

The program Navi-trainer has the ability to assess the performance of the trainee, who possesses also the necessary theoretical knowledge, particularly in relation to movement of the vessel and analysis of the situation facing the trainee. However, the analyser in the main menu enables the trainee to see the displayed exercises on the screen, be able to print out the results and save in a separate file. In addition, the trainee can look on his/her performance by checking it against the training report in the printed exercises that shows the trainee's name, name of the exercise, date and time when the exercise was begun and ended, factors that caused the ending of the exercise and other general data. Figure 4.8 shows the report of the exercise based on the performance of the trainee.

```
Name: Trainee name
Exercise: St. Petersburg port
Chart: 28000
Worst visibility: 30.00 nm
Finished: 02.06.93 At: 11:31:48
Month: 01
Local time: At start 12:00;   At finish 12:02
Finish: Grounding
Own ship: FERRY
M/S "Anna Karenina"
Passenger car ferry
Service Speed              = 20.6 kts.
Displacement               = 10,535 Tons
Length overall             = 145 meters
Breadth moulded            = 25.2 meters
Draft forward              = 5.0 meters
Draft after                = 5.0 meters
Lat.wind area              = 32,000 sq. m.
Engine power               = 4 x 6,500 k.w.
Two propellers (2 x 4.1 FPP)
One bow thrusters (2 x 590 k.w.)
Bulbous bow
Forward deckhouse
        dist. to bow       = 34.4 meters
        height of eye      = 26.5 meters
```

Figure 4.8: A typical example of training report

In addition, the training report includes other messages such as alterations of course, the use of autopilot and other controls, that are outcomes of the finished exercises, which are automatically recorded by the analyser. This provides information that the exercise has been completed, indicating any wrong decisions made by the trainee in the exercise.

PAGE 00	**Training Report**
12:00:20	Automatic pilot was turned on.
12:00:41	Automatic pilot was turned off.
12:02:01	You have not avoided a close-quarters situation with target 'c'. It is a power driven vessel under-way.
12:02:50	Grounding.

Figure 4.9 Training report that contains a number of other messages

4.4 Officer of the Watch

'Officer of the Watch' (OOW) is a dynamic personal computer-based simulation from PC maritime, designed for the training, teaching, demonstration and development of strategies for minimising the risk of collision at sea. OOW provides a powerful three dimensional "Rule of the Road" simulator based program. 'Officer of the Watch' is a stand alone software program which runs on a standard IBM compatible computer, comprising hard disk, floppy disk drive, an 80386 processor, with maths co-processor and mouse. A VGA colour monitor is necessary to run the programs more efficiently. A printer is also necessary to print out exercise data. The whole package of OOW consists of two programs, namely Officer of the Watch and OOW Course Designer. The latter program enables the instructor to create new sets of exercises which cover certain topic areas, e.g., light recognition or radar plotting. The pre-programmed exercises enable the student to work either under supervision or away from the classroom environment, as part of a distance-learning course.

4.4.1 The layouts

The program opens with an instruction of declaration and conditions that provided for the trainee to understand that the manufacturer of this program has no liabilities whatsoever arising out during in the real life watch-keeping (see figure 4.10). Once the learner or the user has signed on, the files menu will appear. Click on load, and the load course dialogue box will be displayed and the learner can choose from among the given exercises.

The control panel consists of the functions for visuals, expert system, stopwatch and the ship's controls. On the right hand side of the control panel, there are indicators of the ship's speed, course, and rudder angle. Also provided are the engine telegraph and steering gear control. Found on the left hand side are the radar, chart, entry logbook, the button view of the main screen and the control for the exercise recorder. Figures 4.11 illustrates the typical control panel of the program OOW.

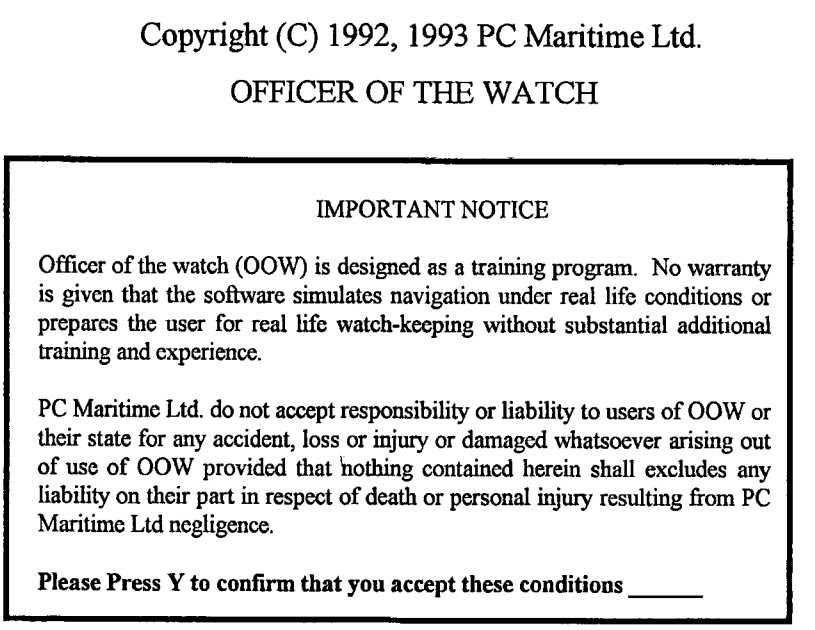


Figure 4.10: Instruction message of the OOW

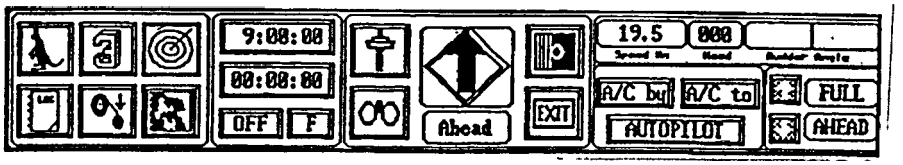


Figure 4.11: The main control panel

In the middle part of the control panel are the four three-dimensional views from the bridge windows. The learner can choose any sector of the four views on the horizon. The clock sets the time of day as soon as the learner starts the exercise while the stopwatch records the time that has elapsed. While the compass repeater takes the bearing of any vessel (navigational marks and any site of land), the binoculars are available for magnifying any target. Futhermore, the expert system can be used to obtain any information or details of any vessel or navigation marks that are visible from the bridge or in radar views. The starting and stopping of the exercise are also controlled by the button functions. In addition, a whistle is also used for producing the prescribed short and prolonged sound blast by means of the keyboard functions.

Messages and questions (either instructions or warning) will appear on the screen, to be responded to by the learner. Figure 4.12 shows a typical example of a message defined by the course designer.

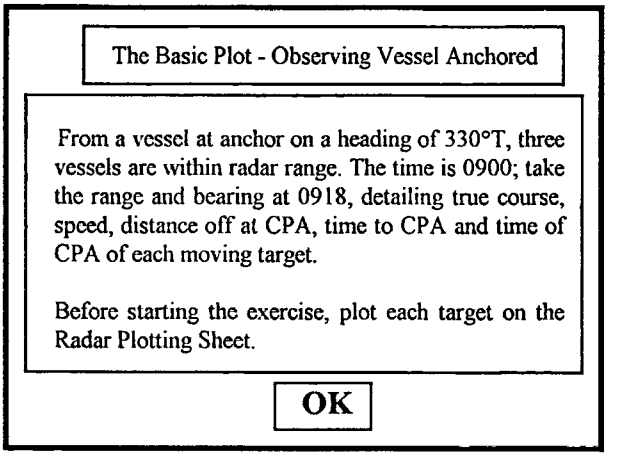


Figure 4.12: A typical message from the program OOW

4.4.2 Instructional characteristics

OOW loads and runs with an exercise produced from the course designer. It is also understood that the learner has prior knowledge of the Rules of the Road (COLREGS), including (sound and light signals) and (the vessel maneuverability). Once the program has been completed or partially completed the learner or the user can save it in the hard disk and may run it again in another session, as desired by the learner. A dongle has to be installed to be able to activate and run the program. An error message will appear in case the graphics system is not properly installed (see figure 4.13). In essence, the learner or the user is able to manipulate any lesson or session by adjusting the different controls (to the control panel or in the main menu).

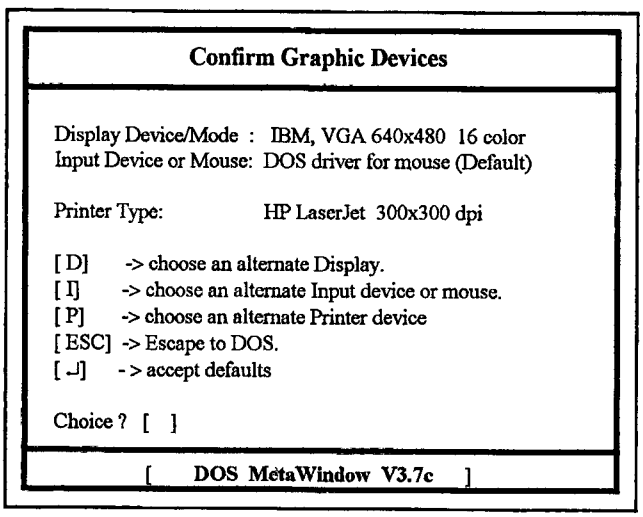


Figure 4.13: Confirm graphic devices

4.4.3 Operational characteristics

The program comes with a fairly comprehensive library of ship models. OOW consists of fifteen different vessels ranging from a fishing vessel to a very large crude carrier (VLCC) defined by the course designer. At any instance, among the fifteen vessels nine of these can be engaged in an exercise as well as used as 'own ship'. The course designer can program any of the vessels with features that affect other vessels' behaviour, such as a vessel constrained by her draft, a fishing

vessel engaged in trawling, or a vessel aground or at anchor. There are many other activities to choose from that make the program or the lessons more realistic.

A number of navigational marks can be placed anywhere and arranged by the instructor to make the coastal arrangements more realistic as in a real-life situation. Examples of this such as navigational marks and vessels are shown in figure 4.14. In addition, a vessel can possibly run aground based on the design and depth of the contour. In addition, any exercises that require coastal navigation or port calling are easily constructed.

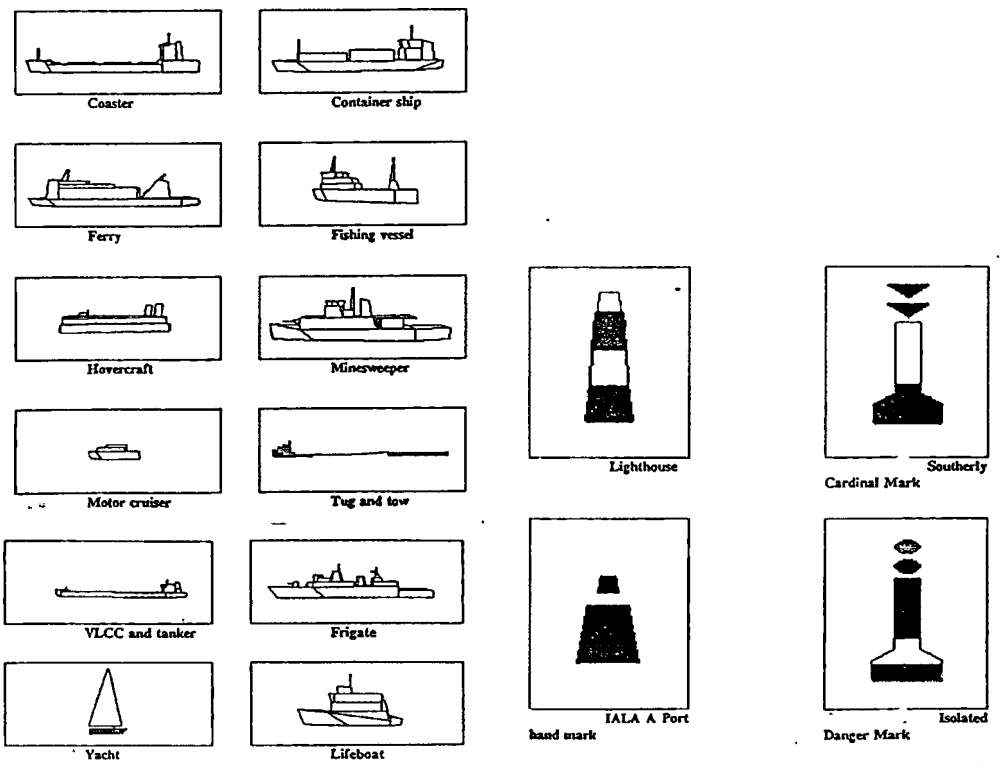


Figure 4.14: Example of model vessels and navigation marks

The radar view basically consists of the following basic controls: the range scale, variable range marker, electronic bearing line (EBL), the anti-clutter, the range rings, heading marker, head-up and north stabilised and the in/out variable range.

Figure 4.15 shows the typical radar display. Using the mouse cursor the learner can adjust the control button by pressing it to its desired adjustment.

The log book records in the logbook view window needs to be checked by the learner in order to find out what actions should have been taken in the previous lesson or exercise. The information includes the various activities such as engine and rudder movement, viewing sector and the use of binoculars. Aside from viewing the details in the logbook, it can also be available by a graphical presentation.

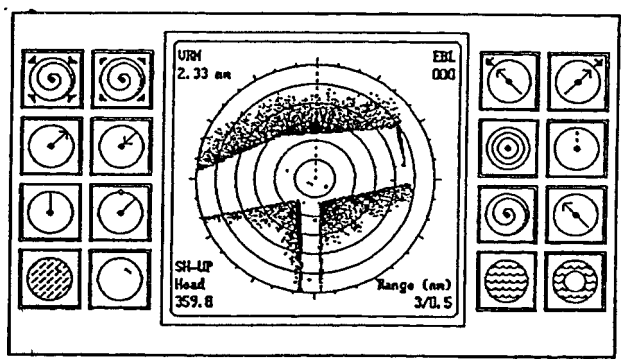


Figure 4.15: A typical radar view display from OOW program

An electronic chart is provided, showing the progress that the own ship is making with respect to the coastline and/or navigational marks (see figure 4.16). The learner can change the chart scale by zooming in or out. Binoculars can be used to identify the type of target vessel and any navigational mark (see figure 4.17).

The expert system in the program is very important for the student or for the individual learner in obtaining any target information from the system. It therefore becomes an interactive tutorial system, assisting the learner whenever it is needed.

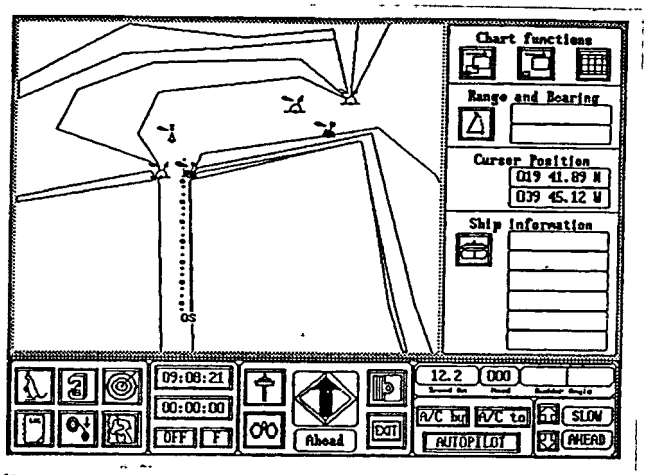
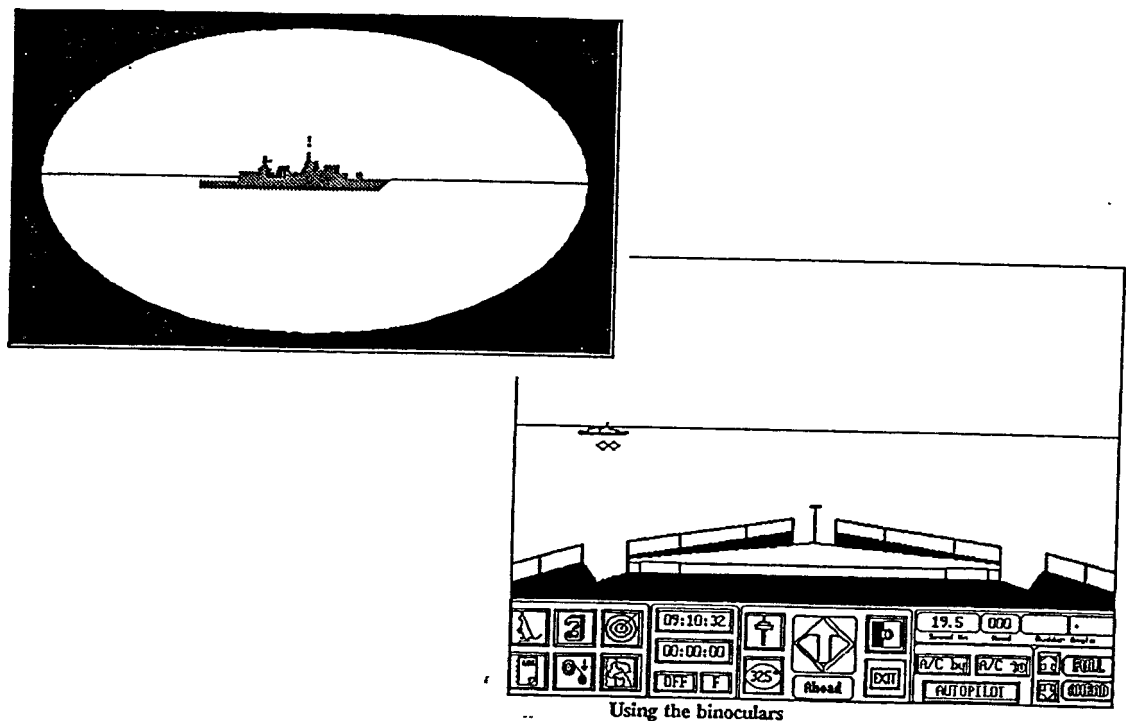


Figure 4.16: A typical chart view from the OOW program



4.17: A typical binoculars view from the OOW program

A test question mode is accurately defined in order to test the ability of the learner. Such question are generally of a multiple-choice type with the appropriate time frame given for its solution. In-built assessment programs it test the skills and

ability of the learner. Figure 4.18 shows an example of a test question from an exercise in OOW. The response to the question will then be analysed by the computer program to see if the learner got the correct answer (see figure 4.19). This is recorded in the logbook. This test establishes how well the learner understands the basic principles of the rules of the road.

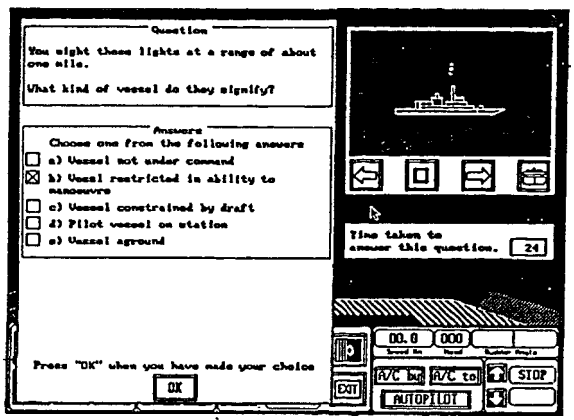


Figure 4.18: A typical question

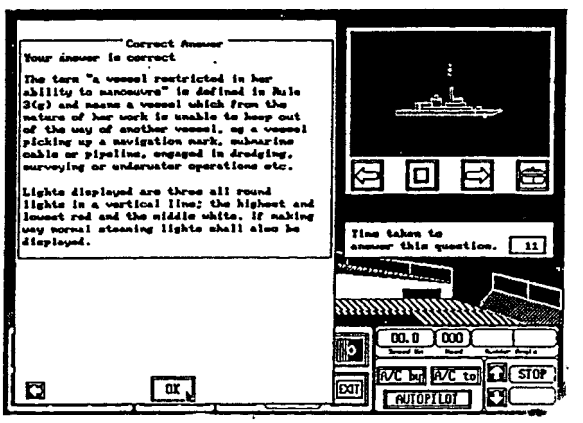


Figure 4.19: A typical answer

4.4.4 Assessing performance

The performance of assessing the program 'OOW' has deals with the analysis and debriefing of the work of the trainee during the exercises. Data has to be drawn upon from various screens as well as the exercise details to find out how, when and why a particular view or piece of equipment was chosen and used. The trainee can monitor his/her work during the exercise and view on the screen of the different records logs such as full log, bridge log, profile log and question and answer log. The bridge log contains a record of navigational information and the student's log entries. A full log records all the events which have occured during an exercise. A profile log provides an analysis of the percentage of time spent in each area of the simulator to provide the instructor with an instant readout of the student's style of watchkeeping. A question and answer log gives a lists of all the correct answers. A set of sample records is shown in figure 4.20. However, the Instructor may assess

the performance of the trainee by viewing the results through the logbook. In essence, the instructor can decide immediately if the trainee is gaining knowledge on a particular exercise. If not satisfactory the trainee could start again until he/she demonstrates that he/she can cope with the previous exercise in relation to real life watch-keeping.

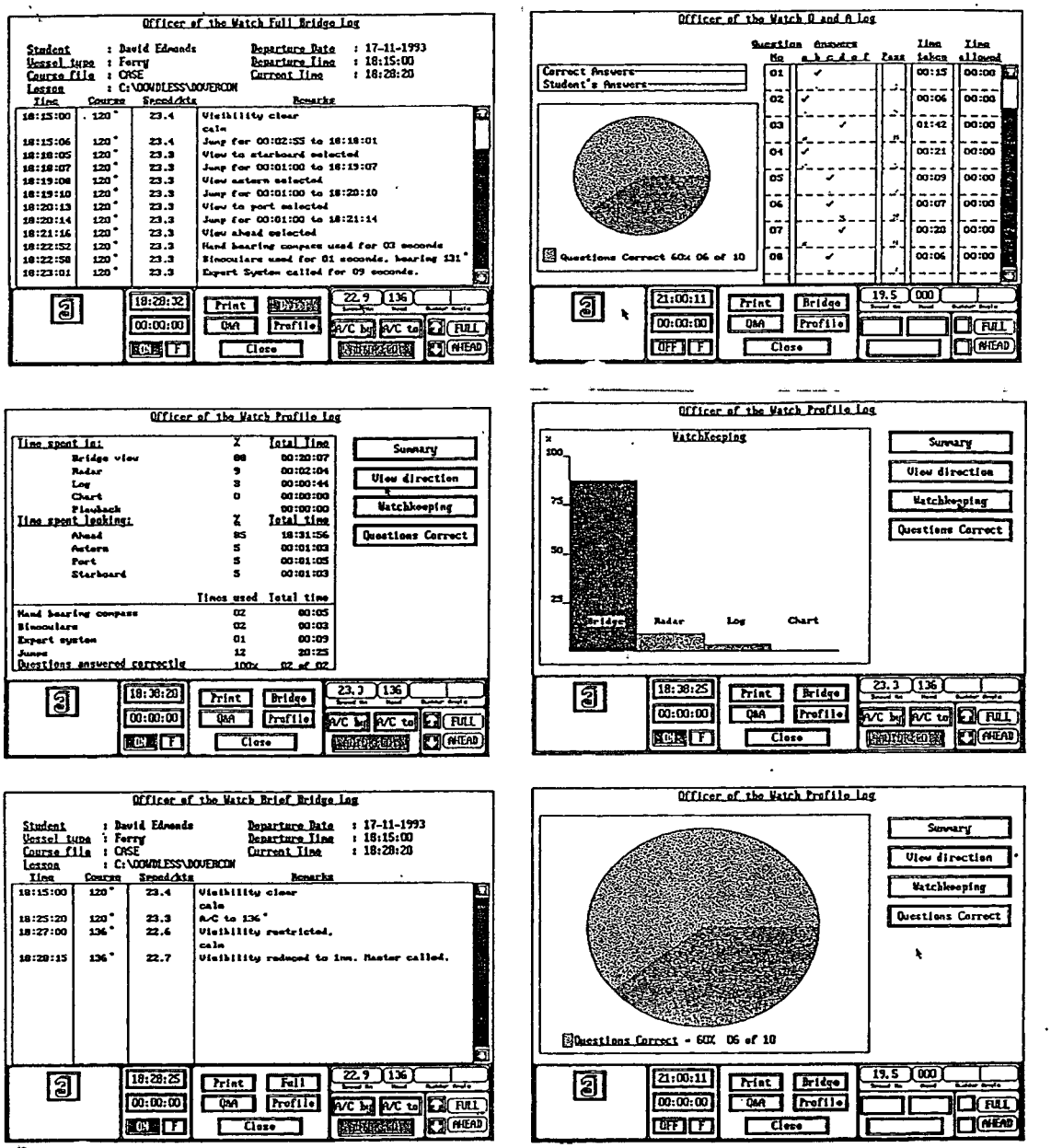


Figure 4.20: Sample records of a student's performance in OOW

4.5 Comparison of software program 'Navi-trainer' and 'Officer of the Watch'

Among the educational software designed by the different manufacturers, 'Navi-trainer' and 'OOW' are somewhat unique and different. Based on the author's point of view, these two developed educational software programs are easy to use and are capable of developing skills, not only for the mariner, but also for students who wish to run the program but who have little computing background. In comparing the two pieces of software, it is necessary to form a set of criteria to formulate the advantages and disadvantages of the programs. However, the basis for the criteria should come from the evaluation team which is interested to see that the program being taught in schools is necessary for the students' learning requirements. The author has further distinguished the differences between the two software programs through the following evaluation reports:

Potential as a teacher instruction tool

Looking at the potential use as a teacher instruction tool shows that 'Navi-trainer' program, has an excellent performance dealing with the manoeuvrability of the vessel, and berthing and unberthing conditions (mostly shiphandling). The design of the mathematical models of the vessel relates well to the the real world, and as well, the user or the trainee can immediately change the weather conditions. The use of Radar/ARPA and electronic chart are also very good instruction tools showing clearly the situation of the vessel, including possible scenarios such as grounding or potential collision points. 'Officer of the Watch' is another excellent software program which is concerned mostly with the upgrading and use of new techniques and modern equipment, e.g., Radar and ARPA, electonic chart (ecdis), knowledge on lights and shapes and familiarization on rules of the road. In essence, the instructor can design the exercise through the course designer program.

Potential as a learning and skilling tool

The program 'Navi-trainer' is very friendly and easy to use. It has an interesting background of every scenario, motivating the trainee to develop skills to a high degree. The program 'Officer of the Watch' is also relatively easy to use. It provides a task to test the skill of the trainee in which that task is exactly the same task as in the real world. It provides the potential to evaluate the trainee's exercise by viewing the results of the action that they have just undertaken.

Ease of use by the students

The program 'Navi-trainer' is simple to use as compared to 'OOW'. The reason behind this is that in the program 'Navi-trainer', the trainee can possibly manoeuvre the vessel by adjusting the control function and it is easy for the trainee to understand the controlling of the vessel in stopping or moving ahead just by pressing the desired button. Likewise, 'OOW' is also easy to use by the trainee, but some of the functions are difficult to understand; in fact, the sequences are in order but the problem is that the trainee has to wait for quite sometime before the program decides to take action.

The Instruction manual

In the program 'Navi-trainer' most terminology used is based on IMO standards. The instruction manual is properly laid out and very easy to read. Each chapter describes every detail from the start of the operation up to editing and assessing the trainee's exercise. The instruction manuals for each 'OOW' package are well designed and easy to follow. Nautical terminology used are also based on IMO standards. Likewise, each control functions is clearly explained and extensive samples of graphics are shown to illustrate the meaning of each function. A security dongle is used to run both the programs.

Suitability for types of courses and levels of students.

Both programs have the potential to be used for several types of courses including Radar/ARPA observer course, practice on collision avoidance, and safety to navigation and for the levels of students most of them should be ship officers (probably for masters and mates).

4.5.1 As a training tool

The educational software programs 'OOW' and 'Navi-trainer are the best and most powerful tools on the market for the training and upgrading of knowledge of students as well as for the mariners. They provide basic theoretical background to the handling and manoeuvres of ship's including complex multi-vessel simulations. Nevertheless, it gives an idea on how to tackle such situations e.g., collision avoidance, traffic separation schemes, passing at or near the channel, where a certain skills are needed to avoid difficult circumstances. The training capability should be based on the IMO STCW standards.

4.5.2 As an assessment tool

The main purpose of the test is to assess the student's performance, knowledge, understanding and ability to perform a specified task. The 'Officer of the Watch' and 'Navi-trainer' programs are more specific on the analytic type of scoring. The formulation of the assessment is given in a set of questions and answers in a multiple choice type, which means it helps the student/trainee to analysize the problems. Some advantages of using a multiple choice type is to increase the number of techniques to prevent cheating, to correct and mark the question in a automatically, objectively and immediately manner. It also helps to assess the student/trainee in the training college for taking such course at the expense of critical thinking and a deeply understanding.

4.6 Summary

Both programmes are very effective and can contribute to the application on board of basic safety standards, as well as ensuring that the levels of skill can be maintained. From the author's point of view, these two types of programmes are of equal capability in the training of students. The only noted difference is that the 'Navi-trainer' is more particular on Radar/ARPA concepts while the 'Officer of the Watch' is more on the basic understanding of different rules of the road. Both programs provide good teaching and training aspects that can be transferred to the real world.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 The future role of computer technology in Maritime Education and Training

5.1.1 A general overview

The rapid evolution of computer technology has brought about a wide range of essential tools for use in the shipping industries, as well as in the maritime institutions. Nowadays, most schools have adopted the use of microcomputers in the classroom environment. The Computer-Assisted Learning (CAL) and the Computer-Based Training (CBT) concepts have been a great help for maritime education and training as it enables students to improve their knowledge, skills and understanding through the use of computer technology. However, students from primary, secondary and tertiary levels must be knowledgeable on the proper handling and use of the modern computer-based technology which enables them to work with any programs using word processing, spreadsheets, computer graphics or simulation.

As there will be further continual developments and improvements, one must be able to cope with the growing complexities of this technology By the end of this century, the author expects that most homes will already have their own information/entertainment system, such as integrated television, sound reproduction, communication, and computing facilities. It follows then, that with the use of those

networks where they may be able to receive direct educational programs for children via satellites. Similarly, children will be able to learn quickly using the wide range of educational equipment, such as videodiscs and videocassettes that provide many educational programs. In essence, in using these valuable resources, children will be able to learn in advance before they begin going to school.

The future of the use of microcomputers in the training of students as well as for the seafarer in general will very much be influenced by the steps taken today. Microcomputer technology will allow the student to perform many of the routine duties that are associated with new curriculum in a more efficient manner. It improves the ability of the students to use all the available information within the school setting. The ethical use of computers in maritime education and training will change many of the teaching methods of every institution and have the potential to develop more effective training and instruction tools concerning the use of educational software.

5.1.2 The need to upgrade the system of education at PMMA

The Philippine Merchant Marine Academy should therefore, change the system of education in order to upgrade the training program of the midshipmen by placing more emphasis on the use of computer technology (e.g., simulator, computer-based and other media based resources). The introduction of these new systems of education must also apply to the Instructors as well as to the students who will then gain teaching knowledge and skills, and become competent in the new world of technology. PC's are ideally suited to addressing many of the needs of the students, while not suffering the disadvantage of high cost found in many simulation systems. The PMMA is a front-ended and sandwich type of education where the students in their second year of education are on their training period on board the vessel. Therefore, before embarking on the ship, each one of them should already be familiar and know how to use this new technology for education. Moreover, in

upgrading the system of maritime education and training at PMMA the focus of the proposed training should be based on the following criteria:

- Adoption and implementation of a curriculum consistent with IMO standards.
- Intensive faculty development including instructor training.
- Development of computer aided learning facilities.

5.2 Recommendations

With the view of possible improvements in the maritime education and training system towards the new technology, it is recommended that the following steps be taken to implement the proposed changes:

.1 Computer based classroom laboratories be developed for groups of 12 students.

.2 Funds be provided to purchase maritime education software to support the core curriculum.

.3 The core curriculum be reviewed to incorporate to the optimum level computer aided learning and computer based training methodologies where the advantages of the technology are demonstrated.

.4 Changes in the IMO STCW Convention placing greater emphasis on the use of simulation technology for competency to be reflected in the course curriculums.

.5 A program of training for instructors be initiated to upgrade their pedagogical skills in the use of computer based technology.

.6 PC based simulation programs for skill enhancement of new watchkeeper be purchased and used for all new trainees.

Attaining the desired goals will not be easily achieved. It needs time, dedication and the need of concerted effort by those who are responsible, either

directly or indirectly, for the education and training of students using the new technology.

APPENDIX

LIST OF CBT PACKAGES

(Prices shown are the latest estimates available)

VIDEOTEL MARINE INTERNATIONAL LTD.

- *SHIP'S LIGHTS, SHAPES AND SOUND SIGNALS*

A program in two parts, first a Tutorial and Learning program, and second, a three level multi-choice quiz. The quiz scores 2 point for a right time answer and 1 point for the right second time. The content is complete and right up to date.

Price	$ 600.00

- *MARLIN - A ship's Loading Calculator Program*

This is a suite of programs derived from Loading Programs written to comply with classification society rules. They use real ship data and allow with the trainee to simulate real conditions of loading and discharge.

Price (for each of 5 separate ship-types)	$ 640.00
Price (for complete suite of 5 ship types)	$ 2,560.00

- *CLOUDS (Meteorology Part 1)*

An interactive training program dealing with the formation of the many various types of clouds. Starts from first principles and includes the international

classification of clouds for weather reporting. The program is supplied with a full colour cloud recognition chart.

Price $ 792.00

- *SAFETY CHALLENGE SERIES*

A question and answer program designed to test safety awareness on general aspects of safety in a variety of marine and related situations.

Price $ 360.00

- *NAVMASTER*

Navmaster is a self-teaching and self-assessment program on electronic navigation aids. Radio waves, their propagation and errors and the geometry of hyperbolic navigation systems, particularly Loran C and Decca.

Price $ 560.00

- *SISRADAR - Radar simulation*

Radar simulation on a personal computer, this package starts with a single own-ship configuration and is expandable up to 16 own ships. Each own-ships using a separate PC. Most facilities found on the most expensive Radar Simulator are displayed on the student own colour display. The Instructor is able to define his own exercise area. Full set-up instruction are provided.

For IBM or compatible with EGA colour standard screen. Computer are linked either by serial links on by a network depending on the configuration chosen.

Price (For serial link):

Single station (S2)	$ 1,800.00
One to Two Stations plus Instructor (M2)	$ 6,000.00
One to Five Stations plus Instructor (M5)	$ 12,000.00
Six to Nine Stations plus Instructor (M9)	$ 20,800.00
Ten to Sixteen Stations plus Instructor (M16)	$ 38,400.00

- *PROFESSIONAL TOUCH TYPING TUTOR*

This is an advance typing tutor, excellent for those who need to learn to type to take full advantage of modern computer and communications systems.

Price $ 240.00

- *BUOYAGE SYSTEMS*

An interactive training program with instruction and knowledge testing on IALA buoyage systems. Covers knowledge testing on IALA buoyage system A and System B, lights and shapes recognition.

Price $ 792.00

- *PRINCIPLES OF RADAR*

This program starts at first principles and deals with the physical parameter of radar operation. It also covers practical use of radar for navigation and collision avoidance. In 8 sections this program provides a complete self contained radar teaching tool.

Price $ 792.00

- *INTERNATIONAL CODE OF SIGNALS*

This interactive training program deals with, phonetics, single letter meaning, important double letter meaning and other sections of the code to provide a complete teaching and testing tool for signals.

Price $ 592.00

- *MARINE QUESTIONS*

This is a new concept which is designed to help managers assess the knowledge of seafarers by using a microcomputer. The computer 'asks' the questions and captures the answers. Questions are selected at random from a question bank on chosen subjects. The answers are marked and permanently stored for examination and analysis by the manager.

Marine Questions is a valuable aid in:

* recruitment selection
* testing when considering candidates for promotion
* validating training

or in any situation where an objective test of knowledge is required.

The heart of the program is the question managment software. This selects and presents questions to the student, notes and stores the answers given. This package includes comprehensive facilities for displaying, manipulating and printing the answers given by the students. The questions can be often used. Questions may be accompanied by associated graphics pictures.

The question mangement software is used in conjunction with a number of *Question sets*. Videotel has a bank of standard *Question sets*. Alternatively they can be supplied to order or standard sets modified to meet individual needs.

Examples of standard *Question Sets* currently available are:

* Rule of the Road
* Safety
* Cargowork and Deckwork
* Engineering Knowledge
* Electrical Knowledge

Price from $ 1,200.00

TRANSAS MARINE OVERSEAS LIMITED

- *NAVI-TRAINER*

The Navitrainer family of Bridge and Radar Simulators is supremely reliable. The simulator comprises a visual scene of an actual port reproduced using video-film and a detailed 3-D port re-build data, a fully vector-digitised electronic chart system and a mimic of a modern ARPA/RADAR.

NAVI-TRAINER may be used to meet the needs of the leisure sailor in Yacht Clubs or Advanced Pilot and Senior Officer training provided by the most prestigious of Military and Commercial Training Institutes.

Other applications for NAVI-TRAINER which have been identified by existing users include:

* Rule of the Road training and testing
* ARPA/RADAR familiarisation
* On board continous training and assessment of ship's officers
* Dedicated Pilot training for particular ports and specific ships.

* Port development and channel dredging analysis.
* Feasibility studies for larger ships using existing channels and berths.
* Accident or near-miss investigations.
* Development of specialised-ship handling skills.

Price (Pls contact the Head office for more details)

POSEIDON EDUCATION AS

- *POSEIDON NAVIGATION SIMULATOR PNS*

All navigation aids are correlated and give the position of the Own Ship in real time. Functionally for each instrument is in accordance with the actual Position, Date and Time of day.

Operation of the Student Simulator is performed on the specially designed Concept Keyboard included with the PNS and a conventional Mouse or Trackball. The Concept Keyboard simplifies operation of the simulator and enchances the functionality of each instrument. The Mouse or Trackball operates the Marker similar to an ordinary Radar.

Price $ 4,489.00

- *POSEIDON ARPA SIMULATOR PAS*

The ARPA Simulator is an extensive of the PNS by adding the operation of Automatic Radar Plotting Aids to the True Motion radar's functions.

The ARPA has all basic features found on most types of ARPA -Radars used today. The functions of the Poseidon ARPA Simulator is designed to comply with

IMO Model Course 1.08 ARPA Radar when simulating at least 2 Own Ships simulataneously.

Price $ 13,468.00

- *POSEIDON EXERCISE MAKER PEM*

Network-Program - The Network-Program is developed to suit the specific needs of the simulator software and to avoid complications using conventional office-type networks. The Network is easy to operate and utilizes inexpensive standard net-cards and cables. When using the network, 1-8 Student simulators can be monitored real-time by the Instructor.

Exercises can be run in Common Mode or Individual Mode - wherein the first means that all Student and Instructors ships are in the same exercise. The second means that the Students start with the same exercise and thereafter split apart to sail against the Instructor's ships.

Mapping Program - The Mapping Program lets the Instructor create his own Coastlines from local charts by using an inexpensive Digitizing Tablet.

The Instructor operates PMD by using the mouse-cursor to activate functions for preparing the digitization. Each own-produced coastline can consists of up to 1,800 points, Larger areas can done by the manufacturer on request.

Plotting Program The Plotting Program can be activated by the Instructor in order to log an exercise for printout after completing the sailing. The program automatically scales the frame of the plotted chart and the Instructor can select Range. The initial situation before the start of an exercise can also be plotted.

Price $ 4,489.00

- *POSEIDON GMDSS / GOC SIMULATOR - PGS*

The Poseidon GMDSS Simulator (PGS) contains all the essential elements necessary for running communication training under the Global Maritime Distress and Safety System.

The simulator system is based on the use of locally acquired standard personal computers and network systems for data and voice. The user friendly Poseidon GMDSS Simulator makes it easy for the Instructor to develop and perform exercises with 2-15 students at the same time.

The Poseidon GMDSS Simulator enables maritime academies inexpensively to boost their educational capacity by adding the Poseidon GMDSS Simulator to their communications training equipment.

Price	1 Instructor and 2 students	$ 14,964.00
	1-13 additional units	$ 4,489.00

PC MARITIME LIMITED

- *OFFICER OF THE WATCH "Real Sea Experience at the Press of a Button"*

This is a powerful three-dimensional "Rule of the Road" simulator designed to teach all the procedures and strategies for minimising the risk of collision at sea. The program uses an expert system to guide the student and the conduct of the exercise. The view from the bridge is shown and whilst underway the student can also obtain a radar picture and consult the chart.

Predesigned exercises are available. A powerful Course Design package allows an instructor to design exercises.

Price $ 5,200.00 for the first unit, prices for additional units available on request
$ 4,000.00 for the Course Design program.

- *NAVMASTER*

Navmaster is the most exciting new development in navigation software since PC Maritime published PC Wayplanner. Here at last is the first electronic charting system to offer a highly-developed user interface combined with expert database management of waypoints and routes, guaranteeing exceptional ease of use and powerful navigation tools.

Designed for windows™, and featuring Multi-media capabilities, Navmaster is the foundation software for all serious navigation programs for the future. From now on, Navmaster is the only choice for stability of product, excellence of design and access to new information technology on CD ROM - the Pilot Guides and Almanacs of the fututre.

Price N/A

- *POLY PLOT 4.0 Global PC Navigation Systems*

1. Poly Plot - Celestial Navigation Operating System, Including Dead Reckoning, Great Circle Navigation, Compass Deviation Control, Local Apparent Noon, Sun, Star, Moon and Planet Sight Reductions, Sight Clustering, Automatic Running Fixes (mixed bodies), Twilight Forecasts, Star and Planet Finders, Night Sky Polar and Azimuthal Planispheres, VGA color Graphics, Mouse support, easy "Windows" type operation. No esoteric knowledge is required.

Price $ 144.00

- *POLY-PLAN & THE GAZETEER*

Produces Voyage Log Plans, Course, Distance & Bearing, Effective Speed, Printed Prediction Logs, ETAs, Racing Prognostications, and much more, including a Waypoint Gazette of over 5000 Nautical Waypoint Address.

Price $ 67.00

- *POLY-GRAF*

Calculates Great Circle Plots, Logs & Courses, Stows Plots & Fixes during voyages, Produces Mercator, Rectangular-Equidistant & Polar-Gnonomic Charts etc.

Price $ 30.32

- *STAR-MASTER*

Night Sky Tutorial. A practice Tool for the Novice Navigator, with On-Screen Star Charts. Includes Star Maps, Finders and Planispheres.

Price $ 27.12

- *POLY-QUICK & THE RDFX*

Complete Package of Navigation Aids, with Wind & Tide, Corrections, Tracking Assistance, Traverse Summations, Beaufort Scale Data, Vert. & Horizontal Sextant Positions, Compass Error Reporter, and more... The RDFX provides instant Radio Direction Finder position Fixes from the true compass direction toward the transmitters only.

Price $ 79.92

- *POLY-CIRFIX*

Uses new computer technology to plot vessel's position quickly and accurately with just two Sextant Sights. Almanac, Sight Reduction Tables, Dead Reckoning Positions, and Plotting are not required.

Price $ 84.72

- *POLY-TEACH*

Manual course by the books, using HO-249 & Reed's Almanac, Plus in depth, on-screen basic skills tutorial. (Free with POLY-PLOT buy).

Price $ 25.60

- *DEMO SCHEME*

Limited use count, full function program diskettes. If bought after trial, the company ships a manual and 'bump number', which restores the disk to unlimited use. Choice of any one of above.

Price $ 10.00

BARON AND DUNWORTH

- *MARINER*

Mariner Loading Program for Stability and Strength - The "Mariner" on board loading program provides continuously information relating to the reserves of stability and longitudinal strength for future conditions and loading.

"Mariner" features menu driven graphics screens to provide a fast and easy to use system for the assessment of statutory requirements for:

* Intact stability
* Damage stability
* Longitudinal strength

Price $ 350.00

- *CRISIS*

"Crisis" casualty situations evaluation software - "Crisis" complements the "Mariner" loading program and provides rapid evaluation of casualty situations taking into account:

* Collision damage
* Grounding
* Effects of tide
* Cargo/balllast transfer

"Crisis" uses different calculation techniques from conventional stability methods to enable any damage scenario to be modelled and analysed in a few minutes. Proposed remedial action can then be assessed and optimised.

Price $ 350.00

SSPA

- *PORTSIM - PC based ship manoeuvring simulator*

SSPA Maritime Consulting AB has developed reliable mathematical manoeuvring models. These mathematical models are now combined with modern

PC-based colour graphics into a powerful and flexible realtime simulation tool called PORTSIM.

PORTSIM A is a training simulator for realtime manoeuvring training and ship handling. PORTSIM A is delivered together with one or more specific ships and ports according to the customers specifications. The simulator is very easy to handle all man-machine communication is completely mouse-controlled and no previous computer experience is required.

Price $ 6,500.00

- *PORTSIM B*

PORTSIM B version includes an additional tug assistance feature. Up to three tugs can be individually operated and their activities are continuously displayed on the screen. PORTSIM B is excellent for training of complex tug assisted manoeuvres and alternative strategies can be tested and compared.

Price $ 8,200.00

- *PORTSIM C*

PORTSIM C version is intended for ship port and fairway designers and consultants engaged in manoeuvability, ship handling and safety aspects. The main additional features of PORTSIM C are the expert modules.

Price $ 31,250.00

- *SPILLSIM*

SPILLSIM is an oil spill training simulator now being developed at SSPA for the Swedish Coast Guard (SCG). The simulator will fill the gap between theoretical knowledge and practical experience. SPILLSIM is to be used within the SCG's organization, where rescue commanders and on-scene-commanders (OSC's), will train in complete spill operations in order to optimize the use of the Swedish Coast Guard's resources. Until now, this training support is almost only available at accidental spills occuring in Swedish waters.

Price N/A

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