COMPUTER LITERACY
AS
ADDITIONAL EMPOWERMENT MECHANISM
IN
LEARNING PROGRAMMES

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by

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ABSTRACT

The world of digital interactivity, of computers, of cyberspace and the "e-revolution', is making computer literacy more indispensable than ever. There is an increasing demand for ICT skills worldwide – South Africa is not alone in identifying shortages. The information and communication technology in South Africa is exacerbated by emigration on the one hand and the previously disadvantaged learners on the other hand. With an education system that is stretched, higher education has not kept pace with information and communication technology training in South Africa, therefore learners display a shortcoming of basic computer skills. The purpose of this study is to emphasise the importance of implementing computer literacy training throughout the entire learning programme of learners at higher education institutions.

Learners randomly selected from the Faculty of Management Sciences, Vaal University of Technology, indicated their computer literacy via questionnaires and levels of experience. It is clear that the abilities of the learners are not sufficient to ensure that they are computer literate or that they will be effective users in the workplace. This study results in a powerful argument in support of the extension of continued growth in computer usage in the workplace.

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ANOVA	ANALYSIS OF VARIANCE
ASP	ACADEMIC SUPPORT GROUP
ATM	AUTOMATIC TELLER MACHINE
BC	BEFORE CHRIST
CBT	COMPUTER BASED TRAINING
CD	COMPACT DISC
CD-ROM	COMPACT DISC-READ ONLY MEMORY
DTP	DESKTOP PUBLISHING
E-COMMERCE	ELECTRONIC COMMERCE
E-MAIL	ELECTRONIC MAIL
ENIAC	ELECTRONIC NUMERICAL INTEGRATOR AND COMPUTER
FMS	FACULTY OF MANAGEMENT SCIENCES
HE	HIGHER EDUCATION
HEI	HIGHER EDUCATION INSTITUTION
HTML	HYPERTEXT MARKUP LANGUAGE
ICT	INFORMATION AND COMMUNICATION TECHNOLOGY
IT	INFORMATION TECHNOLOGY
LP	LEARNING PROGRAMME
NBT	NET BASED TRAINING
NQF	NATIONAL QUALIFICATIONS FRAMEWORK
OBE	OUTCOMES-BASED EDUCATION
PC	PERSONAL COMPUTER
RDP	RECONSTRUCTION AND DEVELOPMENT PROGRAMME
SA	SOUTH AFRICA
SAQA	SOUTH AFRICAN QUALIFICATIONS AUTHORITY
SETA	SECTOR EDUCATION AND TRAINING AUTHORITY
SOHO	SMALL OFFICE/HOME OFFICE
TI	TRADE AND INDUSTRY
URL	UNIFORM RESOURCE LOCATOR
VCR	VIDEO CASSETTE RECORDER
VUT	VAAL UNIVERSITY OF TECHNOLOGY
WBT	WEB BASED TRAINING
WWW	WORLD WIDE WEB

CHAPTER 1

1. A CURRENT PERSPECTIVE

Before computers were invented, data was collected and processed manually in a variety of tedious ways. This involved changing old documents with a pen and retyping the amended pieces of paper in full. The document was then stored in a filing cabinet (Scott *et al.,* 1994:1). Data collection for early computers was often done by transcribing hardcopy data into computer-usable forms such as punched cards or paper tape (Hutchinson and Saywer, 1992:23). Long and Long (2000:106) mentions that the earliest forms of teaching were oral: the teacher spoke, the learners listened and then together they talked and wrote about the subject. Walker (1999:1) states that today's society and education environment has significantly changed since the evolution of Information and Communications Technology (ICT). The term ICT ordinarily refers to computer-based information technology and communications.

In the 1950s computers were large and slow and were designed to handle routine tasks such as payrolls. Mainframes were built in the early 1960s and minicomputers in the late 1960s. The computers built in the 1970s were the first personal computers (PCs). Tens of millions of personal computers were found in workstations in offices, factories, laboratories, schools, homes, hospitals, government agencies, banks and retail stores in the 1980s.

There can be no doubt about the impact of technology on our society over the past few years (Anderson, 2002:1). Qualified people, who have the knowledge and the understanding of using this fast developing technology, are needed to utilise it to its full potential (Scott *et al.,* 1994:1). One of the key findings of Hutchinson and Sawyer (2000:1.4) is that, in today's fast-changing technological world, you will hardly find an organisation in society that does not require people with knowledge of ICT.

Discussions with Bester (2000:16) indicated that there is a definite lack of computer literacy in various fields. Computers have acquired an enormous importance in trade and industry (TI) as a tool for gaining and managing information and as a means of communication. The ability to use computers is considered as an essential asset when seeking employment.

During the past few decades there has been an explosion in the amount of ICT in society, which has had a great impact on the individual's daily life (Rodrigues, 1997:1). In addition to the above, Parker (1998:viii) mentioned that "...many jobs depend heavily on computer-based information, and your success in the workplace is more likely to depend on your ability to use it."

Ntshona (1998:3) argues that "...technology literacy, economic development and growth are inseparably linked and that South Africa (SA) is lagging behind in these areas." Hutchinson and Sawyer (2000:1.3) stress the importance of becoming computer literate in order to stay productive in the workplace and to meet forthcoming challenges. Coolidge (1998:2) mentions that "...if you don't have computer skills, it's like you don't know how to read." It is, therefore, important to become computer literate to meet future job requirements (Hutchinson and Sawyer, 2000:1.4).

In today's information age it is impossible to avoid using a computer, whether directly or indirectly. A person is a computer user by using the automatic teller machine, the price scanner in the super market, playing video games or retrieving information in the library - to name a few of the many computer devices. A person should, however, go beyond pushing buttons and become a trained user - someone who can join a business and use the computer as a problem-solving tool (Hutchinson and Sawyer, 1996:2,3). Capron (2000:4) argues that the personal computer has become the machine for everyone – in the workplace, the school and the home.

Computers are used to improve productivity, aid decision-making, help to alleviate the cost of labour, energy and paperwork. It can be inferred from literature that the presence or absence of computer literacy will harness a crucial influence on the current information-intense century (Wozniak, 1999:23).

2. PROBLEM STATEMENT

2.1 Primary problem

The problem to be investigated is the lack of ICT skills of the learners of the Faculty of Management Sciences (FMS) at the Vaal University of Technology (VUT). Although the majority of learners have access to computers, it is experienced that computer literacy training is completely absent in some learning programmes (LPs). Many learners graduate with adequate job related skills, but are unfamiliar with ICT skills. TI in SA, like other countries throughout the world, forecasts a shortage of ICT skilled workers. This suggests that appropriate computer literacy training may be necessary to enhance the potential of learners in acquiring adequate computer skills that are essential requirements from the workforce.

2.2 Sub-problems

This study will investigate the importance of computer literacy for learners

- as an important additional tool to the academic LPs;
- as an important requirement for future jobs in TI; and
- to determine formal and informal access to computer technology at the VUT.

3. OBJECTIVES

3.1 Main objective

To identify computer literacy needs of learners in the FMS at the VUT, in conjunction with specified needs from TI.

3.2 Specific objectives

- To discuss the introduction to the study, the reasons for the study, the formulation of the problem and the research methodology used in this study.
- To provide a historical background to motivate this study.
- To investigate computer literacy from the perspective of TI versus training.
- To present empirical findings and results of the investigation.
- To make conclusions and recommendations according to findings.

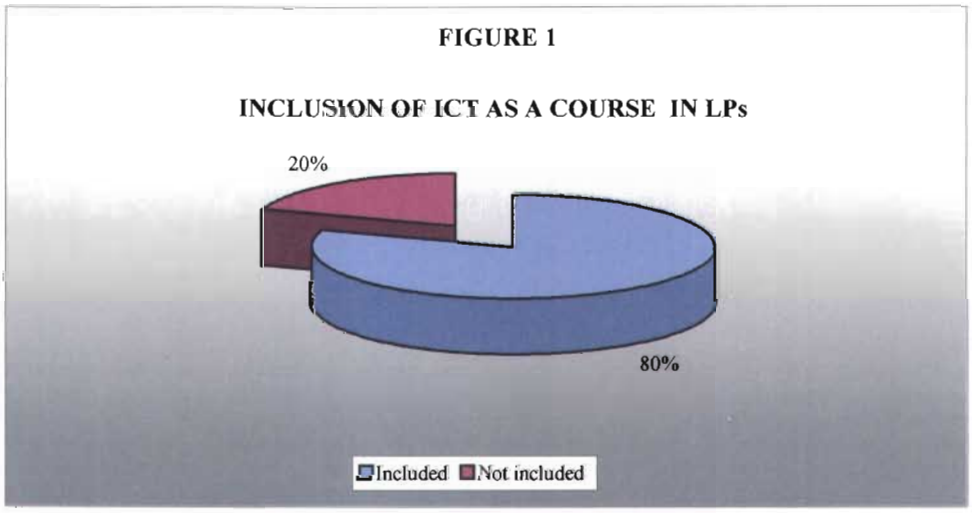
4. METHOD

4.1 Pilot study

Lecturers at the VUT noticed that there is an absence of ICT supported courses in some of the curricula in the FMS.

FIGURE 1

INCLUSION OF ICT AS A COURSE IN LPs



As presented in Figure 1 a random sample of 50 percent was drawn from the different LPs to find that 20 percent of these LPs have not included computers as additional learning aid.

4.2 Literature study

Literature focusing on the need for computer literacy training for learners will be studied. The following databases will be used: Innopac Goldfields Library

VUT, MCB-Online, EbscoHost Online; Dialog; Uncover, ISAP, SACD, UCTD, TECH and NEXUS.

4.3 Empirical study

Statisticians at the VUT assisted with the design of the empirical study and a statitician in private capacity assisted with the final presentation of the empirical findings. The quantative method of data collection and processing was used.

Research design

Two survey questionnaires were designed to determine the correlation between computer literate learners and the need for computer literacy in TI. A pilot study was conducted using a sample of 50 second year undergraduate learners (Section A) and 20 personnel (Section B) of the VUT to determine the internal consistency of the instruments.

This applied research project included the year 2002 full-time learners in the FMS, VUT. Four groups from different LPs will purposively be selected to complete a questionnaire. The learner population will also be screened in order to determine their informal access to computer technology.

Ten companies were purposively selected from TI in the Vaal Triangle region. A cover letter was attached to the questionnaires explaining the purpose of the study and informing the respondents that their responses will be treated as anonymous and confidential.

- Learners
  - Measuring instrument

    Quantitative survey

    Structured questionnaires were designed in order to identify the existing levels of computer literacy amongst the sample groups and to

determine the need for computer literacy training. Questionnaire (Section A) also established if ICT is readily available to the learners.

Section A: Structured research instrument to learners

This instrument will assess the effects of the variables such as gender, population group, field of study, academic level, access to computers, computer usage and time spent on a computer.

- Procedure

  Permission was obtained from lecturers involved with the particular groups selected, to interrupt scheduled lectures on a pre-determined date, in order to complete the questionnaire. Learners were briefly informed about the study and its relevance. No learners refused to participate. Completion of the questionnaires then took place during the first 15 - 20 minutes of the lecture and were returned thereafter.

- Target population

  Full-time learners in the FMS were used in this study. Four groups (two groups with ICT training and two groups with no ICT training as a component of their LP), were purposively assigned as follows:

  Group 1 = Management of Training:

  first year learners (n = 160), male (n = 64) and female (n = 96), (no computer support offered).

  second year learners (n = 120), male (n = 48) and female (n = 72), (no computer support offered).

  third year learners (n = 80), male (n = 32) and female (n = 48); (computer support offered).

  Group 2 = Small Business Management:

  first year learners (n = 60), male (n = 24) and female (n = 36), (no computer support offered).

  second year learners (n = 30), male (n = 12) and female (n = 18), (no computer support offered).

third year (n = 25), male (n = 10) and female (n = 15); (computer no support offered).

Group 3 = Cost and Management Accounting:

first year learners (n = 240), male (n = 96) and female (n = 144), (no computer support offered).

second year learners (n = 200), male (n = 80) and female (n = 120), (no computer support offered).

third year learners (n = 160), male (n = 64) and female (n = 96); (computer support offered).

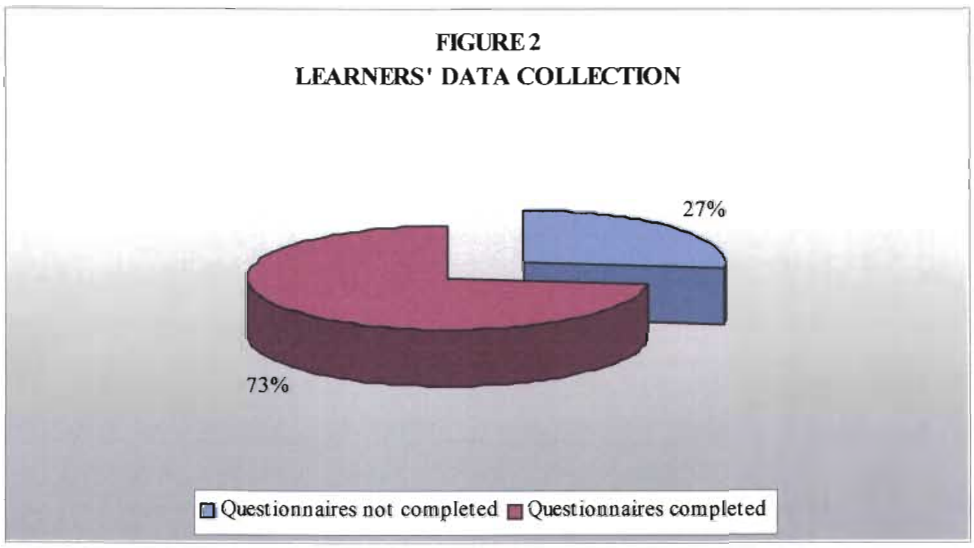
Group 4 = Labour Relations Management:

first year learners (n = 150), male (n = 60) and female (n = 90), (optional).

second year learners (n = 110), male (n = 44) and female (n = 66), (optional).

third year (n = 100), male (n = 40) and female (n = 60); (optional).

FIGURE 2
LEARNERS' DATA COLLECTION



The 27 percent outstanding questionnaires were due to absenteeism of learners on the day of data collection.

- Trade and industry
  - Measuring instrument

Various large companies from TI in the Vaal Triangle region, who provide employment to many University graduates, were used in this study. The respondents represented all ranks in each company's job category: managerial, technical, engineering and administrative.

Section B: Structured research instrument to TI

This instrument assessed the effects of variables such as gender, age, job category, computer usage, computer training and institution where computer training has been done.

- Procedure

  The advisory committee representatives from the companies involved with the different departments at the VUT, were approached to assist. Detailed instructions were provided to the Human Resource Department officer of each company for administering the surveys to employees. Two weeks after the delivery it was collected again from the different companies.

- Target population

  Total employees of ten companies $N = 200$.

  Company 1 $n = 20$

  Company 2 $n = 20$

  Company 3 $n = 20$

  Company 4 $n = 20$

  Company 5 $n = 20$

  Company 6 $n = 20$

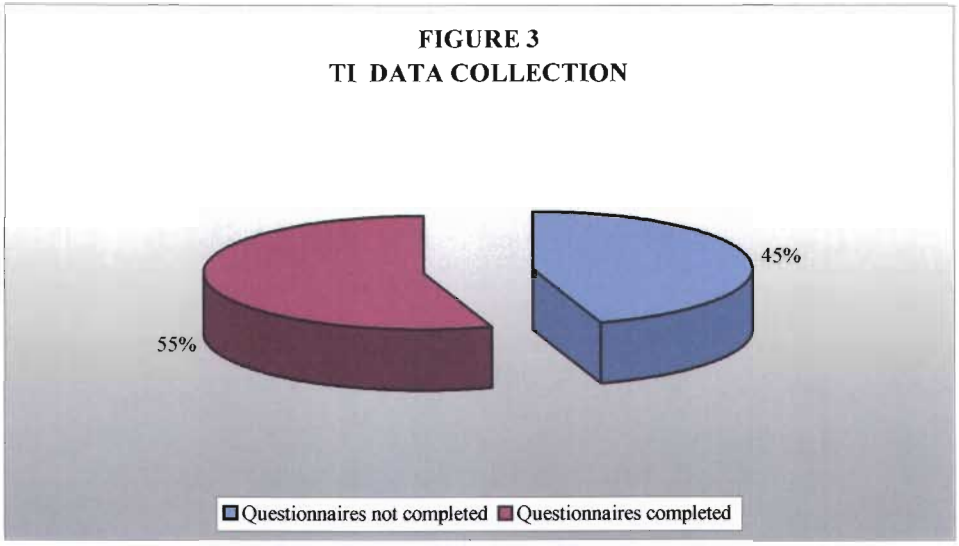
  Company 7 $n = 20$

  Company 8 $n = 20$

  Company 9 $n = 20$

  Company 10 $n = 20$

FIGURE 3
TI DATA COLLECTION



A total of 55 percent of the questionnaires were received back from TI.

5. STATISTICAL ANALYSIS

Data was computer analysed using Microsoft Excel to assess the reliability and validity of the data. Analysis of variance (ANOVA) procedures were used to determine where specific interaction effects existed among the variables studied. The results are illustrated using graphical (bar charts, scatter charts and/or pie charts) and tabular presentations.

6. DESCRIPTION OF TITLE/KEYWORDS

In this study both genders will be referred to as "the user" in an attempt to facilitate easier reading and any statements made with regard to needs or training literacy, or training, are applicable to both genders. The use of this method of reference is not intended to be discriminatory.

Computer literacy/competence

The definition of computer literacy has evolved since the 1980s when most professionals thought of it simply as "technical knowledge" and to users it only meant "computer awareness". According to Encarta World English

only meant "computer awareness". According to Encarta World English Dictionary (2001) Technical relates to "... or specialising in industrial techniques or subjects". This study will refer to "technology" which is defined by Encarta World English Dictionary (2001) as: "... the study, development, and application of devices, machines, and techniques for manufacturing and productive processes".

No clear distinction has been drawn between computer literacy and computer competence. In general computer literacy refers to having knowledge and understanding of the capabilities, limitations and implications of computers. Computer competency refers to having a skill that enables a user to manipulate the computer through computer applications (Hutchinson and Sawyer, 2000:1.3). Capron (2000:545) defines applications as "... programs designed to perform specific tasks and functions, such as word processing." In an attempt to be consistent, "computer literacy" and not computer competency will be used in this study.

Computer literacy

Capron (2000:547) describes computer literacy as "...the awareness and knowledge of, and the capacity to interact with computers".

Topping and McKenna (1999:1) refers to computer literacy as "...the knowledge and competencies in using computers generally: for example keyboard skills, familiarity with the Windows environment, and so on". McKay (2001:2) states "...computer literacy does not mean a user needs to know how to use every single piece of software he may encounter. It does not mean he needs to know how to write programs or network computers. He just needs to know some basics – how to save and open a file, how to use a word processing program, and how to send and receive e-mail – for starters."

The evolution of ICT, particularly the Internet, in dramatically transforming access to information, are changing the definition of computer literacy continuously as described in the following two definitions:
Dern (1997:2) defines basic computer literacy as "...how to turn on, start and stop the computer, install software packages, use basic hardware, (keyboard, mouse, and so forth) create a file, (type, save, edit and print) and to communicate with networks." Charp (1999:2) refers to computer literacy as "...knowing how to turn on computers or other devices, to start and stop application programs, communicate with networks, use the Internet and e-mail. It includes the ability to save, print, file and transfer files electronically. Computer literacy also involves knowing how to operate technology-based tools such as printers, video cassette recorders (VCRs), telephones, fax machines, copiers and other communications devices effectively."

Additional

According to Encarta World English Dictionary (2001) additional is "extra: added on to something else." Computer literacy should be added as an extra course in the LPs of the learners.

Empowerment

Empowerment means giving users the power to act and make decisions on their own (Hutchinson and Saywer, 2000:11.4). According to Encarta World English Dictionary (2001) empowerment is to give somebody power or authority or to give somebody a sense of confidence or self-esteem. To develop computer literacy through computer courses will empower the learners in a technology-enriched environment.

Mechanism

A definition of mechanism as provided in The Concise Oxford Dictionary (1995:846) is "... the mode of operation of a process". Encarta World English Dictionary (2001) defines mechanism as: "... a method or means of

doing or controlling." Computer literacy is a method or skill learners should have to operate a computer-based system.

Learning programmes

A LP is a purposeful and structured set of learning experiences and related assessment and attainment requirements within a particular field of learning which leads to the achievement of specified learning outcomes leading to a qualification (PU vir CHO, 2000b; SAQA, 1998).

7. CHAPTER CLASSIFICATION

- CHAPTER 1:
- Introduction
- Problem statement
- Objectives
- Method
- Statistical analysis
- Description of title/keywords
- Time schedule
- Summary

CHAPTER 2: HISTORICAL AND THEORETICAL BACKGROUND

- Introduction
- Data processing prior to computers
- The evolution of computers
- Information and communication technology evolution
- Summary

CHAPTER 3 – IMPORTANCE OF COMPUTER LITERACY TRAINING

- The shortage of computer literacy
- What is computer literacy?
- Important factors in implementing computer literacy in training programmes

- TI expectations of learners
- Summary

CHAPTER 4 – EMPIRICAL FINDINGS

Presentation and discussion of findings:

- Learners
- TI
- Access to technology
- Summary

CHAPTER 5 – SUMMARY CONCLUSIONS AND RECOMMENDATIONS

- Summary of the most important aspects of the study
- Conclusions that are evident from the study
- Recommendations according to findings
- Summary

8. TIME SCHEDULE

	2001
Identify research problem	January
Formulate research question clearly	February
Literature study	
Prepare research proposal	March
Hand in to study leader	July
Enrolment	
Proposal accepted by study leader	August
Presentation of accepted proposal to the Senate of the	
Vaal Triangle Technikon	October
Preparing the questionnaires	November
	2002
Application for funding	January
Questionnaires out	February
Data processing and analysis	March

Chapters 1, 2 and 3	August **2003**
Chapters 4 and 5	July
Final submission for examination	September
Final submission of edited and completed dissertation	November

9. SUMMARY

McKay (2001:1) indicates that computer literacy implies some skill or knowledge, which is necessary for every person to be able to cope with the computer-centred society. Evans (1999:2) believes that although the majority of learners have access to computers, a vast majority in SA is not receiving proper education in this vital area. Those who avoid the technological revolution may find themselves confronted by an information society that has little tolerance for individuals lacking basic technological literacy.

This study will aim to discern the importance of learners being computer literate. Attention will also be given to what computer literacy entails and the necessity of including a computer literacy course into LPs.

In chapter two the historical background, the circumstances of disadvantaged learners where computer access is concerned and employers' requirements for the entrance level into the job market will be discussed.

CHAPTER 2

HISTORICAL AND THEORETICAL BACKGROUND

1. INTRODUCTION

The first chapter presents a brief overview of the investigation of the research project. In this chapter a brief synopsis will be given at the early years of computers and then an investigation on more recent history.

Two decades ago most people had little to do with computers. Only specialists like programmers, data-entry clerks and computer operators used computers. Then microcomputers came along and changed everything. Computers became commonplace in homes, offices, stores, the education sector and industry. The computer has been the major force moving society from an industrial age into what has come to be known as the information age. People realised that, in order to function effectively in this information age, users should have sufficient computer knowledge. Hodge and Miller (1997:2) note that a flood of advances in ICT is affecting the way individuals live and support business. For government it makes administration in a complex modern mass society possible and users can interact globally. It is clear that no country will be left untouched by the information revolution and SA is no exception.

Meyer and Baber (1998:30) believe that a person wanting to become computer literate should obtain a brief review of computer history in order to identify some underlying concepts of ICT.

2. DATA PROCESSING PRIOR TO COMPUTERS

People have recorded data, processed data and transmitted the results for thousands of years. Cave paintings communicated information to young

hunters and the ancient Egyptians created a crude form of paper called papyrus to write on. This offered a better way to perform the calculations than the inventions made by scratching symbols into clay tablets like the Babylonians, or arranging pebbles in patterns like the Sumerians (Hutchinson and Saywer, 1998:1.17). An early manual calculating device, which is still in everyday use in China, was the abacus (Meyer and Baber, 1998:30).

3. THE EVOLUTION OF COMPUTERS

Hutchinson and Saywer (2000:1.18) argue that computers have been commercially available long enough and that computers can be divided into several "generations":

3.1 First generation (1944 – 1958

- Technology

  The major hardware characteristic of this generation computer is the use of vacuum tubes for internal computing operations. The principle disadvantage of vacuum tubes is the amount of heat they generate. Another disadvantage is the amount of space that circuits using vacuum tubes occupy. The first commercially produced computer was the Electronic Numerical Integrator and Computer (ENIAC) (Williams, 2000:270-283).

- Demand

  The main focus of demand for first-generation computers was to perform scientific applications, particularly military contract work (Meyer and Baber, 1998:35).

- Software

  The ENIAC could be converted to operate as a stored program computer by wiring it up to perform 99 different very elementary computations and having each of these initiated by one of the 99 possible programme lines (Williams, 2000:270-283).

- Storage

  Punch cards and punched paper tape were the principal media for the input, output and external storage of data and instructions (Capron, 2000:538).

3.2 Second generation (1959 – 1963)

- Technology

  Two major hardware features were the use of transistors that replaced the fragile vacuum tubes of the previous generation and the use of magnetic cores to replace the first generation's magnetic drums for internal storage (Hutchinson and Saywer, 2000:1.18).

- Demand

  The major demand for computers was from business, university and government organisations (Capron, 2000:539).

- Software

  The practice of writing application programmmes in machine language gave way to the use of the multiprogramming system (Meyer and Baber, 1998:38).

- Storage

  Disk storage that supplemented magnetic tape units came into more frequent use for peripheral operations, which enabled users faster access to data (Capron, 2000:539).

3.3 Third generation (1964 – 1970)

- Technology

  The major breakthrough in this generation was the integrated circuit, which combines transistors and related circuitry into one unit. Integrated circuits are etched onto small wafers of glass called silicon chips (Meyer and Baber, 1998:38).

- Demand

  The development of advanced telecommunication systems allowed for data communications between computerised monitoring systems onboard

spacecraft and land based data-processing centres (Meyer and Baber, 1998:40).

- Software

  Changes in software included the development of the first full-scale operating systems to manage all of computer's hardware and software resources and the introduction of system and application software (Meyer and Baber, 1998:40).

- Storage

  Programmers tended increasingly to store software and data on magnetic disks. Integrated circuit technology was more cost effective and increased the memory capacity dramatically (Hutchinson and Saywer, 2000:1.18).

3.4 Fourth generation (1971 – current)

- Technology

  The technological change that distinguishes the fourth generation computers from the third generation is the development of the microprocessor. A microprocessor contains the control and arithmetic/logic units of the central processor etched on a single silicon chip (Meyer and Baber, 1998:40).

- Demand

  The IBM PC containing a chip consisting of hundreds to millions of transistors, were developed. Users are now able to purchase computers at a reasonable price (Hutchinson and Saywer, 2000:1.19).

- Software

  New program products were introduced that combined software for several applications in a single package (Hutchinson and Saywer, 2000:1.19).

- Storage

  Many microprocessors also have storage elements etched into the chip where millions of binary digits of data can be stored (Hutchinson and Saywer, 2000:1.19).

3.5 Fifth generation (now and in the future)

Some experts say a fifth generation is on the way. Definitions of what constitutes fifth-generation computers do not always correlate. Some people think that new microcomputers with faster operating speeds, greater processing capacity and virtually unlimited memory should be included. Other people believe that fifth-generation computers will have circuitry based on gallium arsenide. Gallium arsenide offers a fivefold speed increase and uses only one tenth of the power that silicon uses. Scientists have also tried to develop new superconductors that can conduct electricity with no resistance, thus generating no heat but great speed. Future computers may use light (opto-electronics chips) to process information 3 000 times faster than today's electronic computers (Hutchinson and Saywer, 2000:2.25, 2.26). In a related concept Kurzweil (2002:1) predicts that by the year 2030 PCs will have grown so vastly in speed and capability that they will achieve the full capacity of the human brain.

4. INFORMATION AND COMMUNICATION TECHNOLOGY EVOLUTION

Kiplang'at (1999:3) simply defines ICT as "... technologies dedicated to information storage, processing and communications." The computer has become helpful in managing knowledge at a time when the amount of information is expanding exponentially.

In a sense the computer revolution and the information revolution seem to go hand in hand. Jimba (1998:2) describes the information revolution "... as the result of convergence between information and communications technologies."

4.1 The information evolution

The first evolution in this area was the invention of writing 5 000 to 6 000 years ago in Mesopotamia. Several thousand years later, in 1 300 BC, the

written book was invented in China (Drucker, 1998:6). The consecutive revolution laid the foundation for the printing press and movable typing. The most recent information revolution developed the radio, computer and television (Quarantelli, 1997:1).

Lazowska (1997:2) notes that today, everybody is part of an exploding information society. It is acknowledged that more than ever before in the history of human development, everyone requires constant and continuing access to information and will do so throughout their working and leisure lives. A user's knowledge of computers will assist him/her to cope with and understand today's technology so that he/she can take his/her place in the information society. Norton (1999:3) believes that the "... information age is affecting companies of all sizes and we need to continually develop our skill to become more competitive in a world that is experiencing rapid change." Fulton (1998:3) argues that the constant evolution of the Internet adds to large amounts of information that leads to the need for developing ICT literacy skills.

4.2 Evolution of computer users

From the seventies and into the early eighties, a vast improvement in software development took place, which changed the focus of the computer user from programming to application utilisation (Thomson and Solms, 1998:1,2). Whenever a new technology is introduced, displacement of some workers and readjustment in the conditions of employment are bound to occur (Carter, 1996:156). People often consider the possibility that computers could replace humans as the most intelligent beings on earth. However, Mokadi (2002:9) argues that, "...the computer should only be viewed as a tool that may leverage human intelligence but can never replace it."

One of the most dramatic changes in the last three decades has been the rapid development of ICT, which has gradually found its way into business and industry through computers and computer-related technologies. Many jobs in

the twenty-first century will involve computers in some way and members of the workforce who are not able to use them will be at a disadvantage. It is, therefore, critical for individuals to have the necessary education and skill to compete in the information revolution. Walker (1999:2) believes that learning how to use a word processing program, is an excellent step toward computer literacy.

4.3 Evolution of computer uses

The use of information technology has changed dramatically over the years. Twenty years ago, when PCs were in their infancy, users viewed them as fragile scientific instruments and treated them with respect, if not awe. Norton (1999:2) indicates that the first word processor was regarded as not much more than an electric typewriter with a printer that produced top-quality printed material. Later, word processing software was developed for use on a computer. In addition to this, Gregson (1994:1) describes one advantage of the PC as that different software can be installed to perform other tasks besides word processing. A second advantage is that the more sophisticated software becomes, the more frequently it can be updated.

Watcher and Gupta (1997:13) observe that the workforce has changed substantially from an industrial to a technology base. While conditions are changing Quarantelli (1997:4,5) notes that these technological developments offer the ability to capture, to analyse and to use information in unique and powerful ways to aid decision-making. This paved the way for convenient word processing and brought about the beginning of a great evolution in the use of computers. Bekker (2001:24) also indicates that a whole new industry, the computer field, was developing and adding new possibilities for the uses of computers and allied devices like communications. Similarly, Auerbach (1997:33) argues that recent innovations in ICT provide the user with a new set of tools to use that will increase productivity and efficiency in all business areas. All businesses today are facing the challenge of how to use new technologies effectively in order to stay competitive.

4.4 Evolution of data communications

A remarkable technological advancement was the invention of the wheel around 3 500 BC. This powerful new tool made it possible to transport information which was otherwise transported by people on foot or horseback, by smoke signals or drum sounds, or by carrier pigeon (Hutchinson and Saywer, 1992:339). After generations the industrial revolution was launched by the steam engine that was adapted for use in transportation. The often significant inventions that lead to the technology revolution, were the combustion engine, the automobile, the electric light bulb, the aeroplane and the telephone (Simon, 2001:2). Jimba (1998:1) emphasises that, when new technology turns society in a new direction, it is not the result of a single invention but of a host of additional, completely different inventions.

With the use of movable type during the second half of the 15th century, printing became a means of mass communication. The information technology people of the printing revolution provided mankind with recorded and written information in low-cost, mass-produced books (Drucker, 1998:6). Anon. (2002:4) believes that today's information age began with the telegraph, which was the first instrument to transform information into electrical form and transmit it reliably over long distances. In 1950, most people thought that radio, telephone and books were enough, but technological and scientific advances accelerate the coming of the information revolution. Soon it was found that, to search for information across many publications, books and documents, the vast store of knowledge amassed by humanity would become all but inaccessible to anybody except narrowly defined specialists in a particular field. During this time the idea of computers and telecommunications was born. Hutchinson and Saywer (1992:339) indicate that the microchip was invented during the 1960s and it quickly became a low-cost mass-produced commodity, able to process large amounts of information at high speeds. Microchips inside computers then governed information in usable form, but were not available in offices or other business organisations over long distances.

Wiant (2000:2) believes that the information revolution of the late twentieth century was spearheaded by technological breakthroughs stemming from the development of computer networks. It was in that era that ICT, which was once scarce and expensive, became plentiful, cheap and available in abundance to nearly everybody. Shelly *et al.* (2001:1.3) explain that modern high-speed digital transmission systems opened the way of efficiency in distributing data over long distances through the use of computers and telecommunications channels and equipment. Jimba (1998:2) argues that cyberspace is a worldwide collection of networks, and business is now done through the channels of the Internet and the World Wide Web (WWW).

4.5 Computer evolution and the library

Gorniak-Kocikowska (2001:1) argues that the printing press revolution contributed to the creation of the library in its present form and played a meaningful role in education, scholarships and in public life. Learners and academia that mostly relied on the power of their own minds could then gain information from printed books. However, this all changed in that libraries are now changing again to adapt to the information technology revolution. In all likelihood, Gorniak-Kocikowska continues to believe that "...the computer revolution will have an even more profound impact on the library than did the printing press revolution."

Lancaster (1999:4) suggests that people need to be taught the skills of how to navigate the new electronic information resources in order to complement the knowledge they have previously obtained from just the printed word. ICT has made and continues to make more information available, but it becomes more challenging for users to know how to access, use, evaluate and to produce information (Anon. 2002:58). Dugdale (2000:2) indicates the world's information and library collections are becoming digitised and far more accessible through the new technology. If not computer literate, Poustie (1999:10) warns, many people will effectively have no access to much of the most current information in electronic libraries.

4.6 The education evolution

4.6.1 First world education evolution

Education is the process of developing knowledge through instruction. Traditionally, this instruction came from people such as parents, teachers and from printed material such as books. Learners sitting passively and taking notes while an educator performs at the front of the room are not the best way to transmit knowledge clearly and concisely.

Only recently in Europe, has ICT begun to have an impact on traditional approaches to education. Many educators are questioning the wisdom and effectiveness of traditional techniques in the light of recent developments in technology-aided education. Computer-based training (CBT) and Web-based training (WBT) help learners to become actively involved in the learning process instead of being passive recipients of information from a traditional lecture (Petrovic *et al.*, 1998:1). With the arrival of technology in academia, educators are turning to computers to assist with the learning process (Gorniak-Kocikowska, 2001:6). In support of this, Fletcher (2001:1) argues that the PC and its associated technological innovations have become commonplace for learning at all levels, from pre-school to postgraduate continuing education.

4.6.2 Education evolution in South Africa

The overall low level of computer literacy skills of users in SA (Hodge and Miller, 1997:13) cannot be discussed without taking the complete SA historical and political situation, with its apartheid, separate development and multinational racial policies of education, into account.

The policies of apartheid in SA higher education (HE) sabotaged education for black people in ensuring that education in the black communities (this includes Africans, Coloureds and Indians) was inferior and limited (Gumbi, 1998:184). As indicated by Coetzee (1989:322), the black learner "...must

not be subjected to a school system which draws him away from his own community, and misleads him by showing him green pastures of European society in which he is not allowed to graze." Learners attending black schools were, and still are, under prepared for HE. It was only after 1991 that government's first attempts through legislation and new policies controlled education to non-racial education. For the first time many learners had equal opportunity for access to education facilities that had previously been reserved for white learners only (Du Toit, 1995:212).

In 1994, when the Government of National Unity came into power through SAs first democratic elections, it was committed to broadly redress the educational inequalities of the past. Early steps were also taken to:

- unify the education of all SAs in a single national Department of Education; and
- a strategic management team that was to plan the transition from the old, ethnically based departments to a new national education system.

In the period under review the fundamental policy statement was the White Paper on Education of February 1995. In terms of broad policy, the Government emphasised the importance of ICT to facilitate the upgrading of education by implementing the Reconstruction and Development Programme (RDP). Many of the policy initiatives that have their roots in the RDP are:

- The importance of ICT to facilitate upgrading of education and other programmes;
- recreation and other services by improving the quality of information available; and
- providing communities throughout the country with access to expertise and usable data (Hartshorne, 1995:1,2).

The use of ICT provides a major challenge in linking basic needs with information highways in innovative ways that improve the capacity of industry to successfully reintegrate into world markets. A key activity is the

development of appropriate educational materials that turned towards curriculum development. The National Qualification Framework (NQF) was not only developed to revise the curriculum but also to establish outcomes based education based on a system of credits for learning outcomes achieved. This would widen access to HE, since presumably, many black students fail to secure matriculation exemption, not because they are incapable but because of inequity created by the apartheid system. In order to increase the enrolment and academic development of disadvantaged learners, a SA Qualifications Authority (SAQA) has been established, charged with creating eight qualification levels, applicable to both school and adult learners (Hartshorne, 1995:2). Working in conjunction with SAQA, the Sector Education and Training Authorities (SETAs) were established to address the needs of Industry specific learners. This has resulted in legislation that envisages all employers to pay 1 percent of payroll to SETA by 2001 (Bird, 1999:54,55). The under preparedness of learners from historically disadvantaged communities constitutes an important element of the educational inequalities of the past. Some higher education institutions (HEIs) have made considerable efforts to provide disadvantaged black learners with possible routes to overcome academic difficulties in the course of their studies (Mandew, 2000:1-3). Herman (1995:8) mentions that a variety of academic support programmes or "bridging" schemes have been located as possible outcomes to overcome or alleviate some of the difficulties experienced by learners at HEIs.

There are certain factors influencing disadvantaged citizens that contribute to the extremely low level of the ICT society in SA. These factors that have hindered the development of computer literacy at educational institutions have been the core of the education system of the apartheid era. A description of some of these factors will help to understand the current situation in SAs education. It will also highlight the situation of the learners' computer literacy skills in an educational environment.

- Inferior education

  Since the introduction of Bantu Education in SA in 1953, there has been massive inequality in the schooling of black learners in relation to the ruling white minority learners (Herman, 1995:6). Eshraghi (2001:2) emphasises that the damaging legacies of the apartheid era stem from the obvious inequalities like crowded classes, scarcity of teachers, inadequately qualified teachers and the non-existence of textbooks and other materials. Herman (1995:8,9) notes that, although inequalities in education are being addressed in the post-apartheid era, there is a need for appropriate re-curriculation to meet the changing needs of the learner population. The changes should particularly be for those learners from disadvantaged backgrounds who may experience difficulties coping with the demands of the HE system. Some HEIs have embarked on a number of programmes to address the needs of disadvantaged learners. One example is that disadvantaged entrants could register for a course for which the curriculum extends over a minimum of four years rather than the normal minimum of three years.

  The FMS at the VUT introduced an Academic Support Programme (ASP) for the instructional programme Office Management to accommodate low achievers and second language English speaking learners. The prerequisite to one of their major instructional offerings, Information Administration, is computer literacy skills which includes a typing speed of 25 words per minute. During 2002 these learners followed a first-semester computer literacy course to equate them to the standard of the mainstream learners. Assessment was done at the end of the semester and the results were as follows:

FIGURE 4

COMPUTER LITERACY TRAINING

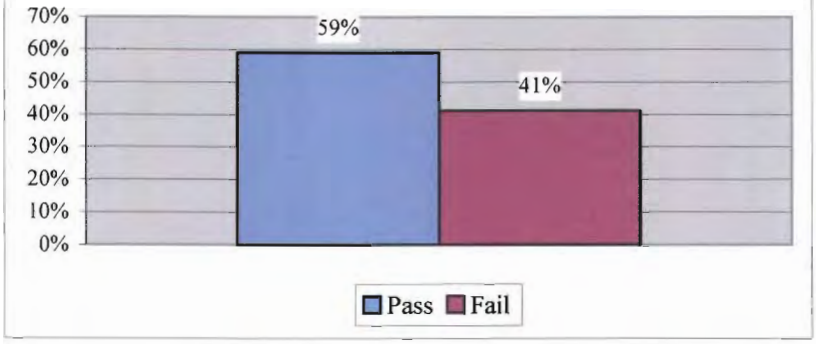


Figure 4 indicates that 59 percent of the learners were successful and 41 percent were not successful in the computer literacy training. The learners who mastered the required skills are now attending the mainstream class and will be assessed at the end of the year with the other learners who were adequately qualified at the beginning of the year. The results might be a significant indication to the effectiveness of the ASP.

Because of the inferior quality of the black education system there is very limited use of ICT in the pedagogic process. De Villiers (1999:59) argues that "... the disadvantaged learner would include a lack of cognitive development to meet the specific demands of a science and technology orientated tertiary education system. The cognitive development of disadvantaged students is a unitary entity involving all of language, culture, background knowledge, learning strategies and academic performance."

With some limited success, attempts are under way to get computing facilities into less privileged schools through corporate sponsorships (Carroll, 1998a:1). With this interest in exploring the problems, Herman (1995:9) believes that these attempts to increase the enrolment and academic development of disadvantaged learners are indeed laudable, as Government has initiated many projects that are hugely beneficial to uplift the disadvantaged learners. It is clear that the vast majority of black

learners underachieve in their matriculation examinations in comparison to the privileged white minority.

- Language barrier

  Eleven official languages are used in SA, of which English is one. English, as a means of communication, is the dominant language of providing information, irrespective of race or culture. In SA, a multi-racial country with eleven recognised languages, has some obvious linguistic drawbacks. Most books and journals in the country are written in English and this is, therefore, the language on which information services are based. The majority of learners in SA typically come from a variety of academic backgrounds and nearly all of these are first generation learners. This does not necessarily indicate that their level of mastery of the English language is sufficient to meet their academic discourse needs at a HEI (Bleach, 1998:1,2). To a reader whose mother tongue is not English, the language barrier is in fact a major obstacle in the flow of information (McLean, 2000:1,3). Nutter (2001:1) indicates that disadvantaged learners are often prone to failure due to a lack of proficiency in the English language as a result of their diverse backgrounds. Miller *et al.* (1998:1,2) indicate that this was compounded by the apartheid education system that did not take cultural communication differences into account. Many of these learners historically received less than adequate education at secondary level to cope with the linguistic demands for HE. Since language and culture are intimately linked, cultural knowledge is largely taught and acquired through the medium of language and it is through language that learners see and understand the world.

- Financial barriers

  Fourie and Henning (1996:151) argue that black learners have been socio-economically suppressed by apartheid and that most of them did not have access to computers like their white counterparts. Today, ICT is arriving in some of SAs poorest communities at the same time as telephone lines and electricity. In some of these communities, the learners have no electricity and have to study in overcrowded areas, making the learning

process very difficult (Carroll, 1998b:1,2). Hodge and Miller (1997:12) indicate that schools that do have computer facilities are those situated in the historically white urban-areas. These schools were far better funded by the state and normally parents had a higher average income level than those of the historically black schools.

- Admission policy barrier

  Hartshorne (1995:2,6) argues that prior to the 1990s, HE admissions in SA were in favour of the white minority. The under-resourcing of schools for black learners is generally accepted as a factor which denies disadvantaged students access to HE that could handicap their development.

  Since the first democratic government elections in 1994 and the introduction of equality of educational opportunities, the increasing need for skilled manpower and the overall desire for HE have led to an increase in the number of disadvantaged learners at HEIs (Herman, 1995:12). In spite of this, Hodge and Miller (1997:13) believe that, for SA as a whole, the number of black matriculation exemption passes was very low. This could have been caused by historical imbalances and the inequity created by the apartheid system. At the end of their twelve-year formal education period, SA secondary level learners write their matriculation examinations. Success in these examinations ensures entry into HE.

- Lack of computer literacy training

  The ability to use computers is a prerequisite to succeed in today's technological environment. Incorporating computer literacy across curricula requires the collaborative effort of the government and HE in SA. The information age has created increasing needs for learners to develop computer literacy skills to prepare them for successful participation in the economy and social life of the country (Rodrigues, 2002:1).

4.7 Evolution in the workplace

Luke (2000:10,11) notes that, before computers were invented, information was stored on paper and a large amount of time and effort was spent capturing,

storing and retrieving that information. After Remington introduced the typewriter in 1874, a neater, more readable and less time consuming document was produced (Meyer and Baber, 1998:141). Prior to 1980, it was not critical for the average person to know how to use a computer in his job. Furthermore, the use of computers generally required a lot of technical knowledge. Computers were large and expensive and few people in the workplace had access to it. Most computers used in organisations, were equipped to do little but carry out high-volume paperwork processing such as issuing bills and keeping track of customer and product balances (Anon., 2002:4). Hutchinson and Saywer (1996:1.20) agree that the rapid developments in new technology have led to a large increase in the amount of paperwork produced. The first of this technology was the appearance of the PC in the general office in the Mid-1970s. This was operated by people with little or no computer background and experience (Meyer and Baber, 1998:40-42).

Most office workers today require their own PCs to prepare budgets and reports, exchange electronic mail (e-mail), organise their work and collect information from the Internet. Not only administrative staff could benefit from tuition in office applications, but managerial and technical staff as well.

Although no scientific survey of computer literacy in SA has been performed to date, Hodge and Miller (1997:11) estimate the total computer literate population at 3.2 million people (or 7.7 percent) of the population, where whites make up 25.1 percent, blacks 5.6 percent, coloureds 7.1 percent and Asians 15.1 percent. This excludes the illiterate and the non English-speaking people in our society.

As a result of the apartheid era, various other reasons were identified for the ICT skills shortage in the workplace in SA. It has become increasingly crucial to gain a better understanding of factors influencing these shortages as noted below:

- The impact of the ICT revolution is so vast, that education and training institutions cannot provide users with the required computer skills (Harvard, 1999:2).
- In the past training was neglected by companies – a false saving on money and time, which led to a poorly skilled workforce (Harvard, 1999:2).
- Le Roux (2000) as quoted by Anon. (2000:28), goes on to say that "... the shortage of intellectual capital in the IT market worldwide is contributing to the SA brain drain, as international companies increasingly poach SAs skilled labour with the lure of massive salaries, perks and incentives."
- "SA has become a 'soft target' for international employers, given the poor performance of the Rand, the rising crime statistics and the consequent mobility of the highly skilled and educated individual." (Thomson 1999, as quoted by Anon. 1999:34).
- Leather says, quoted in Anon. (2000:31). "... the SA government actively inhibits the entry of skills."
- Anon. (1998:33), quoting Smith (1998) suggests that "... less emphasis should be placed on net asset value and more on intellect, skill and knowledge for employees".
- "Currently only a small percentage of SAs adult population is skilled in IT and I believe it is up to us to educate previously disadvantaged people in the use of technology." (Malatse 2000, as quoted by Anon. 2000:21).
- Anon. (2000:24), quoting Dalton (2000) comments that "... a lack of any coherent, industry-wide career development initiative by employers has caused this crisis in SA and world-wide."
- "It's costly and people do not understand why they are being trained. They get bogged down learning features they'll never use and the average person becomes frightened by the technology and tends to resist the attempt to use it." (Auerbach 1998, as quoted by Anon. 1998:24).

5. SUMMARY

Computers are often cited as the major technology change of the last few decades. Fifty years ago, computers were part of an obscure technology that interested only a handful of scientists. Today, they are part of almost everyone's daily life. Possibly the most dramatic recent change has been the exponential increase of information available through cyberspace. Remenyi (2001:36) states that "... when the history of technology in the 20th century is written there is no doubt that together with splitting the atom, putting a man on the moon, swapping a human heart and cloning a sheep, the computer and telecommunications developments which have lead to the internet and the web will feature as important." We are still at the beginning of the information age. There is no doubt that ICT will one day reach the lives of even the most disadvantaged and remote communities and begin to match the power of the printed word.

An investigation of the importance of computer literacy in HE and in the workforce will be undertaken in the next chapter.

CHAPTER 3

THE IMPORTANCE OF COMPUTER LITERACY TRAINING

1. THE SHORTAGE OF COMPUTER LITERACY SKILLS

A rapid expansion of computer use in society makes it crucial for the average person to know how to use a computer. This chapter is devoted to the consideration of the major issues and implications, raised by the utilisation of computers in the workforce and in HE. It is important that instructional programmes in computer education do not neglect these issues.

While computers are increasingly taking centre stage in modern business, Lessing and Maritz (2001:11) claim that International Data Corporation in SA forecasts a shortfall of skilled (ICT) workers to grow to 53 000 by 2003. The need for training programmes is critical, as the effect of ICT is altering the workforce and creating an endless demand for computer skills. In addition to the above, Anon. (1998:30), quoting Wilsenach (1998) predicts that "... PC training would advance staff's core functions and help them provide a better service to the community." Having a pro-active approach to technology, Anon. (1999:22) quoting Nortan (1999), believes that "... not only administration staff could benefit from tuition in office applications, but managerial and technical staff as well."

In order to address this very important, but to date neglected area, Lessing and Maritz (2001:10,11) claim that, compared to First World countries, SA is lagging behind in ICT skills. It is crucial that both government and the ICT sector seriously address the ICT skills shortage in SA. Malveaux (2000:1,2) asserts that many learners who graduate with adequate job related skills are ill equipped where computer technology skills are concerned. The ability to use a computer is a prerequisite to success in today's job market. To meet this

need, Scheffler and Logan (1999:3,11,12) emphasise the importance of computer literacy as an integral part of the HE learning process and the integration of ICT into the classroom. Anon. (1999:12), quoting Annecke (1999), says "... it is really important for us to ensure that the youth of today is equipped with the necessary skills preparing them for the transition from being a learner to an employee. Without basic computing skills this transition is really difficult." Faced with a shortage of computer skills in an environment riddled with high unemployment, White (1999:24) suggests that companies and education institutions invest more heavily in education and training.

Assumptions regarding the poor computer skills of learners of the FMS may be erroneous. The majority of today's learners have access to computers. Sadly though, computer literacy training has still not been incorporated into certain LPs. This suggests that appropriate computer literacy training will be necessary to enhance the potential of learners in acquiring adequate, market related computer skills.

2. WHAT IS COMPUTER LITERACY?

In 1976 John Nevison coined the term 'computer literacy' and called people who had the ability to create computer programmes 'computer literate'. The definition of computer literacy has changed dramatically since the 1970s when knowledge and understanding of computer hardware, software and programming formed the basis of computer users' required skills. Since then, there has been vast improvement in software development that changed the focus to 'application utilisation' (Shelly *et al.*, 2001:1.0,1.9). In agreement with the above statement, Parker (1998:INT.4) states that, in the early 1980s when computers became widespread in society, it became easier to use and change the focus of the computer user from programming to application utilisation. Becoming a computer **user** does not require being a computer **expert**. Computer users considered computer literate must have an understanding of its societal impact in their professional careers. To all users,

even computer-phobics, knowledge of basic software applications is essential. There are many definitions of computer literacy.

Hutchinson and Sawyer (2000:1.3, 1.4) refer to the need to distinguish between **computer literacy** and **computer competency**. They define computer literacy as possessing sufficient knowledge and understanding of how computers work and what a computer is capable of. **Computer competency** leads to skills that provide the user with the ability to operate the computer effectively. Computers are becoming a common tool in all areas of life, and the question of what constitutes computer literacy or computer education is more crucial than ever. Anon. (1999:12), quoting Annecke (1999), states that **computer literacy** is "... to have a knowledge of the latest technology in order to begin working straight away." McKay (2001:2) agrees that **computer literacy** means "... learning fundamental computer concepts and application programmes." Capron (2000:5) offers a three-pronged definition of computer literacy:

- Knowledge

  Learning about computers and gaining knowledge about how it works.
- Awareness

  The more knowledge one possesses about a computer, the more the awareness of its importance.
- Interaction

  To understand a computer results in interacting with one.

By learning specific terminology, concepts and skills, a user becomes computer literate. Having computer literacy therefore, implies having the knowledge and understanding of computers and their uses to function effectively and efficiently in a computerised society.

To help a user to become computer literate, Hutchinson and Saywer (2000:1.3, 1.4) believe that a user needs the following capabilities:

- Terms - Learn the terminology to describe basic computer concepts.

- Functions - Learn the functions of computer systems.
- Uses - The ability to perform useful tasks on a computer system.

A definition offered by Meyer and Baber (1998:14) indicates that being computer literate means that the user has to recognise not only the positive, but also the negative consequences of computers in society:

- Computers have increased access to sensitive information immensely, creating new possibilities for crime and threatening personal privacy.
- The surge in computer use during the past several years has caused a variety of environmental concerns. Computers consume electricity, which has indirectly resulted in the discharge of tons of pollutants into the atmosphere.
- Discarded computers are taking up too much space on the country's rubbish dumps.
- An increasing variety of health-related concerns have surfaced that affect people who work with computers and related technologies.
- Technological failures – loss of important information in a critical situation may endanger lives. Hospitals routinely employ computer monitoring of critically ill patients when nurses are otherwise engaged. If some vital sign falls outside the normal range, the machine beeps a warning. If there is a technological failure, the machine cannot alert the nurse on duty.
- When computers were introduced, many employees were made redundant and were forced to find new jobs.

Capron (2000:10) accurately describes the computer as a fast, reliable, convenient and cheap method of communication and information gathering device. Besides becoming computer literate, Hutchinson and Saywer (2000:1.3) are of the opinion that a user should also learn to be **information literate**. The process of information literacy includes how to obtain, manipulate and assess the relevance of information from the multitude of

resources at one's disposal (Long and Long, 2000:4). According to Scheffler and Login (1999:2), the awareness of how to access information, evaluate the information and how to use the information to make decisions, is required by learners in contemporary classrooms. Since much of this information is available only through the library, Poustie (1999:2,6,10) notes that users need to know how to use the Internet effectively to utilise global information. Laauwen (2001:20) reminds readers to use the radio, telephone, television and faxes to access a wider range of information. He defines information literacy in telecommunications as follows:

- when users know when to use online resources;
- know how to access information competently;
- know how to evaluate information as to accuracy and pertinence for each need; and
- know how to use this information to communicate effectively.

Users who are able to do the above will have lifelong skills, which they will need in the information age.

In order to survive in an information age, Long and Long (2000:4,5) recommend that users will need to become skilled in:

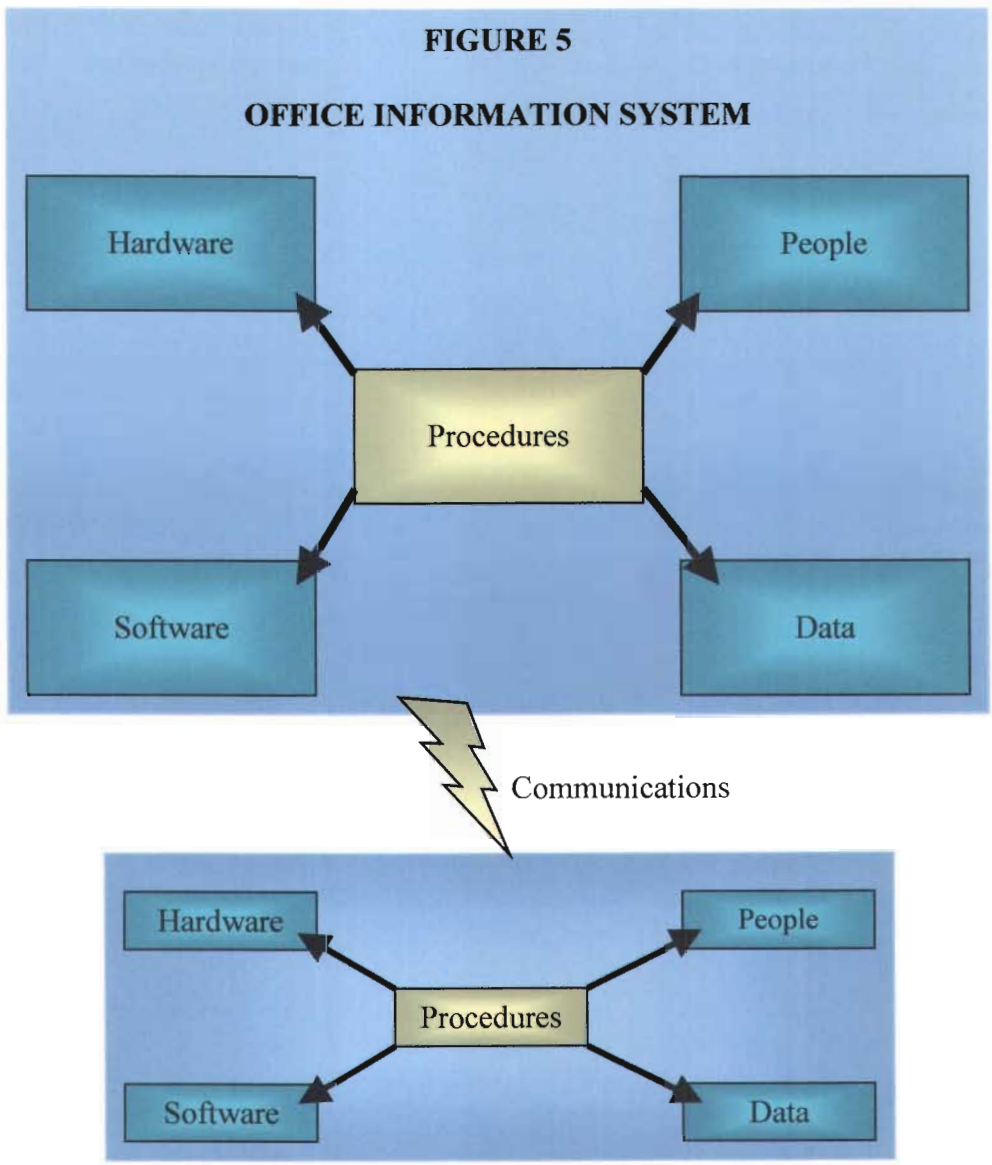
- using and operating a computer system;
- communicating the information via the many telecommunication systems;
- making the computer work for the user;
- interacting with the computer – that is, generating input to the computer and interpreting output from it.
- analysing information about its value, reliability and validity;
- searching cyberspace and gathering information competently from a variety of sources to expand their knowledge;
- understanding the impact of computers on society, now and in the future;
- being an effective user of computer hardware;
- being an effective user of application software and other non-hardware-related computer products and services; and

- being familiar in the language of computers and information technology.

Rodrigues (1997:4) notes that when the term computer is used, it refers to a computer-based information system. Agreeing with this interpretation, Hutchinson and Sawyer (2000:1.5) explain that there are six basic elements interacting in a computer-based information system: hardware, software, data, people, procedures and communications, as indicated in Figure 5.

FIGURE 5

OFFICE INFORMATION SYSTEM

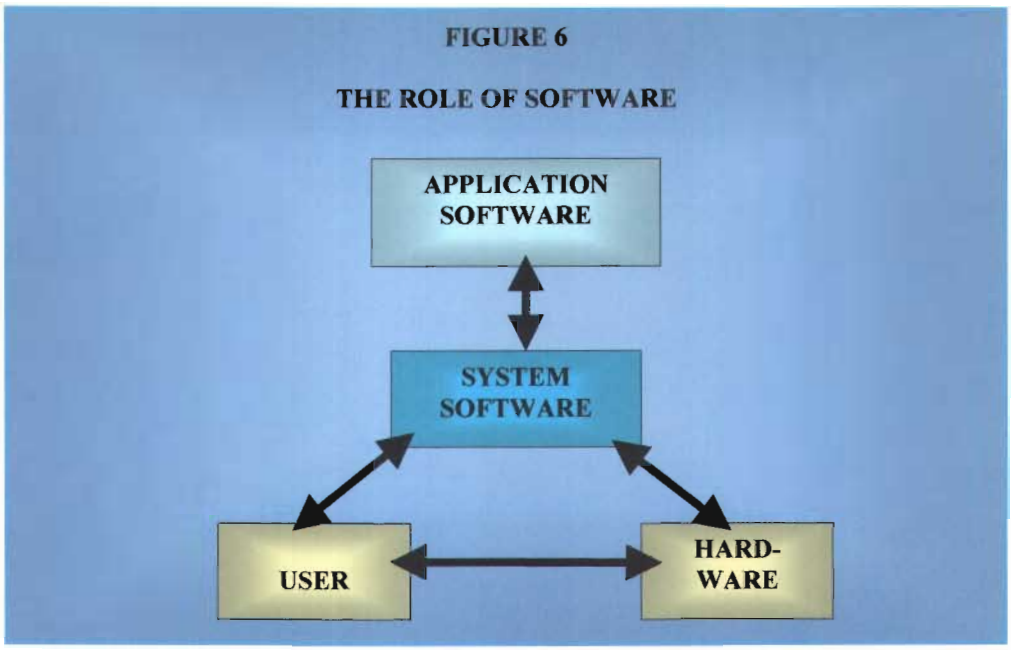


- PC hardware

  Shelly *et al.* (2001:1.5) describe hardware as "... the electric, electronic and mechanical equipment that makes up a computer." They continue to define a PC as an electrical machine system that is capable of accepting data in symbolic form (input), manipulate the data according to specified rules (processes), produce it into some useful form (output) and store the results for future use (storage). Basic computer hardware components include a keyboard, mouse, microphone, PC camera (webcam), scanner, digital camera, system unit, disk drives, printer, monitor, speakers and modem. Daood (1998:1) defines a PC as "... a fast, convenient and a cheap method of communication and information gathering." Hutchinson and Sawyer (2000:1.8, 1.9) describe hardware as the physical equipment such as electronic, magnetic and mechanical devices that allow users to feed data into the computer in a form that the computer can use. In conclusion, Brady (1996:1-4) explains that a user should have a basic knowledge of PC components so that when a service provider offers a new PC component, the user would have some level of understanding to buy the best component and not be intimidated by the provider.

- PC software

  Hutchinson and Sawyer (2000:1.5,5.3) state that software, also called programmes, "...is electronic instructions that tell the hardware how to perform a task." Computers use two basic varieties of software: system software and application software. The system software is an intermediary between the hardware and the application programme, as outlined in Figure 6.



System software or application software is used by users to control the hardware for different kinds of tasks (Shelly *et al.*, 2001:3.3).

- Data/information

  Data is the collection of raw, unorganised facts, figures and symbols captured on and processed by a computer into a meaningful form, called information. In addition to text, data also includes sounds, images and video (Shelly *et al.*, 2001:13.2).

- People/users

  To understand who the computer user is, Hutchinson and Sawyer (2000:1.3) define 'user' or 'end user' as "... someone without much technical knowledge of computers but who uses or wants to use computers to perform work-related or personal tasks, enhance learning and productivity, or have fun." The user makes use of application software to meet any needs for information. Table 1 illustrates the five categories of users and the variety of uses for computers.

TABLE 1: CATEGORIES OF COMPUTER USERS AND COMPUTER USES

User	Description	Uses
Home user	Each family member uses the computer for different purposes.	The home user spends time on a PC for a variety of reasons such as research, education, budgeting and entertainment.
Small office/ Home office user	A small office/home office (SOHO) includes any company with fewer than 50 employees, as well as self-employed people that work out of their home.	SOHO users typically have a desktop PC to perform some or all of their duties.
Mobile user	Mobile users travel to and from a main office to conduct business.	Mobile users have a notebook computer equipped with a modem, which enables them to transfer information between their computer and another computer such as one at the main office.
Large business user	A large business can have hundreds or thousands of employees in offices across a region, the country, or the world.	Users and computers are connected via a network, which enables communications among employees at all locations.
Power user	A power user requires the capabilities of a workstation or other powerful computers.	Power users work with multimedia in which they combine test, graphics, sound, video and other media elements into one application.
Learners	Equipped laboratories and classrooms with PCs.	Students use software packages to complete assignments.

This table outlines the various types of computer users and how computers help them to perform a variety of tasks (Shelly *et al.*, 2002:1.28-1.36).

Computer user as a Web Publisher

Individuals in each of the six categories discussed in Table 1, may need to access the Internet for information. However, users may also have the ability to provide information to other connected users. To accomplish this, many users create Web pages for a variety of reasons:

- Home users publish Web pages that provide information about their families.
- Small business users publish Web pages that provide information about their businesses.
- Job seekers often publish Web pages that resemble a resume.
- Educators publish online courses, called distance-learning courses. (Shelly *et al.,* 2001:1.28-1.36)

- Procedures

  Procedures are steps that must be followed to accomplish a specific computer-related task. When using hardware and software, Hutchinson and Saywer (2000:1.6) suggest that users consult a documentation manual, which contains the instructions, rules and guidelines. An example of a procedure is explained as follows by Shelly *et al.* (2001:13.35): "...interacting with an automated teller machine (ATM) to deposit or withdraw money, a transaction procedure is followed."

- Communications/connectivity

  Computer communications or connectivity is described by Hutchinson and Sawyer (2000:1.6) as the ability to connect computers and other information devices via communications channels that facilitate communications among users and allow users to share resources.

3. IMPORTANT FACTORS IN IMPLEMENTING COMPUTER LITERACY IN TRAINING PROGRAMMES

Bleach (1998:8,9) finds that, in spite of the fact that the network infrastructure in SA competes well with developed countries, access to the necessary ICT appliances is very unequal among socio-economic groups.

Crowe and Howe (1998:2) warns that many learners are dangerously computer illiterate, because of a lack of training in this vital field. In addition to the statement above, Hough and Ellis (1997:3) emphasise the importance of computers as a strategic tool and indicate that computer skills should be an integral part of learning programmes of all the courses in education. If ICT is not integrated successfully into the classroom, Lashbrooke (1999:15) predicts that the shortage of computer literacy is going to hit SA hard. Algozzine *et al.* (1999:1) argue that, too often, technology development is unnoticed, ignored and seldom used in today's educational system and is of no enhancement to the educational system. Fulton (1998:7) advocates an approach for developing ICT skills for all learners to empower them to become knowledgeable workers at all levels in society. Anon. (2001:32), quoting Van der Linde (2000), agrees that ICT skills help "... the students to be more effective in their education as well as prepared for their vocation." Anon. (1999:24) quoting De Beyer, (1999) "... recognises the enormous potential of the Internet to solve some of this country's educational problems." Nonetheless, Yildirim (2000:2) claims that it is expected from HEIs to prepare the next generation in computer technology.

3.1 The role of higher education

All and sundry bemoan ICT shortage, but very few people take action to improve the position. This is where HEIs, such as universities, can fulfil a major role in addressing the dire need for competent computer users in SA. With ICT advancing rapidly, Downs (1998:1) indicates that different approaches in training are necessary to meet the demands placed on education. Evans (1999:1) supports the above by arguing that it is the responsibility of HEIs to equip graduating learners with these technological skills necessary to function in a rapidly changing technological society. Similarly, Wilkinson *et. al.* (1998:10) emphasise that within an expanding ICT environment, education institutions realise that the use of computers among learners could be an effective and meaningful addition to the academic curriculum. To meet the needs of the learners for the next generation, Yildirim (2000:3), makes an

appeal to educational institutions to prepare learners for a more interconnected world. To support the development of a new economic dispensation in SA, Mokade (2002:1) proposes that HEIs provide learners with exposure to utilise the most sophisticated ICT.

Evans (1999:1) is of the opinion that learners mastering basic technological literacy, will become efficient users of the Internet, which is an assisting tool in distance learning. This is where UNISA (previously known as Technikon SA and the University of SA) are of particular importance, because distance learning is being offered to learners who need a specialised course not offered locally or who need to follow their career while studying (Mutula, 2000:6). In a related concept, Hodge and Miller, (1997:7) reveal that the Department of Education is addressing an on-line environment to develop the technological fluency of all learners to prepare themselves for a technological environment. To increase the usage of ICT in HE meaningfully, Petrovic *et al.* (1998:3,4) identify five categories of technology:

3.1.1 Instructor presentation aids

The educator (as alternatives to the "talk and chalk" method, overhead transparencies or slides) uses computer-supported presentations. Presentation software allows multimedia slide-shows, which include text, object-slide transitions, background music, animation techniques and video clips. Mitra and Steffensmeir (2000:2) argue that the real challenge confronting HEIs is to use the capacity of the computer for education as pedagogical: how the technology can be used to improve teaching and learning processes across the curriculum. To bring the learner and the educator together, Algozzine *et al.* (1999:1,2) believe that both would benefit from ICT as computers have evolved ICT into powerful educational tools. This implies that when used properly, (Evans, 1999:7), the computer is an excellent teaching aid that would become a tool for learning in helping learners to learn.

3.1.2 Computer-based training

Core ICT skills have become requirements for HE that change the way learners learn (Long and Long, 2000:xix) The process of learning how to use

CBT (i.e. hardware or software) is to change the behaviour of the learner to use the system in a playful and explorative way to efficiently accomplish tasks. The focus of educational uses of computers has shifted from computers as objects of study to a learning tool (Gilmore, 1995:2). To achieve this goal, Evans (1999:4,6) suggests the necessity of integrating useful application software into the requirements of a traditional learning environment. Learners can then have free choice of time and place for working on an assignment. While suggesting transition to new technology, Majid and Abazova (1999:2) observe that computers have the power to transform education scenarios which includes a major shift from a traditional to high technology classroom. Learners could be routinely required to submit reports and assignments that are prepared with application software.

3.1.3 Access to external information sources

The importance of technology is to enable the learner to access the WWW to collect in-depth information on a subject.

3.1.4 Groupware within the classroom

This is a classroom with networked computers used by learners and educators in addition to traditional forms of interaction.

3.1.5 Groupware external to the classroom

The classroom equipped with networked computers is linked with dispersed workplaces and classrooms.

Abbot and Faris (2000:2), quoting Goldberg and Sherwood (1983), support the statement that meaningful usage of ICT increases the performance of education and training and describe multiple appropriate uses of the computer in the classroom as follows:

- Simulations – learning with a computer

  Biology learners often study living ecosystems in which a large number of variables interact with each other and change over time. Because such dynamic systems are difficult to examine firsthand in the laboratory, teachers find that simulation software is particularly effective for understanding concepts.

- Problem solving – learning about thinking with a computer

  During normal learning activities on a computer learners interact with the computer system at three points:

  - Learners **capture** data in a computer-usable form.
  - During **processing**, learners may be required to give the computer some direction about how to process the data; and
  - at the end, learners review **output** information.

  This information is used as a basis for decision making and **problem solving.**
- Drill and practice – learning from a computer

  Drill and practice is an instructional programme that helps learners remember and use information they have previously been taught. Educators expect of learners to use these programmes for extensive repetitive work with selected skills or knowledge. Examples are addition and multiplication facts, sight vocabulary words and correct spelling of commonly used words.
- Classroom management – managing learning with a computer

  For raw material to become information, it must be managed for a task, directed toward specific performance and applied to a decision. In other words, learners should not shuffle data and information from input to storage, from storage to processing and back to storage and on to output.
- Computer literacy – learning about a computer

  This will demand from learners, not only how to use a word processing or spreadsheet program but also how to use the information as well as easy and fast communication.

In addition to the above uses of computers, different applications for support of the learning process have been established, such as: (Refer to Table 2 for more examples of application software packages)

- Word processing

  Computer-based creating, editing, formatting, storing, retrieving and printing of a text document, such as letters, memoranda or reports.
- Spreadsheet

  An electronic software product creating and manipulating tables and financial schedules by arranging data into rows and columns.
- Desktop publishing (DTP)

  DTP involves using microcomputer and mouse, scanner, laser printer and DTP software for mixing text and graphics to produce high-quality printed output.
- Database

  Large group of stored, integrated (cross-referenced) data that can be retrieved an manipulated to produce information (Hutchinson and Saywer, 2000:6.16).
- Presentation graphics

  A software page used to make presentations visually attractive and easy to understand. With special equipment you can do graphic presentations on slides, transparencies and videotapes (Hutchinson and Saywer, 2000:6.8-6.16).
- Internet:
  - Wilkinson *et al.* (1998:10) describe Internet as "... a world-wide bunch of interconnected computer networks." Scheffler and Logan (1999:2) agree that computers provide learners with tools for research, enable them to access information on the Internet and improve their learning process.
  - Electronic mail – allows communication between educators and learners and between different groups of learners, around the clock, from different locations using electronic technology (Petrovic *et al.*, 1998:4). Traditional learners, who had no exposure to ICT, wrote assignments and projects by hand. Evans (1999:4,5) notes that modern learners type documents, improve their basic typing skills at the same

time and then e-mail the electronic documents to the educator. Distance learning – or the 'virtual HE' – offers access to HE programmes, which appeal to those learners who are unable to attend traditional classes (Hutchinson and Sawyer, 1998:14.39).

- Videoconferencing - According to Lueddeke (1997:2), videoconferencing is: "... live, interactive, closed-circuit video programmes frequently transmitted via satellite to a number of reception sites. In well-planned videoconferences attendees can engage in local discussions and forward (via telephone, fax, computers) questions to presenters 'on air'." Linking to this Petrovic *el al.* (1998:5), describe videoconferencing in groupware external to the classroom as the transferring of knowledge between the educator and the learners or among the learners.
- Class Website – a basic educational Website for HEIs that enables links with learners at home and with libraries. Learners can carry out projects and curriculum studies and they can access resources from home that will enable them to carry out and continue studies and homework. Learners can access information at a time and place of convenience in their schedule. As the information is online, the educator does not have to print multiple copies of learning material (Evans, 1999:6).

As is well known, the library in its present form is a product of the printing revolution. Poustie (1999:1-4) continuous to note that the computer revolution brought changes in the library with the arrival of electronic information. In support of this, Dugdale (2000:3) argues that electronic libraries are essential tools to assist learners in the modern classroom. Librarians have to teach the learners how to effectively use the new technology in order to find information previously only available in printed format. Unless information is only available in printed form, many people would effectively have no access to much of the most current information on the Internet. He suggests that learners should learn the skills of navigating the new electronic information

resources in order to complement the knowledge they have previously obtained from the printed word. In addition to this, libraries need to consider the training of their staff, so that they can teach the learners to get the most value from global information.

Apart from the lack of training, many learners do not effectively interact with computers to learn how to use them as powerful tools to enable success in LPs and in society. Factors that are influencing the use of computers are:

- Learner attitudes

  Mitra and Steffensmeier (2000:9) believe that learner attitudes toward computers can be related to their computer use. Depending on the sophistication of the technology, Karsten and Roth (1998:9) believe that computer literacy experience makes learners feel more comfortable with computing activities, which change their attitudes toward computers.

- Computer anxiety

  According to Dugdale (2000:7), it could be argued that learners are afraid of ICT applications. This could be based on ignorance and low levels of knowledge and training. Ropp (1999:14) also believes that learners with higher computer anxiety had lower self-confidence in their abilities and poorer performance outcomes than learners with lower computer anxiety.

- Linguistic

  Eshraghi (2001:49) says that many HE learners attended schools in rural areas and received a relatively disadvantaged education and most of the learning material and information were presented in English. Supporting the above statement, McLean (2000:1-11) argues that many learners do not acquire English language skills at school that are adequate for coping with the linguistic demands of HE. The majority of the disadvantaged learners are second-language learners studying in English, a language that is not their mother tongue. Most books and journals available in the country are written in English and this is therefore, the language on which information services are based. This has some obvious drawbacks, which has a

negative impact on a learner's learning. The language barrier is in fact a major obstacle in the free flow of information in SA.

- Lack of funding

  The lack of funding and readily available resources is a critical factor in implementing ICT in several Eastern and Southern African HEIs. Many of these institutions (SA included) are connected to a telecommunications infrastructure. However, these facilities are restricted to staff and postgraduate learners (Mutula, 2000:2,3). In addition to the factors mentioned above, Vergani (1999:1-5) identifies the causes of the lack of funding as follows:

  - Learners' inability to pay registration and class fees.
  - Some of the financial problems of the historically disadvantaged HEIs are rooted in the apartheid era.
  - Managerial inefficiency at HEIs.
  - Financial contributions from the Government to HEIs decreased.
  - Financial contributions from donors abroad have also decreased considerably since the end of apartheid.

3.2 Learners preparing for their vocation

In an unlikely scenario, Evans (1999:1) observes that a gap exists between industry requirements and the ability of prospective employees to perform job tasks. Both HE and learners need to devote more attention to learn technological skills. Many HEIs, including learners, have discovered that they are technologically challenged and relatively unprepared for the technological society. Agreeing with the above statement, Davis (1997:4) argues that it is especially pertinent in HE that learners may be unduly limiting their job opportunities as well as their career potential if they do not possess a working knowledge of computer literacy. On the other hand, Rodrigues (1997:2) finds that learners with better competency in computer-related skills would be allowed to walk into an office and immediately be of indispensable value to employers. With so much new software and information now available and accessible, Luke (2000:3,4) notes that many learners and educators are

perplexed as to what exactly is out there that could make learners competent users.

Davis (1999:2) also advocates an approach for developing ICT skills so that learners and employees are able to use computer technology in HE and in the workplace. Rodrigues (1997:4) argues that consumers and citizens need to know how to use computers to be effective in society. Before looking at the effectiveness of the computer, Capron (2000:9) asserts that computers are common tools in all areas of life, but they really excel in certain areas. These areas are associated with some of the LPs presented in the FMS at the VUT. Some of these principal areas are:

- In business
  - Accounting

    When a business computerises its information system, (Laudon *et al.*, 1995:203) accounting is one of the first areas to be automated. Johnson and Johnson (1995:5) mention that employers are placing more emphasis on recruiting accountants with computer skills. It does not appear necessary to make all accountants computer experts, but general PC skills and basic spreadsheet knowledge are most frequently requested.
  - Finance

    Financial professionals should know how to access information quickly and efficiently in order to obtain funds for long- and short-term corporate financial needs. Computerised information systems, with their rapid ability to manipulate and summarise great quantities of data, provide corporate planners the flexibility to explore the financial implications of alternate strategies (Brady, 1996:1-4).
  - Marketing

    Since the computer has rapidly and profoundly changed the way corporate marketing is done, Dennis (1997:1,2) specifies that the PC involves faster communications through electronic data interchange to moving goods and services from producers to consumers. To

successfully accomplish this transfer, the consumer has to be made aware of the product through the electronic information marketplace. Additionally, the product's price and place of distribution has to be acceptable to the consumer.

- Human resources

  The Internet can aid in finding individuals to fill specific jobs, such as through searching the records of current personnel to locate individuals with the required skills. Reports, performance appraisal, affirmative action and labour relations can be created from data stored in the information system database (Elliott and Tevavichulad, 1999:3,5).

- Tourism and hospitality industry

  Just like in any other business, Law and Lau (2000:1) find that the hospitality industries rely on information systems to provide customer services. Hotel managers are extremely uncomfortable with computers, which could have a negative impact on the hotel industry. They suggest that the latter might see technology as a threat to their ability to provide hotel guests with personal attention. It is always safe to anticipate resistance to technological change to prevent a negative effect on the tourism business.

- Education

  Throughout the apartheid era, access to HEIs in SA was restricted to particular racial groupings. Following the 1994 democratic elections, a non-racial education system based on the principles of equity was instituted, providing for central as well as provincial and local organisation of education. Government immediately put a skills development plan into action for education and training that could see SA take huge strides to ICT skills in the next couple of years (RSA, 1995a:5,21). The development of the NQF, which is the set of principles and guidelines by which records of learner achievement are registered to enable national recognition of acquired skills and knowledge, ensures an integrated and learning system that encourages life-long learning. An objective of the NQF is to ensure the development of a competency or outcomes-based

(OBE) education system. SAs educational system produces some of the lowest results in mathematics and science in the world and therefore requires attention. In this regard, Government declared 1998 as the "Year of science and **technology**" (Pretorius, 1998:4,5). In the Education White Paper 3 (RSA, 1997:8) the needs and challenges of HE are set out. These include, among other things, that there is a shortage of trained graduates in fields such as science, engineering, **technology** and commerce.

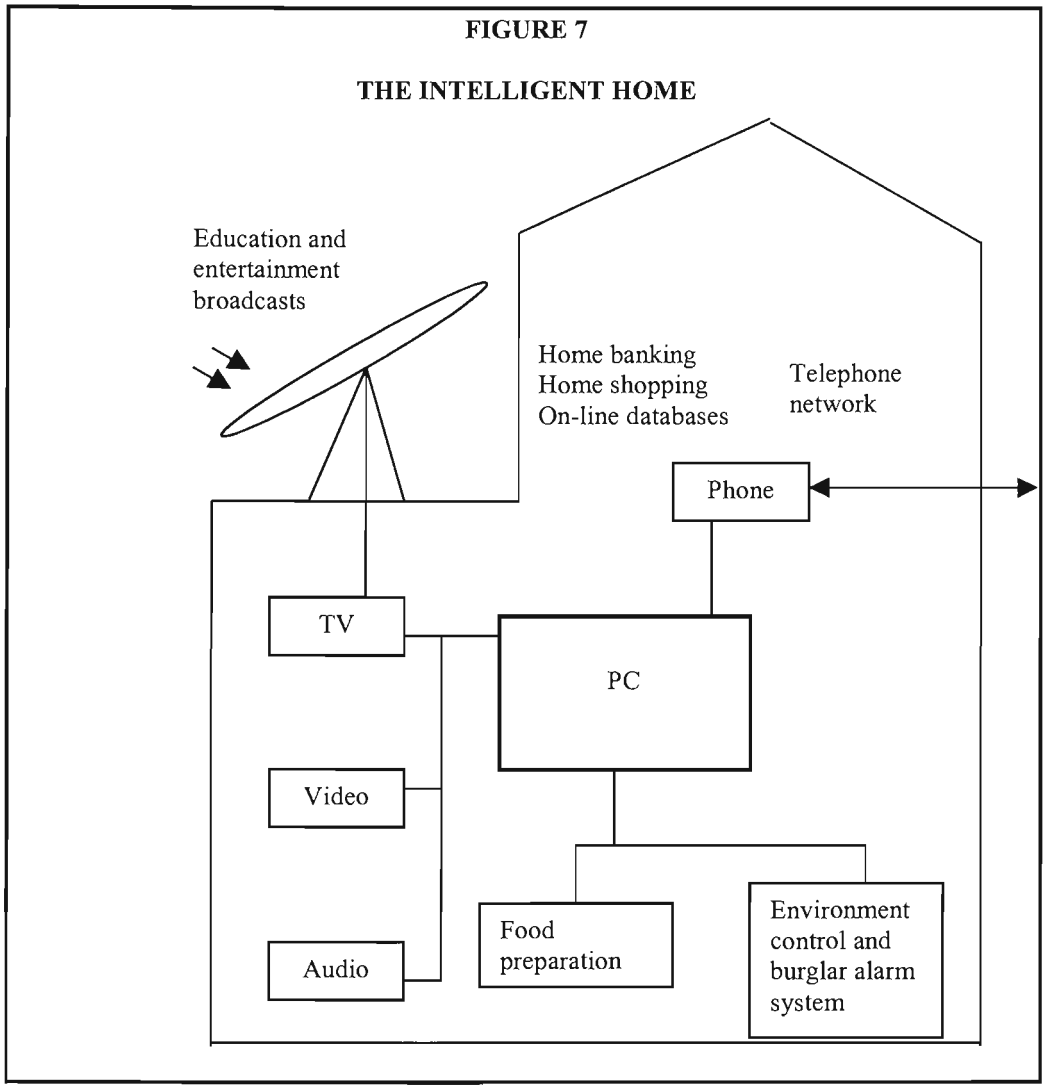
- Socialising

  The evolution of the Internet also adds to the changes the way users socialise. Luke (2000:15) explains that there is less face-to-face contact and more contact through e-mails, chat rooms and discussion groups. The Internet provides the ability to meet people from different places around the world. Recognising the global changes, Capron (2000:4) observes that ICT has revolutionised much of the users' home lives. Besides providing them with access to the daily newspaper and sending a letter by e-mail, shopping and banking can now be done from a home computer linked to the telephone network.

Carter (1996:163) illustrates the electronic links between the various microchip-controlled home appliances systems in Figure 7as follows:

FIGURE 7

THE INTELLIGENT HOME



The kind of futuristic scenario that is envisaged is as follows:

The user is delayed in traffic congestion, makes a telephone call home and activates the different appliances, which are under the control of the computer. The meal, which is in the oven, will start to cook, the central heating timer and the lights will switch on and the curtains will close before dark. The video tape recorder will start taping the desired programme and the burglar alarm system will be activated.

4. TRADE AND INDUSTRY EXPECTATIONS OF LEARNERS

4.1 ICT as a tool to develop the workforce world-wide

With the globalisation of world markets, Fulton (1998:3) indicates that developing nations will have to meet the challenge of producing quality products and developing strategies for the effective utilisation of information technology to market these products. As the complexity of information in society continues to increase, Hough and Ellis (1997:1) assert that technology is an important tool for achieving social and economic development. Since ICT innovations are reshaping today's business environment there is a new paradigm for doing business. Not only does ICT offer organisations both opportunities and new challenges, but provides the potential to flourish in the years ahead.

Having established the essential role of ICT in the workforce, Madu and Kuei (1993:92) believe that ICT will have the following impacts on organisations:

- Technology changes organisational structure.
- Improved communication systems enable organisations to respond to its environment in a timely manner.
- The introduction of new products and services into the marketplace is enhanced and will result in a flood of high-quality computer products introduced to the marketplace. These products have changed the way many companies do business and the type of skills required from employers and employees.

Besides educators, Evans (1999:4) states that current industry standards demand skilled users to be competitive in present and future job markets. In an information-intensive environment, computer literate learners, as non-professionals with only modest skills in computing, can find new and innovative ways to use information to support their work. To achieve this, Abbott and Faris (2000:2) emphasise a strong need for user education and computer literacy enhancement to use computer technology effectively in the

workplace. "In the future, competence in ICT is going to be a major prerequisite when hiring people in the business environment" (Anon. 2000:38, as quoted by Meredith 2000). Besides the need for computers in the workplace, Pellissier (1999:22) states that the computer is the engine driving the information society which changed the mode of business operations. Kaplan and Aronoff (1996:1-5) declare that computers are becoming so common in the workplace that computer literacy is a required skill, not just for survival but also as a key to personal success. In support of the above, Bester (2000:16) reassures the user that computers have revolutionised the technological world. People in all walks of life need to be cognisant about computers if they are to function effectively in an information-rich society. "New technology opportunities are being created by the day and while a certain skills profile was ideally suited to yesterday's business requirement, ICT professionals need to reskill themselves in information technology if they are to ensure their marketability" (Anon. 2000:29 as quoted by Hattingh, 2000). Van Jaarsveld (1999:13) explains that, in order to maintain high standards, employers are serious about rejecting applicants who are not fully qualified. In addition to this, Coolidge (1998:2) stresses that more companies are testing potential employees as well as the current employees on computer competency. Rodrigues (1997:4) maintains that almost every organisation today faces the challenge of effectively introducing new technologies in order to succeed. Employers should aim at getting optimum usage and performance from technology, by employing well-trained users (Jacobs, 2000:35). Some companies are at a stage in their technological development where they are spending millions on hardware and software, but only spend the minimum on staff training (Anon. 1999:8). Technology has provided the workforce with a set of tools to work with and the success is determined by the employees' ability to learn skills and how they utilise these skills (Meyer and Baber, 1998:6). In conclusion, Bradley and Russel (1997:1) predict that computer technology would not be used to its full potential until the people involved in it and affected by it, are completely at ease.

4.2 Information and communication technology as a tool to develop the workplace in South Africa

Research online, conferencing and networking locally, nationally and globally have added new skills, which now define the computer literate person. South African companies are struggling with a shortage of qualified people who are trained to cope with these technological changes. Due to a lack of exposure to ICT, there are not enough learners who have the required basic skills or qualifications in this field. The future evolution of computer literacy encompasses these skills plus the reorganisation and extension of basic computing, software evaluation, telecommunications and hypermedia development. HEIs acknowledge the increased interest of companies on OBE as employers rush to meet the requirements of the NQF. SETAs have to address the issues of ICT training in SA. One of their objectives is to ensure the development of learning programmes in moving away from theory towards practice based training. Users across all industries are urged to go for computer training to satisfy the increasing demands for ICT skills (Heron, 1999:26). Anon. (1999:3) as quoted by Norton (1999), concludes that "... the creation of the NQF is seen by many as the solution of transforming an inequitable and outdated education system into a modern and relevant institution that will serve the interests of both industry and employees promoting equity, productivity, competitiveness and quality in learning."

4.3 Information and communication technology categories in the workplace that need computer literacy skills

In managing the challenge of the business world, the user needs to know how to use PCs effectively. Knowledge of ICT has become a prominent feature in the workplace, therefore, the following categories of computer skills are identified to be necessary when recruiting graduates:

4.3.1 Basic computer literacy

Elliott and Tevavichulada (1999:2) suggest that users should learn some general-purpose application programmes to become more effective and efficient in the workplace. The following popular application software products have been identified:

TABLE 2: APPLICATION SOFTWARE PRODUCTS

SOFTWARE APPLICATIONS	POPULAR PACKAGES
Word Processing	Microsoft Word Corel WordPerfect Microsoft Pocket Word
Spreadsheets	Microsoft Excel Corel Quattro Pro Microsoft Pocket Excel
Databases	Microsoft Access Corel Paradox Microsoft Visual FoxPro Oracle
Presentation Graphics	Microsoft PowerPoint Corel Presentations
Personal Information Manager	Microsoft Outlook Corel CENTRAL Palm Desktop
Accounting	Intuit QuickBooks Pastel Accounting

(Shelly *et al.* (2001:3.7)

Column one lists popular software applications and column two the popular packages for these applications.

4.3.2 Network computer literacy skills

Without core computer literacy, a company that allows its users to use the Internet runs serious risks, for example:

- Users bog down corporate software.
- Software gets infected with viruses.
- Users become less productive.
- Information security is at risk.

In addition to the above, basic Internet vocabulary, such as terms, abbreviations for example Uniform Resource Locator (URL) and WWW, are required to operate effectively in this online business environment (Dern, 1997:2). Users in the business world connect to the Internet to access a variety of services:

- Net-based training (NBT)

  The latter is also called online, Internet- or web-based training. With Internet as the fastest growing area in ICT training today, White (1999:24) notes that it leads to the need of developing network-computer literacy skills. Blain (1999:5) says that, to date, SA has not kept pace with the developing world, for reasons like the low average level of education and apartheid.

- Web browsers

  A Web browser is a software package that enables the user to display Web pages as well as navigate the Web or other parts of the Internet. Web browsers are used as front ends to locally mounted resources as well as to Internet resources (Hutchinson and Sawyer, 2000:8.13). In this case, Evans (1999:7) argues that knowing how Web browsers function is essential.

- E-mail

  Users need to have an understanding of the company's e-mail system, which, Rowley (1999:1) argues, can serve as an excellent communications vehicle for the dissemination of information throughout an organisation. E-mail can be seen as substitutes for written correspondence, such as internal memoranda and external letters or telephone conversations.

- Intranet

  An Intranet is a private Internet network internal to a specific company. A keen understanding of the information superhighway would make an organisation more marketable. The company will also stay abreast of the technologies used in e-commerce to streamline their payment and collection processes, gain cost efficiencies and enhance productivity.

- Extranet

  An Extranet is a network of two or more Intranets to connect not only internal personnel in a company but also select customers and suppliers.
- Videoconferencing

  Videoconferencing (teleconferencing, videoconferencing) is a form of conferencing using video cameras and monitors that allow people at different locations who use a network or the Internet to see, hear, and talk with one another (Shelly *et al.*, 2001:3.33,9.20, 10.8).
- Research

  The Internet provides access to an online collection of material that allows a user to search for information about a particular subject, regardless of location.
- Multimedia-based training

  Multimedia-based training is a type of CBT that combines text, picture, sound, video and animation to be hyperlinked and used in an effective manner in any document (Hutchinson and Sawyer, 2000:7.35, 8.12).

4.4 Industry and higher education in South Africa

Gosling (2001:3) states that industry is one of the main customers of the skills developed by HEIs, but there is a lack of interest and involvement by industry with these institutions. The following reasons were identified:

- There is a lack of effective communication between business, HE and Government in SA.
- Both HE and the Government acknowledged that business has failed to lodge itself as an effective stakeholder in HE.
- Business people in SA have a limited understanding of the information age and its implications for the future of business.
- Research concerning industrial innovations in SA universities is still very underdeveloped.

4.5 Information and communication technology enables the organisation to improve its productivity

Cooper (2001:2) argues that the way organisations is restructured to take advantage of the technology and to optimise the contribution of those who use it, is a key factor in realising productivity gains. Likewise, Auerbach (1997:33) believes that the greatest gains are realised when users are provided with computer literacy skills and they are immediately productive and efficient. Although Kaplan and Aronoff (1996:4) refer to the PC as a commonly used productivity tool, it is only as effective as the user's knowledge in applying it to a particular task. In spite of concerns by certain employers, Kane-Berman (1998:17) believes that the computer has been identified by economic analysts as a device that will help boost productivity growth.

The legacy of apartheid has left SA with a relatively under-productive, under-performing workforce, ill equipped to move up and to develop the country's economy. There is no doubt that we lack a properly educated, trained, skilled and accredited workforce that exhibits the right work ethics (Williams, 2001:17).

According to Anon. (1999:1,2) quoting Thomson (1999), there is a second circumstance that has a profound effect on industry when users leave the country, which "... results in little return on investment and a loss in productivity." Anon. (1998:2) quoting Story, (1998) concludes that one of the stated goals of the Skills Development Bill is "...to enable employers to achieve rising levels of productivity and competitiveness."

5. SUMMARY

The computer is the most important invention of modern society and one effect that warrants consideration is the impact of the computer on the user and on the future. A user will need more than just computer literacy to

succeed in the 21st century as all job categories require computer and related skills. Davis (1997:5) agrees that competency in ICT is a core skill, which enables learners to perform a full and active part in modern society. In support of these concepts, Capron (2000:4) justly argues that the use of computers is no longer something that a person **may** want to use if and when he is interested; computers have become rather like the motor car – it is an **essential** part of mankind's existence.

A phenomenon facing the ICT industry in SAs industry today is the acute shortage of technology related skills. Fletcher (2001:2) suggests that the best means of addressing computer literacy is to equip learners with the skills necessary to support learner achievement. As organisations become increasingly dependent on computer systems, the importance of preparing the learner to use technology systems effectively becomes important. However, lacking computer literacy skills would not exclude most graduates from the job market. Davis (1997:4) explains that the more skills they exhibit, the more attractive they would be to potential employers.

Technology provides industry with a cost-effective and efficient way of streamlining and improving business operations, enhancing customer service quality and boosting worker productivity. By acquiring and constantly fine-tuning the systems skills needed to take advantage of all that technology offers, industry can re-engineer its business processes and add significant value to services and products.

The next chapter will focus on the method of data collection and reveal the findings of the investigation.

CHAPTER 4

EMPIRICAL FINDINGS

1. INTRODUCTION

Computer literacy is the ability to deal with the computer itself in terms of learning what is needed to know to solve a problem. In chapter three the question was raised whether or not learners really need computer literacy in today's ICT environment. The two main categories of people, learners and employees, need to have knowledge of computers to be effective ICT users. Too often, technological innovations are unnoticed or are ignored. The latter would have the following consequences on learners and employees:

As computer literacy is a prerequisite in today's working environment, the exclusion of ICT in the LP of learners will have a deli mental effect on the employability of both learners and employees.

When gaps exist between ICT requirements or knowledge and the ability of a user to perform ICT tasks, training is a mandatory tool for improving performance. This then, raised the question whether courses on computer literacy should be included in LPs to:

- empower learners in their studies,
- equip them with the skills required by employees and
- aid them towards becoming technologically competent citizens.

In this chapter an attempt will be made to answer the above question through analysing and discussing the results of two studies in detail, viz. a learner's study and an employee study discussed in sections A and B respectively.

1.1 Section A

The results from the analysis based on data derived from VUT learners in the FMS, will identify:

- the existing levels of computer literacy amongst the sample groups;
- the need for computer literacy training; and
- the effects of the variables such as gender, field of study (that is the in- or exclusion of a computer course in the LP), academic level, access to computers, computer usage and time spent on a computer will be assessed.

1.2 Section B

The data analysis will be done on the data received from the questionnaire sent out to different companies. In order to obtain an overall picture of the type of employee a VUT management learner should be, the responses to the questionnaire were to measure:

- computer requisites for employees; and
- variables such as age, job category, computer usage, computer training and institution where computer training was done.

2. ANALYSIS AND FINDINGS

2.1 Section A

The data concerning the learners in this study were divided into two categories, viz: male and female. Each category was again sub-divided into two sections. These related to whether or not the learners had been exposed to an inclusive computer course in their particular LP. In addition to the above-mentioned categories and sections, learners were also grouped according to their academic level of study (refer to Annexure 2).

Upon finalisation of the categorisation of data, the following statistical tests and analysis were run on the learner data:

- a random sample was taken from each group;
- regression analysis;
- t-Tests; and

- ANOVA analysis

  Each of the above was run in order to determine the effects of the variables mentioned in the introduction of Section A, and will be discussed in detail in this chapter.

Objectives

In order to determine how computer literate the learners were at each level, the following questions should be considered and studied separately:

- How computer literate is the learner?
- What is the difficulty level of the tasks the learner regularly performs?
- What is the amount of time the learner spends using the computer?
- Is there a significant difference in the computer literacy scores of those with a course included in their LP as opposed to those learners who are not exposed to computer training?
- Do those learners with access to a computer at home have a higher computer literacy percentage than learners who do not?
- Does access to a particular computer venue have an influence on the learners' computer literacy skills?
- Is there a difference in the level of computer literacy between males and females at each level of study?

An analysis of the answers to questions 14.1 – 14.11 of the questionnaire resulted in an answer to the first three questions above. These questions are related to particular tasks that the learner feels comfortable doing. Each question has four options, which means each score is out of 4:

- Not at all - 1
- Sometimes - 2
- Definitely - 3
- Most definitely - 4

The responses to questions 14.1 – 14.11 were then totalled for each learner out of 4 and a percentage calculated out of 44 (refer to Annexure 3).

Answers to questions 12.1 – 12.7 in the questionnaire indicated the difficulty of the tasks regularly performed by learners. Each question was assigned a difficulty rating between 1 - least difficult and 5 – most difficult:

- Create Assignments (using Word, Excel and/or PowerPoint) - 5
- Create letters - 3
- Create your curriculum vitae - 3
- Send and receive e-mail messages - 4
- Search the Internet - 4
- Visit a Website - 2
- Play games - 1

This question was a multi-selected question and a score was calculated in the following way:

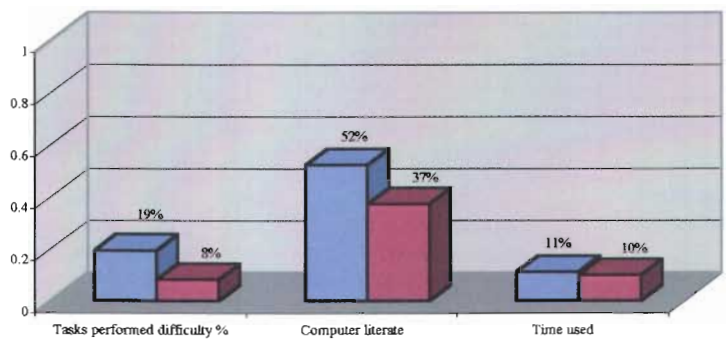
Number of tasks (7) * Sum of difficulty scores (1 – 5) = Total difficulty rating (154). This group of questions is referred to as the tasks regularly performed by learners. It should be noted that these questions might reflect the perceived competency perceptions of the learners. Poor language proficiency and constraints have been identified as two possible factors that might influence computer literacy negatively. These statements will be explained in chapter 5.

Question 13 was used to determine the amount of time the learners spent using the computer. The results obtained from questions 12.1 – 12.7 were converted into a percentage, which was used to perform the analysis. The groupings used in the graphs and figures termed "computer aided" and "non-computer aided" refer to whether or not a computer course is included in their diploma.

Figures 8, 9 and 10 provide an indication of the results on the male profile:

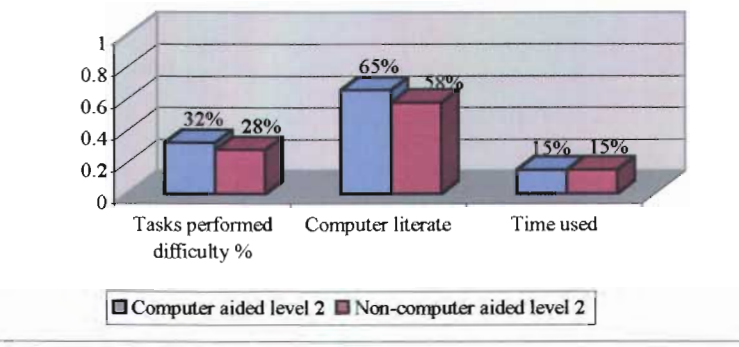
MEAN COMPARISONS FOR **MALES** IN THREE DIFFERENT CATEGORIES

FIGURE 8
MEAN COMPARISONS OF THE THREE CATEGORIES



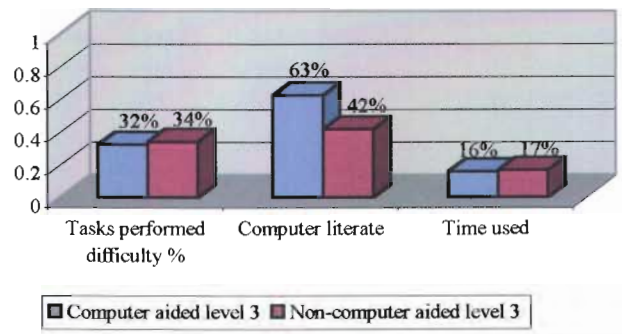
From the figure above it is clear that male computer aided learners in level 1 used slightly more time, are more computer literate and therefore performed better than the non-computer aided learners.

FIGURE 9
MEAN COMPARISONS OF THE THREE CATEGORIES



Male computer aided learners in level 2 used the same amount of time than the non-computer aided learners and performed slightly better than the non-computer aided learners.

FIGURE 10
MEAN COMPARISONS OF THE THREE CATEGORIES

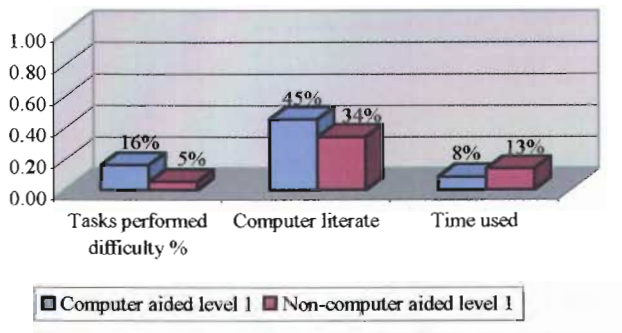


Male non-computer aided learners in level 3 used the same amount of time, but computer aided learners showed a higher computer literate rating.

Figures 11, 12 and 13 provide an indication of the results on the female profile:

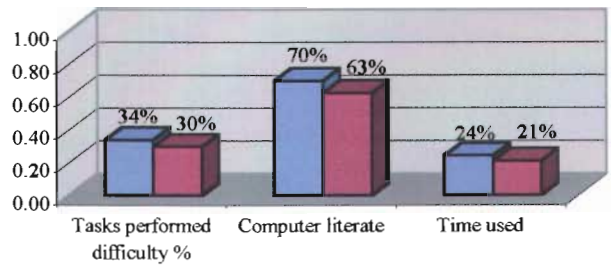
MEAN COMPARISONS FOR **FEMALES** IN THREE DIFFERENT CATEGORIES

FIGURE 11
MEAN COMPARISONS OF THE THREE CATEGORIES



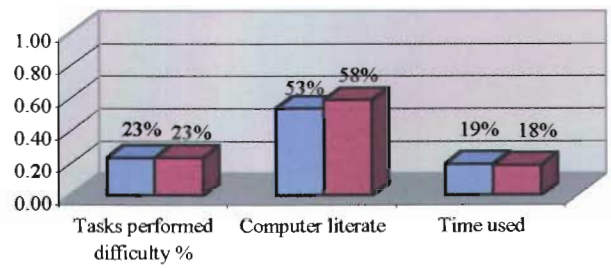
Computer aided learners show a higher computer literacy rating than the non-computer aided learners despite the fact that the latter used more time.

FIGURE 12
MEAN COMPARISONS OF THE THREE CATEGORIES



Computer aided learners used more time, showed a higher computer literacy rating and therefore performed better than the non-computer aided learners.

FIGURE 13
MEAN COMPASISONS OF THE THREE CATEGORIES



Both groups used approximately the same time, and performed the same, but the non-computer aided learners slightly showed a higher computer literacy rating.

The above figures seem to indicate that in most cases, for males and females at each level, those learners with a computer course included in their LP have a higher computer literacy rating than those without a computer course. The statistical significance of this statement will be tested later in this section. This is however, a very simple breakdown of the data. Any measure designed to demonstrate computer literacy has weaknesses, serving at best as an approximation of a learner's actual computer literacy skills. This study

assesses self-perceptions of computer literacy skills rather than the skills themselves.

Does the amount of time spent using the computer and the difficulty of tasks regularly performed by learners have an influence on their computer literacy rating?

The model being:

$y = \beta 0 + \beta 1x1 + \beta 2x2 + \varepsilon$

Where x1 : Task Difficulty % and x2: Time spent using computers

The Hypothesis statement then becomes:

Ho: $\beta 1 = \beta 2 = 0$

Ha: at least one of the βi is not 0

The above hypothesis statement holds for both the male and female regression models below. The following multiple regression output was obtained for **male** learners:

TABLE 3: SUMMARY OUTPUT

Regression Statistics				
Multiple R	0.35			
R square	0.12			
Adjusted R square	0.09			
Standard error	0.17			
Observations	60			
	Coefficients	Standard Error	t Stat	P-value
Intercept	0.37	0.07	5.46	1.09
Time using	0.89	0.48	1.88	0.07
Tasks performed difficulty %	0.13	0.088	1.51	0.14
	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.23	0.51	0.23	0.51
Time using	-0.06	1.85	-0.06	1.85
Tasks performed difficulty %	-0.04	0.31	-0.04	0.31

FIGURE 14

TIME USED RESIDUAL PLOT

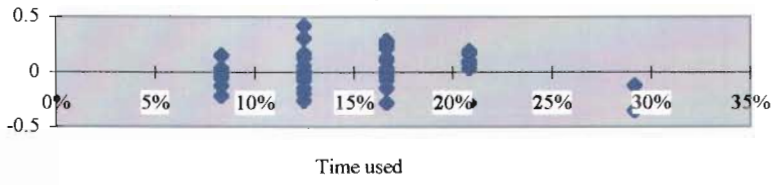


FIGURE 15

TASK PERFORMED DIFFICULTY % RESIDUAL PLOT

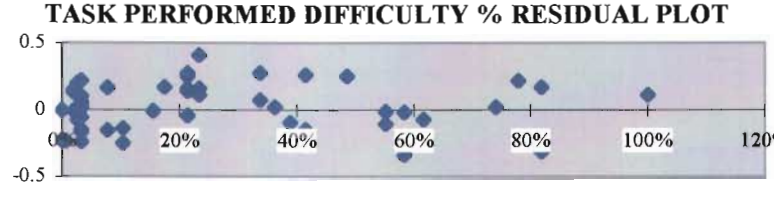
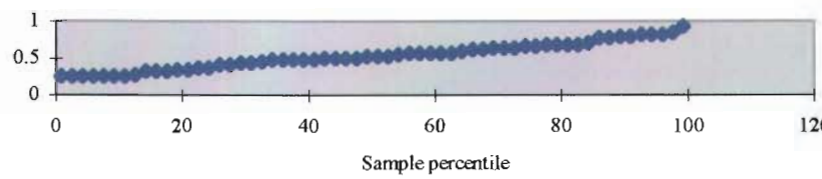


FIGURE 16

NORMAL PROBABILITY PLOT



From the residual plots, it can be seen that the data is normally distributed and falls within the upper and lower 95 percent confidence intervals. The normal probability plot shows that there are no important deviations from normality. (If the data were not normal, this type of analysis would be invalid).

The focus will now move to the results of the t-test performed in the regression analysis in Table 3. It could therefore be said that both variables - time spent using the computer and difficulty of tasks regularly performed by learners - influence their computer literacy rating, in the case of $P < |t|$.

TABLE 4: ANOVA

	df	SS	MS	F	Significance F
Regression	2	0.239294118	0.119647059	4.035264901	0.022960409
Residual	57	1.690070551	0.029650361		
Total	59	1.929364669			

From the above ANOVA table, the F-statistic indicates that at least one of the explanatory variables is significant in effecting the outcome of the level of computer literacy of learners, given the probability that a random variable, having a distribution F(p, n – p – 1), is greater than or equal to the calculated value of F. It is clear from the individual analysis (refer to Annexures 4 and 5), that both the difficulty of tasks performed and time used have an influence on their computer literacy scores.

Considering the t-stat and P-values for Table 3 it is clear since $P < |t|$ in both cases (difficulty of tasks regularly performed and time used), that not only one, but both have a statistically significant effect on the levels of computer literacy of learners. P-value <0.05.

The following multiple regression output was obtained for **female** learners:

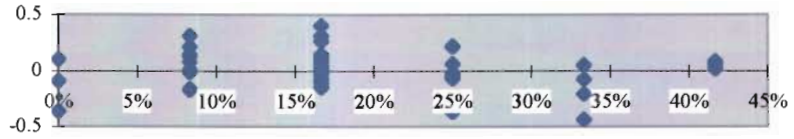
TABLE 5: SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.63
R square	0.40
Adjusted R Square	0.38
Standard error	0.16
Observations	60

	Coefficients	Standard Error	t-Stat	P-value
Intercept	0.35	0.04	8.82	3.09
Time using	0.81	0.20	3.99	0.0002
Tasks performed difficulty %	0.24	0.08	2.85	0.006

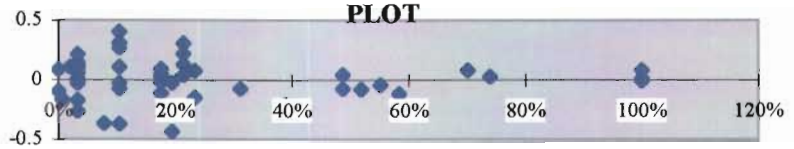
	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.27	0.43	0.27	0.43
Time using	0.40	1.22	0.40	1.22
Tasks performed difficulty %	0.07	0.40	0.07	0.40

FIGURE 17
TIME USED RESIDUAL PLOT



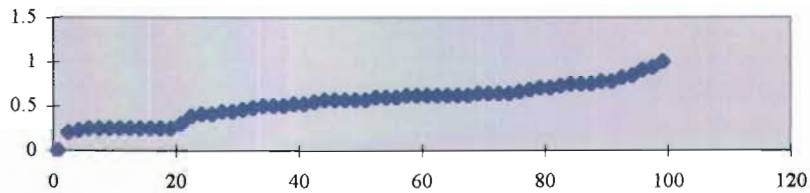
Time used

FIGURE 18
TASKS PERFORMED DIFFICULTY % RESIDUAL PLOT



Tasks performed difficulty %

FIGURE 19
NORMAL PROBABILITY PLOT



Sample percentile

From the residual plots, it can be seen that the data is normally populated and falls within the upper and lower 95 percent confidence intervals. The normal probability plot shows that there are no important deviations from normality. (If the data were not normal, this type of analysis would be invalid).

According to Table 5, both variables - time spent using the computer and difficulty of tasks regularly performed by learners - do influence their computer literacy rating in the case of $P < |t|$.

TABLE 6: ANOVA

	df	SS	MS	F	Significance F
Regression	2	1.008633575	0.504316787	18.81247823	5.32441
Residual	57	1.52803137	0.026807568		
Total	59	2.536664945			

The above ANOVA table shows that the probability of getting an F-value of 18.81 is 5.32. This means that the statistical significance of one of the variables does not have a very high influence on the computer literacy scores of the females. After studying the individual simple linear regression analysis of these two variables, it becomes clear that the difficulty of tasks performed by the females, has the highest influence on their computer literacy scores, and that the time they spend using the computer does not really have an impact. One reason could be that females spend their available computer access time more productively than the males.

Is there a significant difference in the computer literacy scores of those with a course included as opposed to those learners who do not?

The differences in values for "computer aided" (training included) and "non-computer aided" (training not included) were tested using the t-test, producing the tables below. The following t-test table shows the mean comparison of the levels 1 – 3 (level of study) for **male** learners: (refer to Tables 7, 8 and 9).

TABLE 7: COMPUTER LITERACY – LEVEL 1

t-Test: Paired Two Sample for Means	**Males**	
	Computer Aided	Non-Computer Aided
Mean	0.522727273	0.372727273
Variance	0.041666667	0.020913682
Observations	10	10
Pearson Correlation	0.311073122	
Hypothesised Mean Difference	0	
Df	9	
t Stat	2.255833559	
P(T<=t) one-tail	0.025259706	
T Critical one-tail	1.833113856	
P(T<=t) two-tail	0.050519413	
T Critical two-tail	2.262158887	

This t-test has the following hypothesis:

Ho: $\mu 1 - \mu 2 = 0$

Ha: $\mu 1 - \mu 2 \neq 0$

In other words the null hypothesis states: whether the learner has a computer course included or not, the level of computer literacy will be the same. The null-hypothesis as $P < |t|$ is rejected.

Therefore, for male learners on level 1, it is statistically significant that the computer-aided students are more computer literate than non-computer aided learners and the null hypothesis is therefore rejected.

TABLE 8: COMPUTER LITERACY – LEVEL 2

t-Test: Paired Two Sample for Means	**Males**	
	Computer Aided	Non-Computer Aided
Mean	0.654545455	0.575
Variance	0.019605142	0.022503444
Observations	10	10
Pearson Correlation	0.181977157	
Hypothesised Mean Difference	0	
Df	9	
t Stat	1.354979714	
P(T<=t) one-tail	0.104227017	
t Critical one-tail	1.833113856	
P(T<=t) two-tail	0.208454034	
t Critical two-tail	2.262158887	

This t-test has the following hypothesis:

Ho: $\mu 1 - \mu 2 = 0$

Ha: $\mu 1 - \mu 2 \neq 0$

In other words, the null hypothesis states: whether the learner has a computer course included or not, the level of computer literacy will be the same. The null-hypothesis in the case of as $P < |t|$ is rejected.

Therefore, for male learners on level 2, it is statistically significant that the computer-aided students are more computer literate than non-computer aided learners and the null hypothesis is therefore rejected.

TABLE 9: COMPUTER LITERACY – LEVEL 3

t-Test: Paired Two Sample for Means	**Males**	
	Computer Aided	Non-Computer Aided
Mean	0.627272727	0.418181818
Variance	0.020224977	0.018044077
Observations	10	10
Pearson Correlation	-0.085321626	
Hypothesised Mean Difference	0	
Df	9	
t Stat	3.244589833	
P(T<=t) one-tail	0.005042148	
t Critical one-tail	1.833113856	
P(T<=t) two-tail	0.010084296	
t Critical two-tail	2.262158887	

This t-test has the following hypothesis:

Ho: $\mu 1 - \mu 2 = 0$

Ha: $\mu 1 - \mu 2 \neq 0$

In other words, the null hypothesis states: whether the learner has a computer course included or not, the level of computer literacy will be the same. The null-hypothesis is rejected in the case of $P < |t|$.

Therefore, for male learners on level 3, it is statistically significant that the computer-aided students are more computer literate than non-computer aided learners and the null hypothesis is therefore rejected.

The following t-test table shows the mean comparison of the levels 1 – 3 (level of study) for **female** learners:

TABLE 10: COMPUTER LITERACY – LEVEL 1

t-Test: Paired Two Sample for Means	**Females**	
	Computer Aided	Non-Computer Aided
Mean	0.45	0.34
Variance	0.03	0.02
Observations	10	10
Pearson Correlation	0.12	
Hypothesised Mean Difference	0	
Df	9	
t Stat	1.64	
P(T<=t) one-tail	0.07	
t Critical one-tail	1.83	
P(T<=t) two-tail	0.14	
t Critical two-tail	2.26	

This t-test has the following hypothesis:

Ho: $\mu 1 - \mu 2 = 0$

Ha: $\mu 1 - \mu 2 \neq 0$

In other words, the null hypothesis states: whether the learner has a computer course included or not, the level of computer literacy will be the same. The null-hypothesis is rejected in the case of $P < |t|$.

Therefore, for female learners on level 1, it is statistically significant that the computer-aided students are more computer literate than non-computer aided learners and the null hypothesis is therefore rejected.

TABLE 11: COMPUTER LITERACY – LEVEL 2

t-Test: Paired Two Sample for Means	**Females**	
	Computer Aided	Non-Computer Aided
Mean	0.7	0.63
Variance	0.06	0.01
Observations	10	10
Pearson Correlation	-0.34	
Hypothesised Mean Difference	0	
Df	9	
t Stat	1.27	
P(T<=t) one-tail	0.12	
t Critical one-tail	1.83	
P(T<=t) two-tail	0.24	
t Critical two-tail	2.26	

This t-test has the following hypothesis:

Ho: $\mu 1 - \mu 2 = 0$

Ha: $\mu 1 - \mu 2 \neq 0$

In other words, the null hypothesis states: whether the learner has a computer course included or not, the level of computer literacy will be the same. The null-hypothesis is rejected in the case of $P < |t|$.

Therefore, for female learners on level 2, it is statistically significant that the computer-aided students are more computer literate than non-computer aided learners and the null hypothesis is therefore rejected.

TABLE 12: COMPUTER LITERACY – LEVEL 3

t-Test: Paired Two Sample for Means	**Females**	
	Computer Aided	Non-Computer Aided
Mean	0.53	0.58
Variance	0.06	0.05
Observations	10	10
Pearson Correlation	0.10	
Hypothesised Mean Difference	0	
Df	9	
t Stat	-0.51	
P(T<=t) one-tail	0.31	
t Critical one-tail	1.83	
P(T<=t) two-tail	0.62	
t Critical two-tail	2.26	

The t-tests for all the above tables had the following hypothesis:

Ho: $\mu 1 - \mu 2 = 0$

Ha: $\mu 1 - \mu 2 \neq 0$

In other words, the null hypothesis states: whether the learner has a computer course included or not, the level of computer literacy will be the same. The null-hypothesis in the case of $P < |t|$ is rejected.

Therefore, for female learners on level 3, it is statistically significant that the computer-aided students are more computer literate than non-computer aided learners and the null hypothesis is therefore rejected.

Do those learners with access to a computer at home have a higher computer literacy percentage than learners who do not?

TABLE 13: COMPUTER LITERACY

t-Test: Two-Sample Assuming Unequal Variances

	No computers at home	Computers at home
Mean	0.60	0.68
Variance	0.03	0.02
Observations	5	5
Hypothesised Mean Difference	0	
Df	8	
t Stat	-0.93	
P(T<=t) one-tail	0.19	
t Critical one-tail	1.86	
P(T<=t) two-tail	0.38	
t Critical two-tail	2.31	

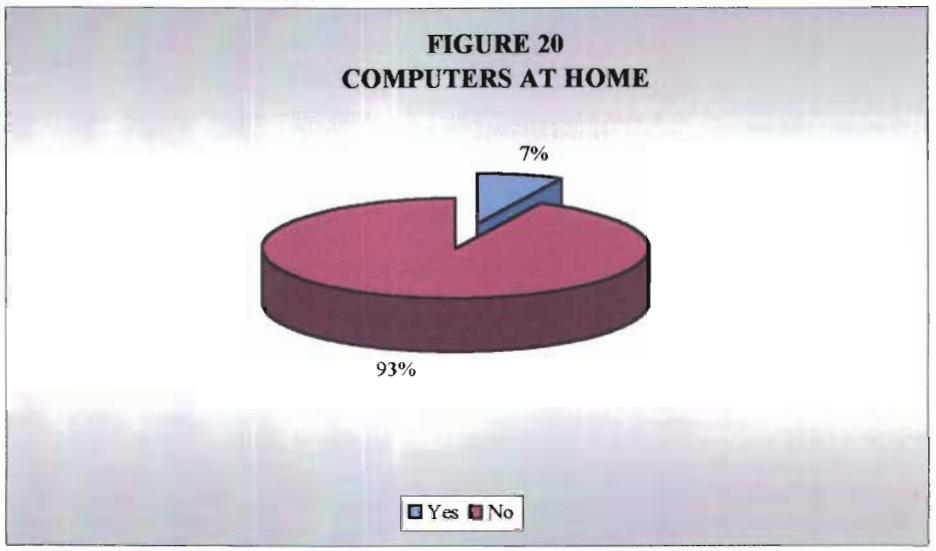
The t-test for the above table has the following hypothesis:

Ho: $\mu 1 = \mu 2$

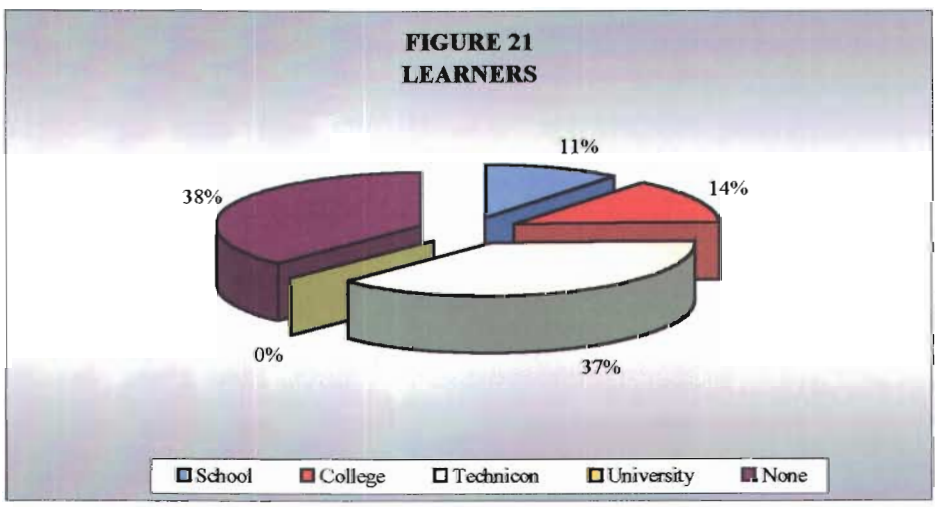
Ha: $\mu 1 \neq \mu 2$

It has been found that whether the learner has a computer at home or not, does not affect their computer literacy scores. The null-hypothesis in the case of P<|t| is rejected. This should have been expected, as learners in this sample have access to computers at the VUT, even though they may not have a computer course included in their LP.

Figure 19 shows that a large proportion (93 percent) of the learners do not own computers at home.



Since income was not included in the data collection, the explanation may be that this is a below average or previously disadvantaged income group who finds it difficult to pursue higher-level education whilst also providing in all their technology needs themselves.



Considering Figure 21, a significant cumulative total of 62 percent (school, college, technikon and university) of all learners were involved in some form

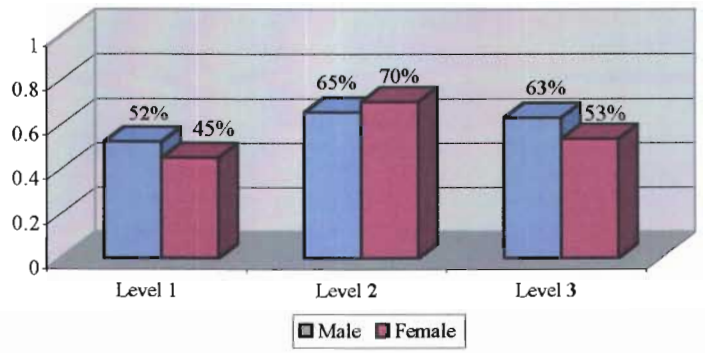
of computer training at a school, college or technikon. This would also substantiate the above finding of the t-test (refer to Table 13).

Is there a difference in the level of computer literacy between males and females at each level of study?

Figure 22 depicts the differences in computer literacy ratings between males and females on each level:

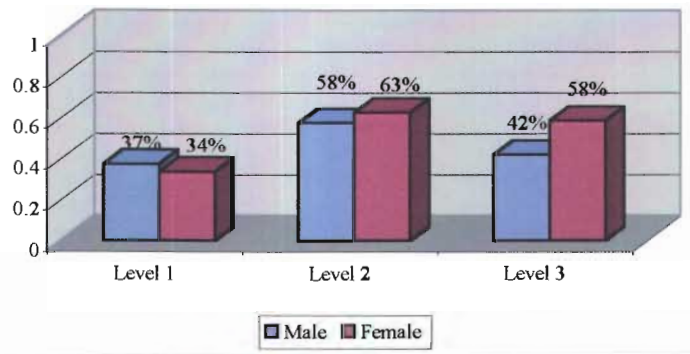
FIGURE 22

COMPUTER AIDED GROUP COMPUTER AVERAGE LITERACY RATINGS



Computer aided females on level two show a higher computer literacy rating than males.

FIGURE 23
NON-COMPUTER AIDED GROUP COMPUTER AVERAGE LITERACY RATINGS



Non-computer aided females on levels two and three show a higher computer literacy rate than males. However, it needs to be established whether this difference is significant at each level or not.

The following t-test tables show the results:

TABLE 14: COMPUTER AIDED – LEVEL 1

t-Test: Two-Sample Assuming Unequal Variances

	Male	Female
Mean	0.52	0.45
Variance	0.04	0.03
Observations	10	10
Hypothesised Mean Difference	0	
Df	18	
t Stat	0.84	
P(T<=t) one-tail	0.21	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.41	
t Critical two-tail	2.10	

The t-tests for the above table had the following hypothesis:

Ho: $\mu 1 = \mu 2$

Ha: $\mu 1 \neq \mu 2$

It has been found that there is a significant difference in computer literacy scores between males and females at level 1. Therefore, the null-hypothesis as $P < |t|$ is rejected.

TABLE 15: NON-COMPUTER AIDED – LEVEL 1

t-Test: Two-Sample Assuming Unequal Variances

	Male	Female
Mean	0.37	0.34
Variance	0.02	0.02
Observations	10	10
Hypothesised Mean Difference	0	
Df	18	
t Stat	0.56	
P(T<=t) one-tail	0.29	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.58	
t Critical two-tail	2.10	

The t-tests for Table 15 had the following hypothesis:

Ho: $\mu 1 = \mu 2$

Ha: $\mu 1 \neq \mu 2$

It has been found that there is no significant difference in computer literacy scores between males and females at level 1. Therefore, the null-hypothesis as $P > |t|$ is not rejected.

TABLE 16: COMPUTER AIDED – LEVEL 2

t-Test: Two-Sample Assuming Unequal Variances

	Male	Female
Mean	0.65	0.7
Variance	0.02	0.02
Observations	10	10
Hypothesised Mean Difference	0	
Df	18	
t Stat	-0.77	
P(T<=t) one-tail	0.23	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.45	
t Critical two-tail	2.10	

The t-tests for Table 16 had the following hypothesis:

Ho: $\mu 1 = \mu 2$

Ha: $\mu 1 \neq \mu 2$

It has been found that there is a significant difference in computer literacy scores between males and females at level 2. Therefore the null-hypothesis as $P < | t |$ is rejected.

TABLE 17: NON-COMPUTER AIDED – LEVEL 2

t-Test: Two-Sample Assuming Unequal Variances

	Male	Female
Mean	0.58	0.63
Variance	0.02	0.011
Observations	10	10
Hypothesized Mean Difference	0	
Df	16	
t Stat	-0.87	
P(T<=t) one-tail	0.20	
t Critical one-tail	1.75	
P(T<=t) two-tail	0.40	
t Critical two-tail	2.12	

The t-tests for the above table had the following hypothesis:

Ho: $\mu 1 = \mu 2$

Ha: $\mu 1 \neq \mu 2$

It has been found that there is a significant difference in computer literacy scores between males and females at level 2. Therefore, the null-hypothesis as $P < | t |$ is rejected.

TABLE 18: COMPUTER AIDED – LEVEL 3

t-Test: Two-Sample Assuming Unequal Variances

	Male	Female
Mean	0.63	0.53
Variance	0.02	0.06
Observations	10	10
Hypothesised Mean Difference	0	
Df	14	
t Stat	1.04	
P(T<=t) one-tail	0.16	
t Critical one-tail	1.76	
P(T<=t) two-tail	0.32	
t Critical two-tail	2.15	

The t-tests in the above table had the following hypothesis:

Ho: $\mu 1 = \mu 2$

Ha: $\mu 1 \neq \mu 2$

It has been found that there is a significant difference in computer literacy scores between males and females at level 3. Therefore, the null-hypothesis as $P < |t|$ is rejected.

TABLE 19: NON-COMPUTER AIDED – LEVEL 3

t-Test: Two-Sample Assuming Unequal Variances

	Male	Female
Mean	0.42	0.58
Variance	0.02	0.05
Observations	10	10
Hypothesised Mean Difference	0	
Df	15	
t Stat	-2.05	
P(T<=t) one-tail	0.03	
t Critical one-tail	1.75	
P(T<=t) two-tail	0.06	
t Critical two-tail	2.13	

The t-tests for the above table had the following hypothesis:

Ho: $\mu 1 = \mu 2$

Ha: $\mu 1 \neq \mu 2$

It has been found that there is a significant difference in computer literacy scores between males and females at level 3. Therefore, the null-hypothesis as $P < |t|$ is rejected.

Overall results for male and female

TABLE 20: COMPUTER AIDED – MALE AND FEMALE

t-Test: Two-Sample Assuming Unequal Variances

	Male	Female
Mean	0.60	0.56
Variance	0.03	0.05
Observations	30	30
Hypothesised Mean Difference	0	
Df	55	
t Stat	0.81	
P(T<=t) one-tail	0.21	
t Critical one-tail	1.67	
P(<=t) two tail	0.42	
t Critical two-tail	2.00	

The t-test for the above table had the following hypothesis:

Ho: $\mu 1 = \mu 2$

Ha: $\mu 1 \neq \mu 2$

It has been found that there is a significant difference in computer literacy scores between males and females. Therefore, the null-hypothesis as $P < |t|$ is rejected.

TABLE 21: NON-COMPUTER AIDED – MALE AND FEMALE

t-Test: Two-Sample Assuming Unequal Variances

	Male	Female
Mean	0.46	0.52
Variance	0.03	0.04
Observations	30	30
Hypothesised Mean Difference	0	
Df	55	
t Stat	-1.26	
P(T<=t) one-tail	0.11	
t Critical one-tail	1.67	
P(T<=t) two-tail	0.21	
t Critical two-tail	2.00	

The t-tests for the above table had the following hypothesis:

Ho: $\mu 1 = \mu 2$

Ha: $\mu 1 \neq \mu 2$

It has been found that there is a significant difference in computer literacy scores between males and females. Therefore, the null-hypothesis as $P < |t|$ is rejected.

FIGURE 24

MEAN DIFFERENCES BETWEEN MALE AND FEMALE COMPUTER LITERACY

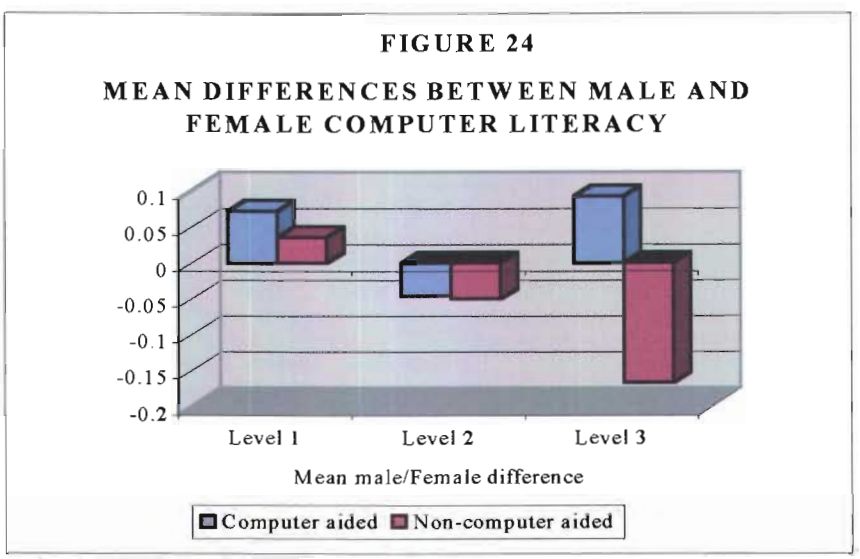


Figure 24 depicts the differences between the mean computer literacy ratings for males and females. A negative difference (< 0) in this case would indicate that the females performed much better than the males for each group at each level. Although this would appear in some cases to contradict the t-test

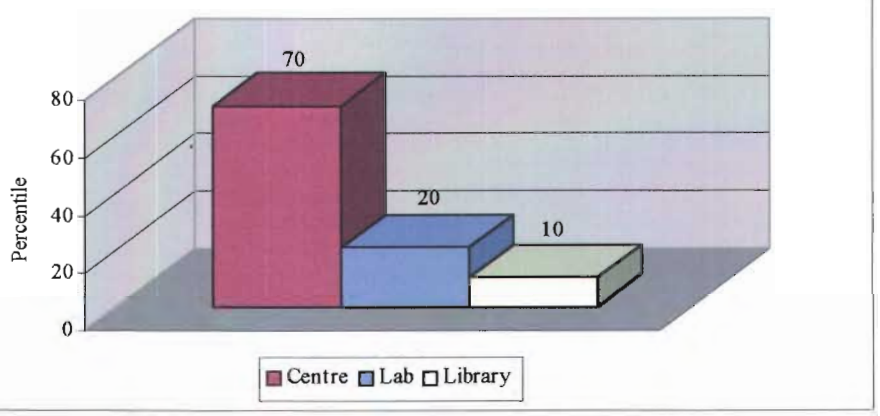
results, it should be kept in mind that the t-test checks for a statistically significant difference between males and females.

Does the access to a particular computer venue have an influence on the learners' computer literacy skills?

From Figure 24 it is evident that there are more reasons that could have an influence on learners' computer literacy.

FIGURE 25

PERCENTAGE OF VENUE USAGE



The most likely venues to use are computer centres, followed by computer laboratories. The library is the least used venue. Learners with computer courses included in their LP are usually the computer laboratory users, whereas learners without exposure to computer courses can only rely on computer centres or the library.

In the next section the results from the employee data will be discussed and compared with the appropriate learner data.

2.2 Section B

The data received from TI was summarised by means of descriptive statistics and compared with those of the learners. This could provide a profile of a

current employee against that of a current learner, in order to determine possible shortcomings in computer literacy levels.

The following points of interest are looked at:

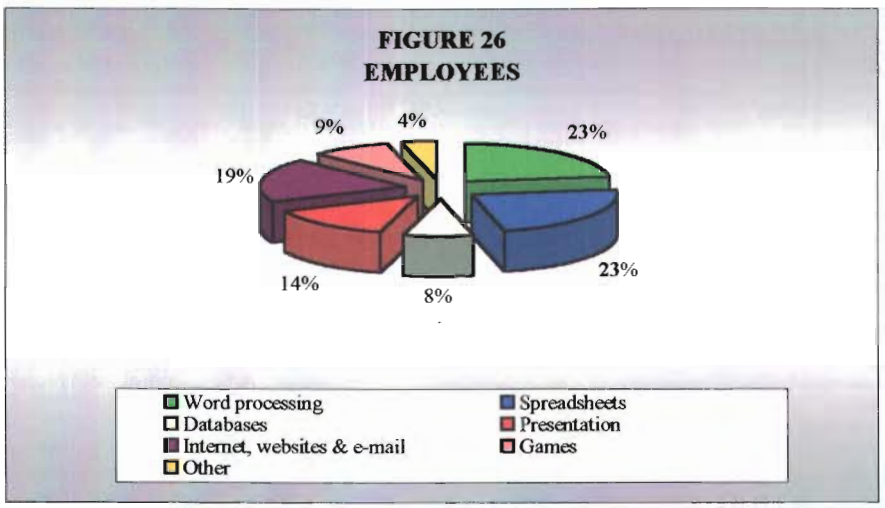
- What types of software applications are being used?
- To what extent is computer literacy a requisite for a job?
- Where did current employees gain computer skills?
- What are the various fields of employment held by the sampled group?

Throughout each of the above points of interest, comparisons will be made with learner data.

What types of software applications are being used?

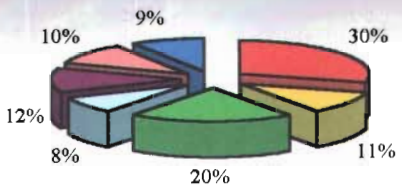
The sample group used the following types of software:

FIGURE 26
EMPLOYEES



From Figure 26 it can be seen that word processing (23%) and spreadsheets (23%) are the most important software used in TI. The software regularly used by learners with a computer course included in their diploma is as follows:

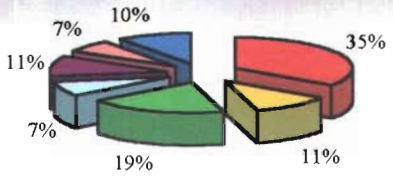
FIGURE 27
TOTAL LEARNERS WITH COMPUTER TRAINING



Word processing
Spreadsheets
Databases
Presentation
Internet, websites & e-mail
Games
Other

From Figure 27 it can be seen that word processing (30%) and database (20%) are the most important software used by learners, but not how capable the learners are in using the software.

FIGURE 28
TOTAL LEARNERS WITHOUT COMPUTER TRAINING



Word processing
Spreadsheets
Databases
Presentation
Internet, websites & e-mail
Games
Other

Figures 27 and 28 only indicate what type of software the learners used and not how capable the learners are in using the software. Both learners and employees used the same software applications as revealed in Figures 26 – 28.

FIGURE 29
MEAN TASK PERFORMED DIFFICULTY

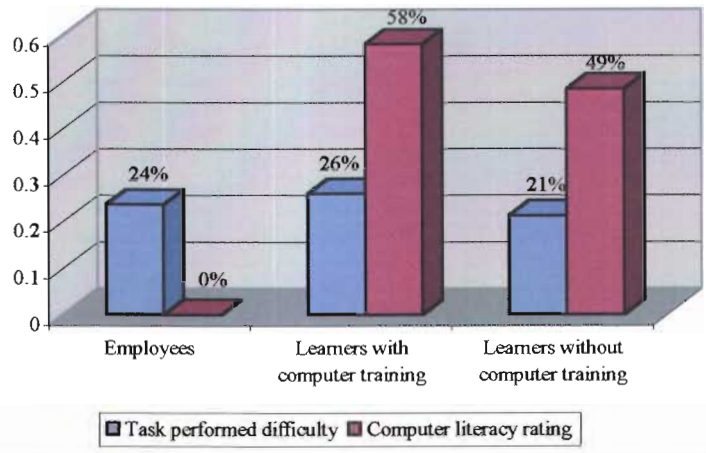
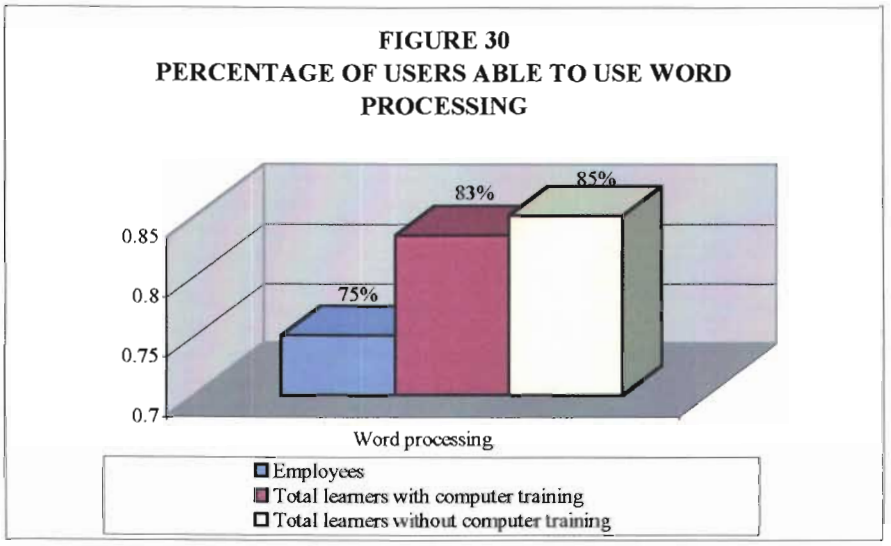


Figure 29 indicates the average difficulty of tasks regularly performed by each group and the variation of the data. No computer literacy data were provided for the employees and thus no comparison could be made on this point. However, one could perhaps assume that at their own level, each group is able to use the software at least reasonably well. This does not mean they could be called experts or even good users.

In order to establish the exact computer literacy levels of learners and employees, a test or examination would have to be carried out and the results compared here.

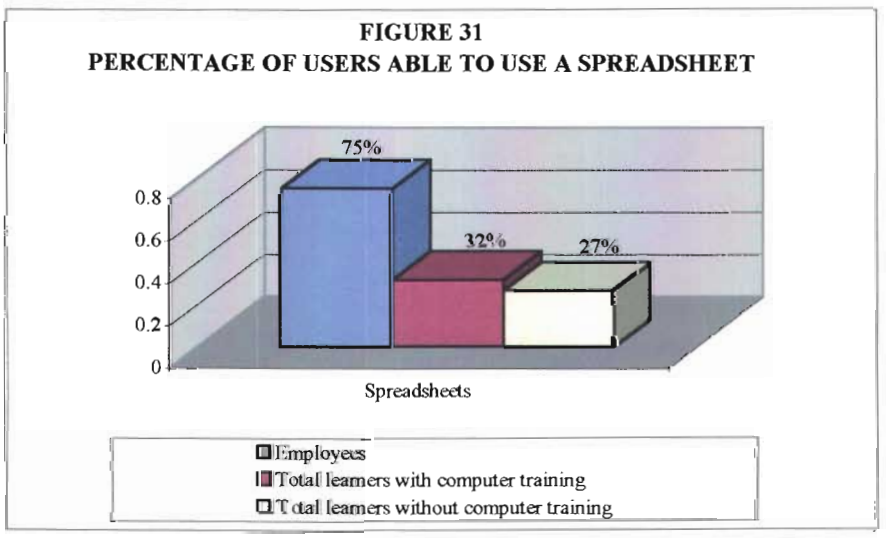
When breaking down the software usage per type and per group, the results are very interesting:

FIGURE 30
PERCENTAGE OF USERS ABLE TO USE WORD PROCESSING



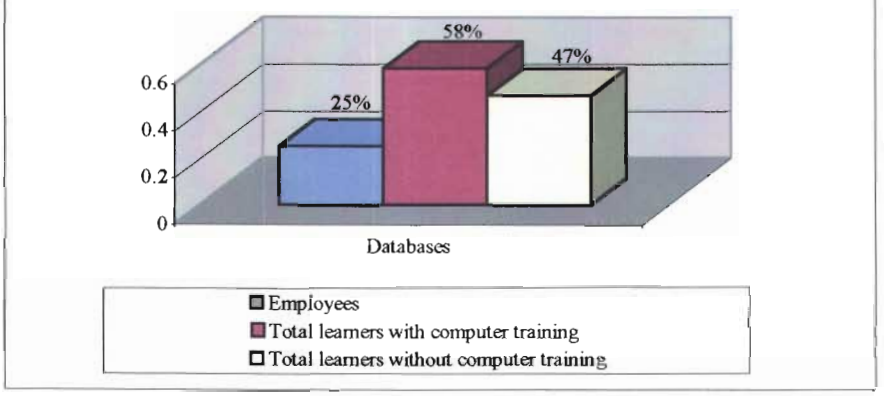
From Figure 30 it can be assumed that learners are able to use word processing software to some extent. There are no examination marks to determine level of competency and therefore it cannot be said that the learners are competent, only that they claim to use a computer program.

FIGURE 31
PERCENTAGE OF USERS ABLE TO USE A SPREADSHEET



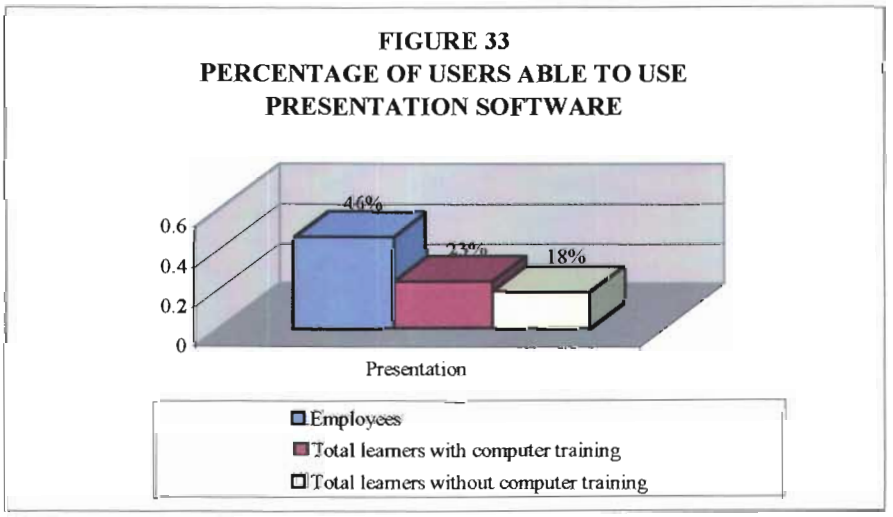
It is evident from Figure 31 that the employees are more experienced and knowledgeable than the learners in their use of spreadsheets.

FIGURE 32
PERCENTAGE OF USERS ABLE TO USE A DATABASE



Although the figure demonstrates that learners use databases more frequently than employees, it could be assumed that learners are able to use databases to some extent.

FIGURE 33
PERCENTAGE OF USERS ABLE TO USE PRESENTATION SOFTWARE



The above graph shows that the employees are more experienced and knowledgeable than the learners in their use of presentation software.

To what extent is computer literacy a requisite for a job?

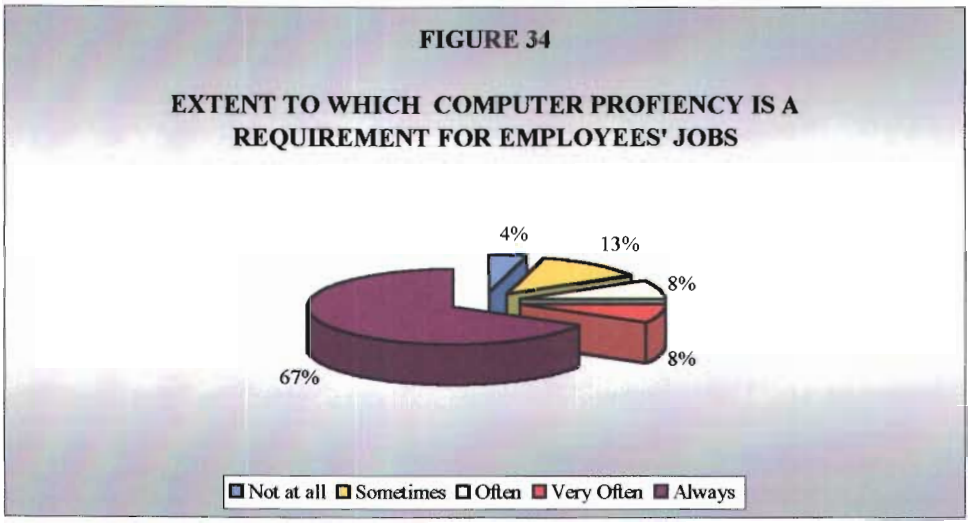


Figure 34 shows that a significant cumulative 96 percent (sometimes, often, very often, always) of the time computer literacy skills are a requisite for employment. Meanwhile, TI leaders are putting more emphasis on recruiting individuals with an understanding of ICT. This is evident from the following abstracts from career opportunities (Anon., 2003:1-8) as indicated in Figure 35.

FIGURE 35

CAREER OPPORTUNITIES

Post number: 1

GAUTENG EDUCATION DEPARTMENT

Chief Financial Officer: Chief Director

Requirements: The candidates envisaged for this post must be:

- Qualified as a Chartered Accountant with extensive appropriate experience in a senior financial management position
- Proven strategic capability and leadership skills
- Problem solving analytical, project management and excellent PC skills
- Thorough knowledge of financial legislation and information systems applicable to the Public Service
- Experience in financial management consulting

Post number: 2

DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM

Senior Administration Officer

Requirements:

- An appropriate Bachelor's degree or equivalent qualification
- Good interpersonal, communication, time management and organising skills
- The incumbent should also be computer literate and have good administration and writing skills in order to write memos, letters and reports

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Post number: 3

GAUTENG PROVINCIAL GOVERNMENT

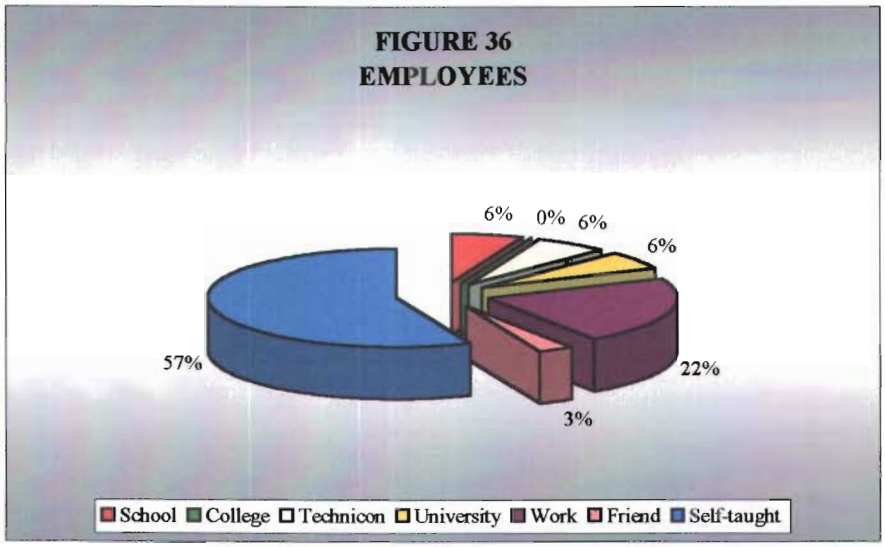
Control Industrial Technician

Requirements:

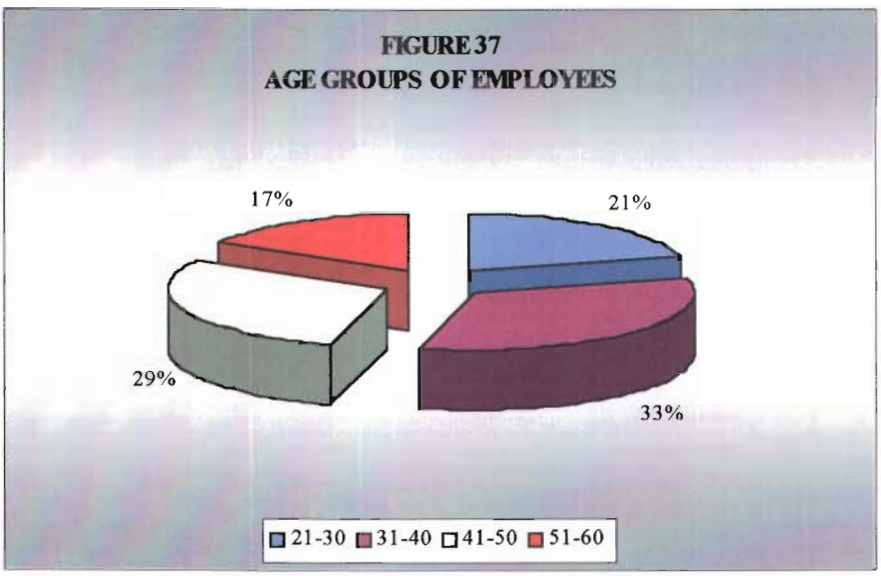
- Post-matric qualification and at least four years relevant experience in DTP and sub-editing
- Strong language skills
- Experience in journalism
- Using Quark Express, Freehand and PhotoShop software packages
- Attention to detail and an ability to work under pressure

From job opportunities (Figure 35) as advertised in City Press (2003) it appeared that computer literacy is a required skill to perform tasks in the workplace.

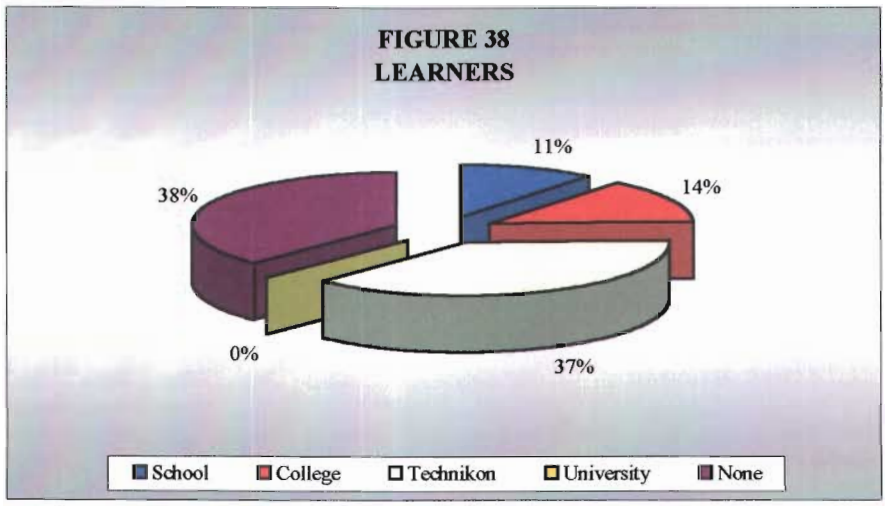
Where did current employees gain computer skills?



It is interesting to note that a fairly large number (57 percent) of current employees are self-taught computer users.

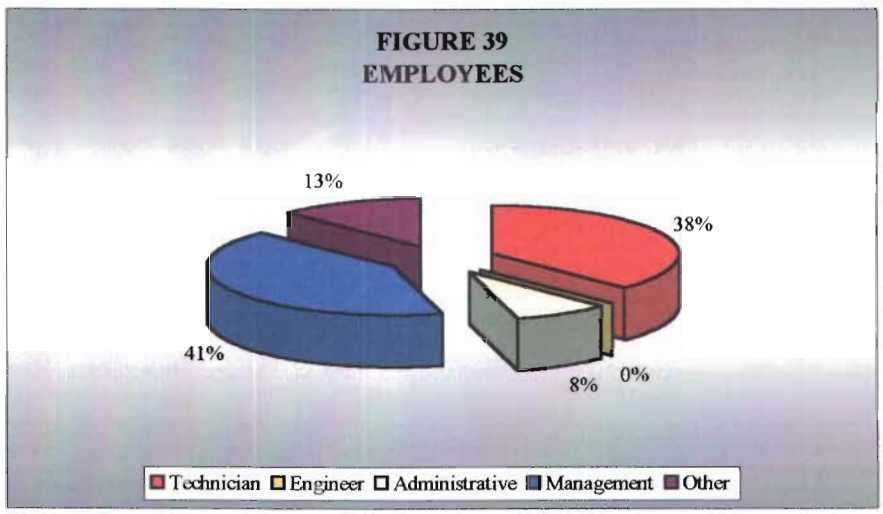


Most (79 percent) of the employees are between the ages of 31 and 50. This statement correlates significantly with the high rate of self-taught users in Figure 36 that one would need to take into consideration as to the availability of computer technology at the time of their studies when they were between the ages of 20 and 30. .



It could be said that 62 percent (school, college, technikon, university) of the learners had to some extent, experience with computers at an education institution.

What are the various fields of employment held by the sampled group?



From Figure 39 above it is evident that computer literacy can be considered as a basic employment requirement skill. All various fields of employment required computer literacy to some extent as a skill to perform tasks, with employees in management the highest (41 percent).

3. SUMMARY

Despite the accessibility of ICT at the VUT, it is noteworthy that word processing was the most frequently used application. Database was the second most frequently used application. The other applications were used with much less frequency. Employees also used word processing most frequently, but spreadsheet was the second most frequently used application.

Some of the questions in the questionnaire were too difficult, as they were asked in most of the learners' second or even third language. This could indicate that respondents selected any option when they were unsure of the meaning of a word or sentence. Learners asked the meaning of words such as 'frequently' and 'rarely' during the completion of the questionnaire.

Employees most frequently used databases and spreadsheets. The uses of the Internet, website and e-mail showed a slightly smaller percentage. Other software applications were less often used. The computer users reported minimal amounts of formal training, as 57 percent (refer to Figure 36) of their computer knowledge was self-acquired.

Surprisingly, females appeared to be more computer literate than the males due to the females' responsibility toward their studies.

The analyses support conclusions regarding computer literacy as a necessary requirement for learners to become efficient users. The latter, as well as the recommendations, will be discussed in the final chapter.

CHAPTER 5

SYNOPSIS, CONCLUSIONS AND RECOMMENDATIONS

1. SYNOPSIS

Computers are globally considered an integral part of daily living in the twenty-first century. The challenge is to employ this extremely powerful tool to its greatest advantage. To do so, users must become computer literate. This means that people should take full advantage of technology to enhance and expand learning opportunities. A general understanding of the organisation, capabilities and limitations of the PC should be developed by the user, but unnecessary technical concepts should be omitted.

Computer availability in HEI is essential, and the advantages of computer-based courses are too great to ignore any longer. The FMS faces a challenging context of special opportunities and problems in attempting to offer programmes for the appropriate use of computers in LPs where deficiency occurs.

Computer history is divided into generations based upon the underlying technology of the time. The first generation of PCs relied on vacuum tubes. Transistors marked the second generation. In the third generation, solid-state technology and integrated circuits were the key features. Microelectronics, specifically the chip and microprocessors, created the fourth generation. Significant new applications have become available that hold special challenges for modern society.

The emphasis has shifted from the physical and mechanical labour required by the Industrial Revolution to the mental labour needed to sustain the latest Information Revolution. During this time data often had to be edited and physically copied more than once by users before it could be processed into

information. Technological advancements have made this cumbersome method almost obsolete. Information is indeed a major concern of today's workforce. Most skill-based jobs heavily depend on the creation, collection, use and dissemination of information.

In the past those with the ability to create computer programs, computer scientists and engineers were the people who could understand and use computers. Only the mentioned people thought to be among computer literate users. PCs are now being used not only in all aspects of the working place, but in all educational fields.

Nothing in computer history has captured the attention of users as the Internet has. Users access the Internet for a variety of reasons:

- to send messages to other connected users;
- to access a wealth of information;
- to shop for goods and services;
- to meet and converse with people world-wide; and
- for entertainment.

While the benefits of the Internet are available to all, learners could gain in using distance education.

Since learners do not have to obtain ideas from various sources to pass examinations, the current emphasis in the teaching and learning environment is mainly on talk and chalk and very little in usage. The broadest possible range of information is available in a "virtual library" in which access to information has no direct connection to physical ownership of items. The challenge today is to replace obsolete data by identifying the volumes of data never known before.

In just fifty years, the computer has had an enormous impact on business, but sadly, education still lags behind. Many HEIs lack contemporary hardware and software resources and the time available in the LP for ICT education is

unfortunately still not enough. This situation has gradually evolved into the current situation where the computer has become another "chalk and talk" tool for educators and learners.

The majority of learners in SA are learners that were previously disadvantaged by apartheid. These learners have little or no experience regarding the professional and academic use of computers. One major factor that has hindered the development of a more information-conscious society in SA has been the nature of the apartheid education system.

The level of computer illiteracy in the country is still very high, especially in the rural areas. There are still not enough users with the requisite ICT skills, particularly users from previously disadvantaged communities and groups. The ability to use computers competently would improve everybody's education and employability.

Being computer literate equips one with the "how" to accomplish a task or solve a problem. Whether one is a learner or employer, the main ingredient in the work situation involves information, i.e. knowing how to get it, how to use it, how to mange it and how to disseminate it to others. At the root of information-based work activities are computers and the systems that support them.

Education has been slower than business in adopting the use of computers. Appropriate steps can be designed to facilitate greater PC usage and acquisition of computer-related skills in education. This is especially pertinent in HE since learners in the early years of their career may be unduly limiting their job opportunities as well as their career potential if they do not possess the appropriate level of computer competence.

The success of many of our large companies relates to ICT. With new applications increasing in complexity, there is a need for users to use the

systems without being them to be proficient programmers. A major challenge for the learner is not only to acquire the knowledge needed to use computers, but to use ICT in ways that can increase the productivity of TI.

2. CONCLUSIONS

The objective of this study was to identify the need for computer literacy courses in LPs for learners in the FMS. From the literature study it is apparent that effective user computer skills are:

- needed as an additional empowerment tool to enable progress during their years of study; and
- are in great demand in the business environment.

Developing such skills should be a key element of management LPs aiming at producing employable workers who have to use PCs as part of their daily activities. HE can go further and recognise the importance of user computer knowledge as an important new discipline and establish relevant programmes to train highly competent users.

The following conclusions emerged from this study:

2.1 Section A

How computer literate is the learner?

It is evident from Figures 8 – 13 that the learners who have a computer course included in their LP, are more computer literate than those without a computer course included in the LP. Conclusions drawn from the above-mentioned figures must be qualified by the acknowledgement of the relative high means from the learners' perceptions of computer self-efficacy. Computer self-efficacy is one's perception of his or her own computing capability (Murphy *et al.*, 1989:5). There are several possible alternative reasons why the means from this instrument are high.

Firstly, learners' perceptions of their own computer self-efficacy (or computer literacy as known in this study) can influence the results of a study. The responses were obtained from learners at the FMS and it must therefore be noted that the data presented in this study are the perceptions of the participants and not necessarily a true reflection of reality. Ropp (1999:5) describes individual perceptions as the lenses through which people understand, interpret and make sense of their world. Perceptions are the product of several components: people's physical and social environments; their psychological structures; their values, needs and goals and their past experiences. This implies that, what may be reality to one person may not be the reality to another. Thus, reality is subjective and is built on people's perceptions. Eshraghi (2001:9) explains that perceptions have great significance in the South African context, especially "... when considering the history of this country. The inequalities perpetuated under the system of apartheid have officially and legally been discontinued, but the psychological perceptions that were created under such a system may indeed be present today. It must be understood that in essence many of the disadvantaged learners have perceptions that are embedded in experiences that emerged under the context of apartheid."

Secondly, the questions could have been too difficult, as the question was asked in most of the learners' second or even third language. The possibility could be that learners selected any option when they were unsure of the meaning of a word or sentence. Learners asked the meaning of words such as "frequently" and "rarely" during the completion of the questionnaire. While South Africans mature their linguistic and cultural diversity, these aspects are unfortunately also sombre barriers in ICT. Most books including all computer manuals in the country are written in English, the language on which information services are based. This has some obvious drawbacks. For the non-English learner the vocabulary, grammar and computer terminology found in the English literature can be a very trying and daunting experience.

What is the difficulty level of the tasks the learners regularly perform and what is the amount of time the learner spends on using a computer?

As presented in Tables 7 – 12, there is a significant correlation between computer aided and non-computer aided learners. Tables 13 - 15 show that data are normally distributed with 95 percent confidence intervals and that no severe deviations occur. If so, it could be said that time used and the difficulty of tasks have an influence on the computer literacy skills of the learners. It was obvious from the responses of both male and female learners that they spent an equal amount of time preparing their tasks. The time spent differed in quality. Comparing the tables in Annexure 4 it is clear that female learners spent their time more productively. Analysis of responses indicated that females have a higher commitment to learn about computer assistance than males did. It also appeared that the learners involved in computer training spend more time in preparing their tasks, which contributes to increased computer literacy. This means that manipulating the two variables (time used and difficulty of tasks) will cause a change in the other variable (computer literacy).

Is there a significant difference in the computer literacy scores of those with computer training courses included in their LPs as opposed to those learners who do not have computer training courses included in their LPs?

Tables 7 – 12 indicate that it can be predicted with 95 percent certainty that learners who have PC training are more computer literate than those without computer training. The results therefore do not support the null hypothesis. The above-mentioned tables also demonstrate that a large number of learners have already used computers before entering a computer course provided in LPs. Even so, learners vary tremendously in:

- how much experience they have had using computers;

- how frequently they use computers; and
- the kinds of applications employed when using PCs.

It can be accepted that non-computer aided learners indicate significant interest in wanting to be computer literate. It is unfortunate that their distinct interest, expectations and attitudes are in some cases not recognised by the current practices of academic computing. These learners will require considerable focused professional support if they are to discover the real significance and importance of computers to their studies, everyday lives and future jobs.

To emphasise this statement Karsten and Roth (1998:4) claim that, although a learner might have concrete computer experience, computer experience *per se* does not guarantee significant interactions with a computer. Dusick and Yildirim, (2000:5) also note that computer courses have been shown to significantly influence computer literacy skills.

Do those learners with home access to a computer have a higher computer literacy percentage than learners who do not?

There is no significant correlation between learners (non-computer aided) having a computer at home and those having access to a computer at the VUT. It would appear that all learners with or without a computer at home do have access to a computer at the VUT. It is notable from Figure 38 that 62 percent of the learners previously had some form of computer access, which had no influence on their computer literate skills. This means that computer training indeed complies with the objective stated: PC training help to improve computer literacy skills. Surprisingly, Crowe *et al.* (1998:2) found that:

- having a computer at home; and
- having exposure to computers at any educational institution did not significantly have an impact on a learner's computer literacy.

Is there a difference in the level of computer literacy between males and females at each level of study?

The results in Figure 24 show that there is a significant difference in computer literacy scores between males and females. A conclusion drawn from the above-mentioned figure must be qualified by an acknowledgement that the females performed much better than the males. Females used their time more productively in preparing tasks that could lead to better computer literacy skills. Another explanation may be that females are much more likely than males to attend computer training courses. From this, it can be accepted that females in general are considered more conscientious in performing their computer-based tasks than males. With organisations constantly striving for increased productivity, HEI LPs should focus on equipping learners with computer skills and time management skills.

In spite of the learners' previous training experiences their ability to use a computer is not sufficient, as the computers are generally under-utilised. In considering the above, Crowe and Howie (1998:1) concede that the availability of computer facilities made no impact on perceived computer literacy or experience. They suggest that appropriate computer training courses are necessary in LPs of learners. From this study it can be seen that learners are not afraid of using technology. Bradley and Russel (1997:12) observe that learners with prior experience of computer technology were found to experience less anxiety over computer use, as compared to learners with less or no experience. Learners with higher computer anxiety have lower self-confidence in their abilities and poorer performance outcomes than learners with lower anxiety levels.

A vast amount of research has been done on gender differences in the workplace pertaining to various topics such as gender differences in factors influencing PC usage. Notably, Harrison *et al.* (1997:1-4) indicate that in the

past few decades females' participation in the workforce has become increasingly important, as they generally comprise a significant percentage of the workforce. On the other hand, most computer-related activities fall within the male domain. For example:

- males exhibit significantly more computer usage than females;
- males are more capable than females in using computers;
- males feel more comfortable than females with computing activities;
- males with previous computer experience demonstrate increased perceptions of competence;
- males have a more favourable attitude toward computers;
- males demonstrate less computer anxiety than females;
- males are the primary designers of computer applications;
- males play a dominant role in computer sales;
- males are predominant in teaching computer courses; and
- males are more knowledgeable in computer languages.

All the above influence learners' ability to effectively master computer skills.

Does access to a particular computer venue have an influence on the learners' computer literacy skills?

The analysis of responses to question 7 indicated that an overwhelming majority (70 percent) of learners previously had access to computer laboratories followed by 20 percent accessed computer centres and a disappointing 10 percent accessed the library.

Only learners with access to computer courses in their LPs have equitable access to computer laboratories as opposed to learners without computer

courses have no access to computer laboratories. Learners with access to computer laboratories supplements traditional methods of presentation by providing powerful communication tools between the learners and the educator directed from the educator's workstation. Unfortunately most of these computer laboratories are not equipped with Internet applications. For most of the learners, visiting these laboratories were their first experience with computers.

Computer centres, where learners interact through computers and the Internet, are situated on the campus. The most prevailing reason for the inaccessibility to these venues seems to be that these centres are mostly fully booked. In order to gain access, learners have to queue outside the door and the waiting time can be as long as three hours.

Computer centres were set up at different sites at the VUT and learners from all faculties throughout the University use these facilities. Initially the provision of such facilities was very successful. As the growth in learner numbers by far surpasses the small number of computers on campus, the facilities offer insufficient access and training opportunities. However, a new ICT centre is already in process at the VUT and will be accessible by 2004. Against this background, Davis (1999:2) concedes that, due to the lack of trained support, computer centres are not an effective environment for learning computer skills.

Electronic libraries are essential tools in this new teaching and learning environment. Working in conjunction with the library, information can be put online to support learners with their studies. However, Yildirim (2000:3) states that Internet searching is useless unless educators are adequately prepared and continuously support learners in using the Internet effectively. The power to discover the right information quickly and easily, to separate 'nice to know' from 'need to know' information is essential if superhighway users are not to drown in electronic junk information (Elliott and Tevavichulada, 1999:4). In response to this challenge, Swigger *et al.*

(1997:55) indicate that while many educators show learners how to use a computer to obtain specific information, few provide them with explicit information seeking skills or tell them how to obtain and use information more effectively. Educators, who are familiar with electronic information sources services, would encourage their learners to explore these sources for their assignments, presentations research projects. Both educators and learners with better computing skills are more likely to benefit from the ever-increasing volume of digital information. Successful outcomes of computer literacy training are associated with trained and knowledgeable educators in the classroom.

2.2 Section B

Throughout this section each question of interest will be compared with learner data.

What types of software applications are being used?

Similarities rather than differences between the two sections seem to best describe the use of software applications in Figures 26 - 28. Both sections use the same general software application (word processing, databases and spreadsheets). Learners without a computer course in the LP prefer word processing above other applications, denying familiarity with a word processing program. Word processing might increase their confidence towards computer usage, should computer training be included in their future LPs. Learners were less familiar with spreadsheets and least familiar with presentation applications. The reasons for under-utilisation presentation software by learners might be a lack of training. From personal experience it is known that learners without computer training in the LPs are not able to use software applications productively.

The learners' familiarity with more advanced applications such as database and Internet services is quite low. One reason could be that there are no

specific computer associated instructions designed in LPs to help learners to use electronic information. Another reason could be that educators themselves lack computer experience. Too often educators view computers as isolated instructional resources that require more time above and beyond their normal instructional planning to meet their current LP objectives. If learners are expected to develop technological fluency, their educators must also possess this fluency. While most educators are eager to use ICT, Fulton (1998:6) mentions that many of them were not taught to teach with computers and other technological tools. From sources studied it appears that motivated educators are now integrating ICT skills into their core studies and are directing their learners to library resources as part of their LPs.

Learners and employees are less likely to use the Internet, with learners 12 percent and employees slightly ahead with 19 percent. The reasons why employees under-utilise the Internet is not a matter of concern to this study. However, a lack of specific training for learners stands as a possible explanation.

Besides the importance of the type of software used in courses, the quality of the course, the quality of the presentation by the educator, effective time management and other important determinants, the duration of periods might also play a role to learners' educational success. Learners in FMS following a computer course have three hours of training per week spread over two years. The number of periods allocated to manage all the computer skills is not sufficient to assure good management of information and seem not to make satisfactory progress during their years of study. If the suggested models on page 57 are considered, the question arises whether it is possible for a learner to become computer literate in such a short period of time.

To what extent is computer literacy a requisite for a job?

The results in Figure 34 indicate 96 percent employer usage of computers, where 67 percent of employees **always** use computers to perform tasks in their jobs. It could therefore be accepted that the frequency of computer usage might indicate more effective computer users. In order to properly establish computer literacy levels of learners and employees, a test or examination would have to be carried out and results obtained should be compared.

From results in Figure 35 it is clear that computer literacy skills were a requisite for employment. Learners should be aware that a lack of computer related activities might constitute a barrier to their occupational success.

The rapid pace of technological advances in the computer industry has forced businesses to reorganise, to acquire the latest computer technology and to demand a computer-literate workforce. Therefore, it is critical for individuals to have the necessary education and skills to compete in this information-intense century. If employees are not capable of using ICT properly, then they will not as effective and efficient as they could be (Vinassa, 2001:30).

Where did current employees gain computer skills?

It is evident from Figure 38 that the majority of learners (37 percent) obtained their computer knowledge from a technikon (university of technology). College training follows this. In response to a general question about computer training, a large percentage (57 percent) of employees were self-taught computer literate. Figure 36 shows that 18 (school, technikon, and university) percent of the employees studied at an educational institution. Among today's learners, only a small percentage (6 percent) had taken a computer course at an education institution. The percentage increased to 22 percent regarding training in the workplace. It is notable (according to Figure

37) that these employees were educated during a period when ICT was not readily available in HEI and only used by specialists in the workplace.

What are the various fields of employment held by the sampled group?

As indicated by Figure 39, the sample included employees representing all ranks in each TI category: technical (38 percent), engineering (13 percent), administrative (8 percent) and management (41 percent). This indicates that computer literacy skills are a requisite in all disciplines in the workplace. It is clear that computers are essential to administrative personnel and thought less important for engineers than for technicians. Management lags behind in using computers. This is hardly surprising, as managers might be the older employees that were trained to do all their planning and calculations manually. Regardless of the discipline, learners should acquire computer skills to be effective information users (TODD, 1998:7). Computer training also seems to be an important factor in TI but it is beyond the scope of this study.

3. RECOMMENDATIONS

Based on the findings, the following recommendations are offered:

- A proper computer program should be compiled and presented to all learners based upon TIs computer literacy requirements. Although most learners are able to use most of the available software, they still seem to be inexperienced in spreadsheets and presentation applications, which according to the employee findings are essential requisites in the workplace. It also appears that educators have a role to play in training the learners in using the Internet effectively. The rapid growth of online electronic information services world-wide raises the question of its impact on learning: on the learning process, on the learning environment and learning benefits for learners. Clearly the dilemma faced by learners

is how to effectively use the new technology in order to find information previously only available in print sources.

ICT training challenges could be met if the following are noted:

- Learners should have access to technology if they were to succeed in the technology world. If implemented correctly and integrated into the classroom, technology could increase learning and productivity. It could improve communication and allow information transfer and collection. It could increase problem solving techniques, and cognitive abilities.
- Learners could either be taught to use technology effectively and use technology to improve their standard of education or they could be resigned to second-rate status in the world.
- It is a reality that the world runs on the latest technology. To lack the ability to work productively with information technology is to ultimately lack the ability to survive. In the workplace the absence of ICT, productivity, information access and problem solving points towards the absence of competitive capability (Rodrigues, 1997:7).

- TI data shows that 96 percent of the time computer literacy is a requisite in some form for employment. It would therefore, be a logical deduction that the better a learner's computer literacy level is, the more able he/she would be at not only performing a job but being productive as well. To do anything less is to deny learners the preparation for life that education promises them. This challenge is of concern to a wide range of industries, and in particular to those industries that embraced automation for labour-intensive, routine tasks and are now looking for ways to improve productivity.
- Furthermore, the learner data show that learners with a computer course included in their LP have a higher computer literacy rating than those learners without any formal computer training in their courses. Making computer resources available to learners so that more time can be spent using different applications (in terms of more time and more and varied

assignments) could increase computer literacy scores. It has been shown in the results from the learner data, that time spent working on a computer has a significant impact on the computer literacy level of a learner. This suggests that learners should be encouraged to enrol for computer classes if they are to increase their level of computer literacy and thus become more competitive in the market place.

Several models are suggested for the integration of computer training in the learning environment of HE learners:

- A general introductory computer course that emphasises useful skills like mastering the keyboard, the ability to open, type, edit, print and save documents. Keyboarding has received little or no attention in learners' preparation or as a requisite in using computers. Until voice recognition is further refined, keyboarding skills will remain important. Venter and Blignaut (1996:29) emphasise that time spent at the keyboard is a significant determinant of computer literacy achievement.
- Learners should master the basic software applications. These include word processing, spreadsheets, databases and presentations in all disciplines, as they are the fundamental tools to success in today's workplace.
- Learners should be able to demonstrate knowledge of basic hardware components and terminology.
- Specialised library research assignments that introduce learners to electronic resources such as catalogues, periodical databases and Internet should be designed. The Internet is an important learning tool as it provides easy and quick access to almost unlimited global information as well as easy and fast communication. It is one thing to have access to the Internet, but another thing to actually use this linkage to share information or do research. Learners may be overwhelmed by information unless they know how to efficiently navigate the Internet by using appropriate search tools. Once learners are computer literate and knowledgeable about searching techniques,

they will start using electronic information sources more frequently and confidently. Assignments will become more meaningful if it is clearly related to the learners' academic programmes.

- Finally, learners should study and understand the uses and misuses of computers in society as a general topic in their education. Teaching learners how computers may be used and what they may be used for are two important topics that require an equally sound academic LP effort. Issues such as computer crime, viruses, privacy and ethics should be included into LPs.

The final question is then, should a computer literacy course be included in LPs to equip learners with the necessary computer knowledge? From this study it should be apparent that effective user skills are in great demand in business. Developing such skills should become a key element in any management studies programme in order to produce employable, computer skilled workers. Effective user skills will enable learners to use any software application in their particular field of work.

It is furthermore recommended that ICT subjects should be included within learners' education courses; and that strategies should be implemented for increasing education support pertaining to computer usage. Yildirim (2000:2) also advocates an approach for developing courses to teach users basic computer skills and provide users with hands-on experience. Therefore, the educators of the FMS face a challenging context of special opportunities to develop and offer programmes promoting the appropriate use of computers. If HE does not understand what they should accomplish with this tool, then it is unlikely that benefits will result from their ill informed attitude.

4. SUMMARY

Learners' interest in using technology is clearly apparent in:

- their use of computer software application; and

- unexplainable attraction to computers in general.

It was determined from the female study that computer familiarity and productive use of time create a higher level of computer knowledge and commitment to learning more about computers. Despite this, the abilities of our learners are insufficient in assuring good management of information and learners do not seem to make satisfactory progress. Although the accessibility of high-quality computer facilities is available it may not be sufficient for management sciences learners to become confident in the use of computers. There is a generalised need to increase the computer literacy level of management sciences learners and a specific need to encourage all responsible stakeholders of the FMS to include a computer course in LPs, if not done yet. The use of the computer as an empowering tool, as well as the integration of computer technology into the LPs of all learners, should be our institution's main priority.

ANNEXURE 1

QUESTIONNAIRE – Learners
COVERING LETTER – Employees
QUESTIONNAIRE - Employees

QUESTIONNAIRE

GROUP A: LEARNERS

Please complete the following questionnaire by marking the appropriate box or filling in the required information where requested.

1. **Gender:**

   Male ☐
   Female ☐

2. **To which population group do you belong?**

   African ☐
   White ☐
   Colored ☐
   Indian ☐

3. **What diploma are you studying for?**

   Management of Training ☐
   Cost and Management Accounting ☐
   Labour Relations Management ☐
   Small Business Management ☐

4. **What level of your diploma are you doing this year?**

   Level 1 ☐
   Level 2 ☐
   Level 3 ☐

5. **Do you have a computer at home?**

   Yes ☐
   No ☐

6. **Do you have access to a computer at the Technikon?**

   Yes ☐
   No ☐

7. If your answer is 'yes', please answer the following questions:

7.1 In which venue/s do you use a computer?

Computer centre ☐
Computer laboratory (class room) ☐
Library ☐

7.2 Indicate the accessibility of:

7.2.1 The computer centre

Only tick the block most applicable to you when you visit the **computer centre** to work on a computer.

Always ☐
Frequently ☐
Rarely ☐
Never ☐

7.2.2 Computer Laboratories (class room):

Only tick the block most applicable to you when you visit the computer laboratories to work on a computer.

Always ☐
Frequently ☐
Rarely ☐
Never ☐

7.2.3 Library:

Only tick the block most applicable to you when you visit the **library** to work on a computer.

Always ☐
Frequently ☐
Rarely ☐
Never ☐

8. Have you followed a computer software application course (hands-on) at

School? ☐
College? ☐
Technikon? ☐
University? ☐
Other? Please specify ☐

9. **Did you follow a practical (hands-on) computer course on any of the following software applications?**

Word processing (e.g. Microsoft Word) ☐
Spreadsheets (e.g. Microsoft Excel) ☐
Database (e.g. Microsoft Access) ☐
Presentations (e.g. Microsoft PowerPoint) ☐
Internet/e-mail ☐
Other – please specify ☐

10. **Did you learn a computer software application by yourself?**

Yes ☐
No ☐

11. **Is there a computer software application course (learning programme) included in your diploma?**

Yes ☐
No ☐

12. **If you use the computer it is to:**
Tick only those blocks that you feel are applicable to you most of the time.

Create assignments for your studies? ☐
Create letters? ☐
Create your Curriculum Vitae? ☐
Send and receive e-mail messages? ☐
Search the Internet? ☐
Visit a Website? ☐
Play games? ☐

13. **How long do you spend time working at the computer per week?**

1 Hour ☐
1-2 Hours ☐
3-4 Hours ☐
5-6 Hours ☐
7-8 Hours ☐
9+ hours ☐

14. When using a computer, do you feel confident with:

14.1 Entering and saving data into a file?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.2 Retrieving a data file to view on the screen?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.3 Handling a diskette?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.4 Exiting from a programme?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.5 Making selections from on-screen menus?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.6 Moving the cursor around the screen?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.7 Using a printer to print your document?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.8 Deleting files when they are no longer needed?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.9 Using the Internet or e-mail?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.10 Understanding terms/words relating to computer software and hardware?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

14.11 Creating directories?

Not at all ☐
Sometimes ☐
Definitely ☐
Most definitely ☐

VAAL TRIANGLE TECHNIKON

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3 September 2002

Dear Employer

QUESTIONNAIRE REGARDING COMPUTER LITERACY

To achieve the M Tech degree in the above-mentioned institution, I have conducted a study focusing on the importance of computer literacy for students and employees.

It will be greatly appreciated if you could assist me with your expertise by completing the attached questionnaire. The information provided will be used to ensure the success of this study and will be treated as strictly confidential.

The questionnaire is user-friendly and it should take about 10 minutes to complete.

Thank you for your cooperation.

A VAN STADEN

QUESTIONNAIRE

GROUP B: TRADE AND INDUSTRY

Please complete the questionnaire by marking the appropriate box or filling in the required information where requested.

1. **Gender:**

Male ☐
Female ☐

2. **Age:**

- 20 ☐
20 – 30 ☐
31 – 40 ☐
41 – 50 ☐
51 – 60 ☐
60+ ☐

3. **Please indicate your job category:**

Technician ☐
Engineer ☐
Administrative staff ☐
Management staff ☐
Other ☐

4. **Do you use computer facilities in your normal day to day work-activities?**

Yes ☐
No ☐

5. **If your answer is "Yes", which of the following applications are you using?**

Word processing (e.g. Word) ☐
Spreadsheet (e.g. Excel) ☐
Database (e.g. Access) ☐
Presentation (e.g. PowerPoint) ☐
Internet ☐
Web site ☐
E-mail ☐
Games ☐
Other ☐

6. Indicate the extent to which you use the above mentioned applications:

Word processing:
0 – 1 hour per week ☐
1 – 2 hours per week ☐
3 – 4 hours per week ☐
5 – 6 hours per week ☐
7 – 8 hours per week ☐
9+ hours per week ☐

Spreadsheets:
0 – 1 hour per week ☐
1 – 2 hours per week ☐
3 – 4 hours per week ☐
5 – 6 hours per week ☐
7 – 8 hours per week ☐
9+ hours per week ☐

Database:
0 – 1 hour per week ☐
1 – 2 hours per week ☐
3 – 4 hours per week ☐
5 – 6 hours per week ☐
7 – 8 hours per week ☐
9+ hours per week ☐

E-mail:
0 – 1 hour per week ☐
1 – 2 hours per week ☐
3 – 4 hours per week ☐
5 – 6 hours per week ☐
7 – 8 hours per week ☐
9+ hours per week ☐

Presentation:
0 – 1 hour per week ☐
1 – 2 hours per week ☐
3 – 4 hours per week ☐
5 – 6 hours per week ☐
7 – 8 hours per week ☐
9+ hours per week ☐

Internet:
0 – 1 hour per week ☐
1 – 2 hours per week ☐
3 – 4 hours per week ☐
5 – 6 hours per week ☐
7 – 8 hours per week ☐
9+ hours per week ☐

Web sites:
0 – 1 hour per week ☐
1 – 2 hours per week ☐
3 – 4 hours per week ☐
5 – 6 hours per week ☐
7 – 8 hours per week ☐
9+ hours per week ☐

Games:
0 – 1 hour per week ☐
1 – 2 hours per week ☐
3 – 4 hours per week ☐
5 – 6 hours per week ☐
7 – 8 hours per week ☐
9+ hours per week ☐

7. How have you learned the most about using computers? (Select only one)

Courses at school ☐
Courses at college ☐
Courses at technikon ☐
Courses at university ☐
Courses offered at work ☐
Spouse and/or friend ☐
Self-taught ☐

8. To what extent is computer proficiency a prerequisite for your job?

None ☐
Sometimes ☐
Often ☐
Very often ☐
Always ☐

9. Does your company regularly send you on computer training courses?

Yes ☐
No ☐

10. If your answer is "YES", where are these courses presented?

College ☐
Technikon ☐
University ☐
Workplace ☐
Other _____

ANNEXURE 2

LEARNER GROUPING

LEARNERS - Males	
Level 1	Q1 - Q14
Computer aided	
Non-Computer aided	
Level 2	
Computer aided	
Non-Computer aided	
Level 3	
Computer aided	
Non-Computer aided	

LEARNERS - Females	
Level 1	Q1 - Q14
Computer aided	
Non-Computer aided	
Level 2	
Computer aided	
Non-Computer aided	
Level 3	
Computer aided	
Non-Computer aided	

ANNEXURE 3

PERCENTAGE CALCULATIONS

Level	Computer literacy score	Computer literacy total	Computer literate %
Computer aided	18	44	41%
	11	44	25%
	27	44	61%
	19	44	43%
	11	44	25%
	30	44	68%
	25	44	57%
	41	44	93%
	25	44	57%
	23	44	52%
Non-Computer aided	15	44	34%
	14	44	32%
	11	44	25%
	18	44	41%
	21	44	48%
	11	44	25%
	22	44	50%
	30	44	68%
	11	44	25%
	11	44	25%

Level	Time used %	Time used	Course included	Tasks performed difficulty score	Tasks performed difficulty %
Computer aided	8%	2	1	4	3%
	8%	2	1	1	1%
	8%	2	1	3	2%
	8%	2	1	5	3%
	8%	2	1	5	3%
	17%	4	1	4	3%
	13%	3	1	56	36%
	13%	3	1	36	23%
	17%	4	1	90	58%
	13%	3	1	95	62%
Non-computer aided	8%	2	0	5	3%
	13%	3	0	5	3%
	8%	2	0	5	3%
	17%	4	1	64	42%
	8%	2	0	0	0%
	8%	2	0	16	10%
	8%	2	0	5	3%
	13%	3	0	27	18%
	8%	2	0	0	0%
	8%	2	0	0	0%

ANNEXURE 4

TIME USED

MALES –TIME USED

SUMMARY OUTPUT

Regression statistics	
Multiple R	0.298323518
R Square	0.088996921
Adjusted R Square	0.073289972
Standard Error	0.174081687
Observations	60

ANOVA

	df	SS	MS	*F*	Significance *F*
Regression	1	0.171707516	0.171707516	5.666085608	0.020602803
Residual	58	1.757657154	0.030304434		
Total	59	1.929364669			

	Coefficients	Standard error	t Stat	P-value
Intercept	0.374784279	0.068339664	5.48413987	9.48927E-07
Time using	1.100595669	0.462366365	2.380354093	0.020602803

	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.23798768	0.511580878	0.23798768	0.511580878
Time using	0.175069526	2.026121812	0.175069526	2.026121812

MALES –TASK DIFFICULTY

SUMMARY OUTPUT

Regression statistics	
Multiple R	0.264557356
R Square	0.069990595
Adjusted R square	0.05395595
Standard error	0.175888253
Observations	60

ANOVA

	df	SS	MS	*F*	Significance *F*
Regression	1	0.135037381	0.135037381	4.364960685	0.041082455
Residual	58	1.794327289	0.030936677		
Total	59	1.929364669			

	Coefficients	Standard error	t Stat	P-value
Intercept	0.482313644	0.031660617	15.23386766	6.19161E-22
Tasks performed difficulty %	0.179713894	0.086018425	2.089248833	0.041082455

	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.418938082	0.545689207	0.418938082	0.545689207
Tasks performed difficulty %	0.007529438	0.35189835	0.007529438	0.35189835

ANNEXURE 5

TASK DIFFICULTY

MALES –TASK DIFFICULTY

SUMMARY OUTPUT

Regression statistics	
Multiple R	0.264557356
R Square	0.069990595
Adjusted R square	0.05395595
Standard error	0.175888253
Observations	60

ANOVA

	df	SS	MS	*F*	Significance *F*
Regression	1	0.135037381	0.135037381	4.364960685	0.041082455
Residual	58	1.794327289	0.030936677		
Total	59	1.929364669			

	Coefficients	Standard error	t Stat	P-value
Intercept	0.482313644	0.031660617	15.23386766	6.19161E-22
Tasks performed difficulty %	0.179713894	0.086018425	2.089248833	0.041082455

	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.418938082	0.545689207	0.418938082	0.545689207
Tasks performed difficulty %	0.007529438	0.35189835	0.007529438	0.35189835

FEMALES –TASK DIFFICULTY

SUMMARY OUTPUT

Regression statistics	
Multiple R	0.478655368
R Square	0.229110962
Adjusted R square	0.215819771
Standard error	0.183617256
Observations	60

ANOVA

	df	SS	MS	*F*	Significance *F*
Regression	1	0.581177745	0.581177745	17.2378	0.000109494
Residual	58	1.9554872	0.033715297		
Total	59	2.536664945			

	Coefficients	Standard error	t Stat	P-value
Intercept	0.460471776	0.030214747	15.23996801	6.1E-22
Tasks performed difficulty %	0.357049572	0.085997836	4.1518437	0.00011

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