A COMPUTER MEDIATED SYSTEM FOR DISTANCE EDUCATION

by

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ABSTRACT

A problem currently facing South Africa is the large number of poorly educated or uneducated people in many parts of the country. Distance education has proven to be an apt solution to this problem. However, one of the numerous constraints associated with studying at a distance is insufficient communication between students and lecturers and the lack of peer interaction.

The integration of Computer Mediated Communications (CMC) in the delivery of distance education courses world-wide has proved to be a means of alleviating this communication problem. The study presented in this thesis examines the technical feasibility of implementing CMC in the delivery of South African distance education courses as a solution to the communication problems experienced by distance learners in this country. For this purpose a system was developed and implemented at a South African distance education institution namely, Natal College of Education in Pietermaritzburg. Based on this implementation a technical evaluation of the feasibility of CMC in the instruction of distance education courses within a South African infrastructure was examined.

As a result of this study we have been able to:

- Determine the technical problems associated with the implementation of a CMC system in a South African distance education environment.
- Identify possible solutions to these technical problems
- Define a set of criteria, which if met by a CMC system would ensure the technical feasibility of the system as a solution to the communication problems experienced by South African distance learners.
- Determine the effects of students' attitudes towards computers on their use of the CMC system.
- Determine the effect of CMC on students' attitudes towards computers.
- Identify any additional factors, besides technical issues, which need to be taken into account when implementing a CMC system.

PREFACE

The experimental work described in this dissertation was carried out in the Department of Computer Science and Information Systems, University of Natal, Pietermaritzburg, from February 1994 to May 1996, under the supervision of Mr R.Dempster.

These studies represent original work by the author and have not otherwise been submitted in any form for any degree or diploma to any University. Where use has been made of the work of others it is duly acknowledged in the text.

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1 INTRODUCTION

1.1 INTRODUCTION

A problem currently facing our country is the large number of uneducated and poorly educated people in different parts of the country. According to Jevons [SMIT87] the only affordable method by which education can be provided in developing nations is distance education. The first section of this chapter examines why distance education is possibly a solution to this educational problem.

Unfortunately, there are several constraints associated with studying at a distance. The most crucial constraint is the lack of communication between fellow students and students and lecturers. These problems are outlined in **Section 1.3**.

Based on the literature surveyed, clearly the implementation of a Computer Mediated Communications (CMC) system in the instruction of distance education courses is a possible means of helping distance learners overcome some problems that they experience. The purpose of the research presented in this thesis is to test the technical feasibility of a CMC system to meet the communication needs of distance learners within a South African distance education environment and infrastructure. **Section 1.4** defines the term "computer mediated communication system". This section then goes on to discuss why CMC should be used to overcome the problems associated with studying at a distance.

Finally, the hypothesis and objectives of this study are presented with an outline of each chapter.

1.2 DISTANCE EDUCATION

This section first looks at why and then how distance education can provide a solution to the education crisis currently facing our country.

According to SAIDE (South African Institute for Distance Education) [SAID94] "the concept of open learning is essential to the reconstruction of education for a democratic South Africa and is a prerequisite for the transformation and restoration of South African education". SAIDE describes open learning as a means of providing all people with "maximum access to learning and knowledge where and when they need it". The only means of achieving open learning according to SAIDE is distance education.

As stated by Sewart [SEWA83] distance learning provides a student with the flexibility to learn when or wherever he or she wants to, at his or her own pace and so promotes open learning. Students who do not live close to a particular educational institution are no longer faced with the problem of travelling to the institution. Furthermore, students are given the opportunity to plan their studies according to any work or family commitments that they may have.

In January 1994 SAIDE conducted an investigation to determine how distance education could be used to solve the education problems facing this country. This investigation included meetings with current providers of distance education throughout the country. As a result of this investigation, distance education was seen as a means to fulfil the following functions:

- study programmes for youth too old for school and uneducated adults,
- providing a means for training people in ABE (Adult Basic Education),
- meeting the need for increased technological literacy, science education and advanced scientific and technological knowledge;
- programmes for teacher education so that the output of new teachers at all levels would be increased and practising teachers can improve their "professional competences";
- as a means to establish a "Second Chance Opportunities for Out-of-school Young People" programme.

Apparently distance education will play a critical role in the resolving of the education crisis in this country. However, there are many constraints associated with studying at a distance. These will be outlined in the next section.

1.3 PROBLEMS ASSOCIATED WITH DISTANCE LEARNING

Distance education is used on a large scale world wide. According to Harasim [MASO89] approximately ten million students throughout the world were taking degree courses at a distance in 1989.

In spite of this there are several constraints associated with studying at a distance. Nicholson [NICH94] a student studying towards a Masters degree at Lancaster University felt that distance education courses are "inflexible". She states that students are provided with materials for the course and are expected to work systematically through them. This is emphasised by Nipper's remark [MASO89], "distance education is authoritarian, as it imposes text or broadcast upon the learners as if the learning material comprises the eternal truth". Students are not given the opportunity to debate issues in these materials or to discuss them with fellow students and lecturers. Jennings [JENN94] explains that distance education frees the learner from the time and place constraints associated with face-to-face education but in doing so it limits or completely removes contact with lecturers and fellow peers.

Alexander [JONE92] stresses that collaborative learning has many advantages over individual learning. Mason et al. [MASO89] describe distance education as not facilitating peer interaction although this is essential for collaborative learning. Instead distance education is described as isolating learners from each other. Students very rarely come into contact with each other if at all. Therefore, there is no chance of students exchanging ideas or opinions with peers. According to Jennings [JENN94] this often leads to the "lonely learner syndrome". This isolation is further stressed by Sewart's [SEWA87] observation that the high dropout rate of distance learners can be attributed to the lack of teacher and peer support.

Mason [MASO89] lists the most common means of communication implemented in distance education to be:

- phone links
- television broadcasts
- radio broadcasts

- transmission of documents via the postal service
- residential meetings

According to Mason [MASO89] the use of the telephone as a means of communication presents a time constraint. The peer or lecturer that the student is trying to contact may not be available at that particular time. Furthermore lengthy telephone calls may not be cost effective. Television and radio broadcasts place time constraints on the distance learner as he or she has to be available at the time of the broadcast.

The disadvantage of students submitting and receiving written work via the postal service is the long turnaround time associated with this mode of communication. According to Mason et al. in some institutions a three-week turnaround time is considered to be good. They stress that this however is too late for the lecturer's or tutor's comments to be of any value to the student.

In the literature surveyed, residential meetings are described as on-campus courses that are usually held at the beginning of every semester or module of the course. Most distance learners have both work and family commitments that make it difficult for them to attend these meetings. Residential meetings place both time and place constraints upon the distance learner.

From the discussion in the previous section it is apparent that distance education will play a critical role in South African education in both the long and short term. Therefore it is essential that a solution to the problems experienced by distance learners be found. Based on the literature surveyed it is evident that a possible solution to these problems is the use of CMC in distance education. The next section defines the term "computer mediated communication" and provides an account of the origin of CMC systems.

1.4 COMPUTER MEDIATED COMMUNICATION

Mason et al. define CMC as the educational uses of electronic mail and computer conferencing while Jones et al. [JONE92] state that "the term CMC embraces a number of systems that

allow the users of linked computers and terminals, connected to a mainframe to communicate with other users."

CMC, more recently also known as **telematics** [GOOD94], allows users to exchange messages and to send files to each other. Furthermore, it facilitates group communication and is typically asynchronous, i.e. the recipient of a message or file does not have to be available to receive the file when it is sent. In doing so CMC does away with both time and place constraints.

CMC facilitates communication by means of E-mail and/or asynchronous computer conferencing. E-mail enables messages in the form of text to be sent from one user to another. Furthermore, E-mail allows for asynchronous one-to-one and one-to-many communication. Computer conferencing on the other hand facilitates group or many-to-many communication. Some implementations of CMC may also include the use of video broadcasting.

Bacsich [JONE87] defines two methods of E-mail. He describes the first of these methods as *point to point* E-mail. This involves a particular user's terminal connecting to the recipient's terminal by means of the telephone line and a modem. The message is then transferred from the user's terminal to the recipient's terminal via the telephone line. The second method of E-mail is referred to by Bacsich as *store and collect* E-mail. Using this form of E-mail if a user wants to send a message he or she dials into a central system after compiling a message and the message for the recipient is deposited into his or her mailbox on the central system. A *store and collect* E-mail system has an advantage over a *point to point* E-mail system in that the terminals used are less complex.

Eastmond [EAST95] states that computer conferencing has similar characteristics to bulletin boards and network discussion groups handled by listservers. However, bulletin boards and network discussion groups "are generally restrictive in the users' capability to form new discussion areas, and they are available publicly and not to private groups". Asynchronous computer conferencing facilitates group or many-to-many communication by allowing several users to join a particular conference. Each user does so by E-mailing his or her opinions and thoughts on a particular topic to the conference. Any contribution E-mailed to the conference is sent to every user that has joined that particular conference.

The recipient/s of a message sent via electronic mail or computer conferencing can then read the message, reflect on it and reply to such a message in his or her own time. **Table 1.1** lists some conferencing systems and the institutions at which they have been developed as described by Bacsich and Mason et al. [MASO89].

Table 1.1: Conferencing Systems

CONFERENCING SYSTEMS	INSTITUTIONS
EIES	New Jersey Institute of Technology
PLANET	Institute for the Future Matrix - Boulder, Colorado
CBIE	Columbia University
CONCLAVE	National Physical Laboratory
CONFER	Michigan University
CoSy	Open University - UK
CAUCUS	Centre for Electronic Communications and Open Systems Support in Education (CECOMM)

The development of such CMC systems according to Zorkoczy [MASO89] began as early as the 1960's. He states that the first CMC system developed was the EMISARI system used by the Office of Preparedness in the USA. This system, together with the PLANET and EIES (Electronic Information Exchange System) systems, formed the first generation of CMC software. These software packages were oriented towards computer conferencing using a "free-form" discussion structure.

The second generation of software packages include Participate, CoSy and COM. These packages provided all the features that the first generation systems offered. In addition to this

the second generation systems introduced electronic mail facilities and catered for larger user populations.

The third generation systems included the CAUCUS system used by the Jutland Open University and VaxNotes used by the Western Behavioural Sciences Institute (WBSI) in California. Zorkoczy describes these third generation systems as having basically the same characteristics as second generation systems with the only difference being that third generation systems facilitated the use of the client-server network model.

Kaye et al. [JONE92] describes the general facilities of a third generation computer mediated communication system to be:

- An electronic mail facility for one-to-one communication.
- One or more means of asynchronous group communication, i.e. conferences.
- A "chat" mode for real time exchange of short messages with other users.
- A directory of all users, with information regarding when they last accessed the system.
- A directory of all listed conferences, with brief details of each one.
- An on line editor and a "scratchpad" for message composition.
- Facilities for file uploads and downloads.

In distance education institutions throughout the world, e.g. the Open University in the UK, CMC has been implemented in the delivery of distance education courses as a means of overcoming certain problems associated with studying at a distance. The next section looks at ways in which CMC provides a solution to these problems experienced by distance learners.

1.5 WHY CMC?

Section **1.3** outlined the problems facing distance learners. The reasons why CMC has the potential to eliminate some of the problems associated with distance education in a South African context are listed below:

- CMC does away with both time and place constraints associated with face-to-face education. This helps students to plan their studies around their work and family commitments. According to Mason et al. [MASO89] " the asynchronicity of CMC augments access enabling students to participate at a time and place convenient to them".

- "The online environment is particularly appropriate for collaborative learning approaches which emphasises group interaction." This remark made by Harasim [MASO89] emphasises that CMC facilitates collaborative learning and hence peer interaction. Students are able to contact each other and share ideas and information. Furthermore they are able to give each other moral support. This is stressed by Riedl's [MASO89] comment, "CMC can provide learners with not only a mutual support mechanism but also a learning environment that is interactive and non-didactic". In this way, CMC enables students to assist each other.

- Mason et al. [MASO89] state that the use of the E-mail option of a CMC system drastically reduces the turnaround time of assignments submitted by students. In addition to this, students can more easily and quickly obtain assistance from lecturers on areas of the syllabus with which they are experiencing problems.

- Messages sent to and by students are usually stored by the system and the recipient can retrieve them at any time that he or she wants to. This is one of the advantages that CMC has over face-to-face education. Riedl [MASO89] states that this enables the lecturer to analyse the stored messages and hence determine the students' level of understanding of a particular subject.

- A benefit of CMC as described by Mason et al. [MASO89] is that CMC reduces any form of discrimination, e.g. sex, gender, race, etc. and hence students who usually find it difficult to contribute to a discussion in a face to face situation interact with fellow students and lecturers far more easily via CMC.

This is emphasised by Harasim [HARA93] who states that text-based messaging

benefits those who may not have a voice in a face-to-face situation due to some type of discrimination.

This is yet further stressed by Bellman's [HARA93] example of Latin American female students who were more active and argued and debated more frequently and easily with their classmates online than in a face-to-face situation.

According to Bacsich [MASO89] within a CMC environment shyness is no longer a problem as it is in a face-to-face conference.

- Mason et al. [MASO89] state that students are given time to reflect upon things when having to respond to a question or comment and are not put "on the spot". Bacsich [MASO89] explains that there is less pressure on the student to generate an impromptu answer.

- In her book "Education on the Internet", Ellsworth [ELLS94] explains that CMC allows the student to play an active role in the structuring of the learning process whereas in traditional distance education this is done by lecturer.

- According to Harasim [HARA93] active participation in computer conferencing provides students with more information on a particular topic by providing each student with multiple perspectives on an idea or theme.

- Harasim also states that CMC provides for a "more equitable pattern of communication among participants" compared to face-to-face learning. In a classroom situation the majority of "verbal exchange" comes from the teacher. In a computer conference students are able to interact.

- CMC allows for guest lecturers or experts to contribute to a particular course and lecture certain modules without having to be physically present on a particular campus [MASO89]. This concept is currently being implemented at Michigan State University. Ellsworth [ELLS94] states that lecturers throughout the state of Michigan and beyond

deliver courses via a CMC system.

From the discussion above CMC appears to not only be a solution to the communication problems experienced by distance learners, but CMC provides distance learners with additional benefits. The study presented in this thesis examines the technical feasibility of using CMC to overcome the communication problems experienced by distance learners in a South African context. The objectives of this study are presented in the next section.

1.6 OBJECTIVES OF THE STUDY

The purpose of the research presented is to first conduct a study of the implementation of CMC systems in distance education institutions throughout the world as a means of providing a solution to the communication problems associated with studying at a distance. Based on this study a system will be developed and implemented in a South African distance education institution. The use of this system by South African distance education learners would provide a means of:

- firstly identifying technical problems associated with the implementation and use of a CMC system in a South African distance education environment,
- secondly identifying the technical characteristics of an effective CMC system for use by novice computer users studying at a distance in South Africa and so determining the technical feasibility of the use of CMC to improve the quality of distance education in South Africa.

Consequently, this study tests the hypothesis that it is technically feasible for a CMC system to meet the communication needs of distance learners given a South African distance education environment and infrastructure.

In an attempt to test the above hypothesis the following objectives will be met:

- Conduct a study of the use of CMC in other educational institutions

- Based on this study develop a CMC system.
- Examine the utilization of the CMC system and hence redefine the importance of this CMC system as seen by South African distance learners.
- Identify the technical problems associated with the implementation of a CMC system.
- Use this system to determine the technical characteristics of a CMC system for novice computer users studying at a distance in South Africa.
- Based on the fourth objective revise the system developed to meet the needs of South African distance learners.
- According to Finnie [FINN87] "attitudes towards computers have been shown to play a significant role in the successful implementation and use of computer systems" and therefore indirectly affects the feasibility of a system. Hence, the relationship between the attitudes of distance learners towards computers and their use of the system will be examined. Furthermore, the effect that using the CMC system has on students attitudes will also be investigated.

1.7 OUTLINE OF CHAPTERS

1.7.1 Chapter 2: Literature Survey

A literature survey has been conducted in three main areas namely:

- Communication networks
- Attitude surveys
- The use of Computer Mediated Communications in distance education.

Chapter 2 firstly introduces each of these topics. It then goes on to discuss the various communication networks that could be used to facilitate computer mediated communications, e.g. BITNET, FidoNet, AT&T Mail, the Internet. Special attention is paid to the workings of the Internet which has become the most popular network used throughout the world.

1.7.2. Chapter 3: Attitude Surveys Conducted

One of the objectives of this study was to conduct attitude surveys in order to determine:

- attitudes of South African distance learners towards computers;
- the effect of the use of the CMC system on students' attitudes towards computers.

Chapter 3 provides an account of similar attitude surveys conducted during the past ten to fifteen years.

1.7.3. Chapter 4: Using Computer Mediated Communications in Distance Education

A number of distance education institutions throughout the world have successfully implemented CMC in the instruction of their courses, e.g. the Open University in the UK, the Jutland Open University in Denmark, the Athabasca University in Alberta, Canada and the Lancaster University. The experiences that these institutions have encountered with CMC are presented in **Chapter 4**.

1.7.4 Chapter 5: Preliminary Study

Chapter 5 firstly examines the specifications of the CMC system implemented. This includes a derivation of a set of criteria which have been used to determine the data communications software package to be implemented as part of the system.

The chapter then goes on to provide some background details on the institution and the students that were involved in this study.

In addition to this a description and evaluation of the pilot study conducted in 1994 is presented.

1.7.5 Chapter 6: The Implementation of The CMC System

Chapter 6 describes the CMC system implemented in terms of:

- The E-mail and file transfer system TELETUTOR developed specifically for the purpose of this study.
- The installation procedures involved in implementing the CMC system.
- The monitoring mechanisms built into the system to monitor the usage of the system.

In addition to this the suite of UUPC (Unix-to-Unix Copy Program) programs which are used as part of the CMC system are described. An explanation of how these programs are integrated with TELETUTOR is also provided.

1.7.6 Chapter 7: Evaluation of The CMC System

An evaluation of the use of the CMC system implemented is provided in **Chapter 7**. This evaluation looks at:

- The purposes for which the system was used.
- The level of interactiveness provided by the system.
- How often the system was used.
- When the system was most frequently used.
- Technical problems encountered by students.

1.7.7 Chapter 8: Attitude Surveys

As part of the pilot study carried out in 1994 an attitude survey was conducted to determine the attitudes of distance learners towards computers. Students were issued with a questionnaire comprised of attitudinal statements to which they had to respond using a seven point Likert scale. The responses to these statements were factor analysed. The results were

compared with those produced by Finnie [FINN87] and Morrison [MORR83].

Prior to the use of TELETUTOR in 1995, students were issued with similar questionnaires. Students were required to complete these questionnaires once again at the end of the course.

Responses to these questionnaires were then analysed to determine whether there was any change in the attitudes of students towards computers. It was also determined whether any change in attitude could be attributed to the use of the CMC system. An analysis of the responses to these attitude surveys are presented in **Chapter 8**.

1.7.8 Chapter 9: Revised System

Based on the evaluation of the system presented in **Chapter 7**, a number of revisions were made to TELETUTOR in an attempt to tailor the system towards the needs of novice computer users studying at a distance. Major revisions made to this system include:

- The addition of an extensive help system.
- A "coach" option which provides users with step by step instructions on how to perform certain functions provided by TELETUTOR.
- A computer conferencing option.
- A number of additional mechanisms which facilitate ease of use.
- A mechanism that enables the tutor or lecturer to send off assignments, study guides, exercises and tutorial letters to all the students enrolled for the course or those on a particular mailing list. When they connect to the server, students are notified by TELETUTOR if they have received any assignments, study guides, etc.
  These are stored in a subdirectory on the students' hard drives and can be accessed at any time via the TELETUTOR interface.

1.7.9 Chapter 10: Discussion

Based on the study conducted, **Chapter 10** provides an overview of the implications of implementing CMC as an aid to the instruction of distance education courses. The results of the evaluation of the use of the CMC system implemented at NCE as well as the results of the attitude surveys conducted are discussed at length.

1.7.10 Chapter 11: Future Research

This chapter examines areas of further research which would contribute to the successful use of CMC in a South African distance education environment. These three areas are divided into the following sections:

- Mechanisms to facilitate ease of use of the CMC system.
- Mechanisms to support possible organizational structures.
- Mechanisms to support possible educational structures.

1.7.11 Chapter 12: Conclusion

Chapter 12 discusses the outcomes of the study by examining how each objective was met.

2 LITERATURE SURVEY

2.1 INTRODUCTION

A literature survey was carried out in three main areas, namely **Communication Networks, Attitude Surveys**, and **Computer Mediated Communications**.

An important component of a Computer Mediated Communication (CMC) system is a communication network. Examples of networks that make communications via a CMC system possible include the Internet, BITNET, USENET, FidoNet and AT&T Mail. These networks are collectively referred to by Harasim [HARA93] as *communication* or *global* networks. The literature survey establishes the origin of these networks. Furthermore, the features offered by these networks, in particular the Internet, are discussed.

An attitude survey was conducted in order to determine whether the use of the CMC system improved the attitudes of students towards computers in general. From an examination of the available literature it is evident that in the past ten to fifteen years there has been a considerable interest in the attitudes of people towards the use of computers. Lee [LEE70] conducted a survey to determine the attitudes of the American population towards the use of computers. A similar study was carried out by Finnie [FINN87] to determine the dimensions[1] of the attitudes towards computers adopted by first year Commerce students enrolled for the course "Business Information Systems 1". These and similar attitude surveys are examined in **Chapter 3.**

Large scale research on the use of CMC in distance education has been carried out in the UK and America. Bellman et al. [HARA93] describe the BESTNET project which involved more than three thousand students and lecturers from institutions throughout the United States and Mexico.

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[1]Dimensions is a statistical term for characteristics of types of attitudes e.g. fear of computers, fascination of computers.

According to Bellman et al. this project involved lecturing at a distance via CMC. It also allowed for academics from different institutions to collaborate on research. The BESTNET project has been extended internationally. A project entitled AFRINET, which has been described by Bellman et al. as an extension of the BESTNET project, is currently being undertaken by the BESTNET project team. This project involves establishing educational, scientific, and social development research links with several African universities and scientific research organizations. Bellman et al. claim that one of the most recent links to Africa is a distance education nursing program that is run in collaboration with the University of California and Universities in Botswana, Lesotho, Swaziland, Zimbabwe, and South Africa.

A review of the CMC systems implemented at various distance education institutions around the world is presented in **Chapter 4**.

2.2 COMMUNICATION NETWORKS

2.2.1 Introduction

Communication networks, also referred to as global networks, are defined by Harasim [HARA93] as "media that connect people". By facilitating computer conferencing, electronic mail, televirtuality and similar media, global networks enable people from different parts of the world to communicate with each other for educational, research, and socializing purposes.

Harasim [HARA93] states that communication via these networks has led to the development of three types of "networlds":

- Social networlds - This category includes the use of electronic mail networks, computer conferencing, bulletin board services, and commercial video text systems.
- Networkplaces - This term refers to work-related communication. Communication networks play an integral part in the lives of many professionals and business people.
- Educational Networlds - Learners can access online classrooms, online workgroups, learning circles and peer networks, electronic campuses and online libraries.

The first communication network, the **ARPANET**, was developed in 1969 by the Advanced Research Projects Agency (ARPA). The Internet, known as the "meganetwork" of the nineties, is described in the literature as the successor of the ARPANET. ARPA used this network to share resources among its sponsored organizations. Concepts such as *host*, *server*, *client*, and *mail list* originated as a result of this project. The ARPANET project also led to the development of the Simple Mail Transfer Protocol (SMTP) in the late 1970's. In 1983 the ARPANET split into:

- ARPANET - for network research
- MILNET - for operational use

Both the ARPANET and the MILNET became backbone networks connecting LAN's (Local Area Networks) into an Internet that was called the ARPANET Internet.

As mentioned above other such networks include BITNET, FidoNet, A&T Mail and USENET. Harasim [HARA93] states that the **BITNET** network connects academic institutions in more than thirty countries. She lists the facilities offered by this network to be:

- Mailing lists
- Discussion groups on various topics
- E-mail
- Short and real-time interactions

FidoNet is described by Harasim [HARA93] as the people's network. It is open to anyone and usually carries no fee. FidoNet consists of more than twenty thousand individual bulletin boards connected across six continents. It facilitates private E-mail, public conferences (group discussions), and file transfers.

AT&T Mail is described by Harasim [HARA93] as a world wide commercial electronic mail service. She states that it connects subscribers to the USENET/UUCP (Unix-to-Unix Copy Program) network.

The most commonly used networks today are USENET and the Internet which are discussed below.

2.2.2 USENET

Both Quartermann [HARA93] and Harasim [HARA93] describe USENET news as having developed independently on a UUCP dialup network. USENET became very popular around 1988. At this stage four hundred news groups had been set up. Harasim [HARA93] describes news groups as discussion forums somewhat similar to mailing lists[2].

USENET news via UUCP via the Transmission Control Protocol (TCP) via the Internet Protocol (IP) was not particularly convenient. According to Harasim [HARA93] this resulted in the network News Transfer Protocol (NNTP) being invented to allow convenient distribution of news over the Internet.

2.2.3 The Internet

Quarterman [HARA93] defines the Internet as a "global network of networks" permitting file transfer and remote login world wide. Furthermore, it supports asynchronous communication. The Internet had 1,88 million users in January 1991 and 4 million users in January 1992. By August 1992 the Internet had one million hosts and between 5 and 10 million users. According to Benson [BENS95] by January 1994 this had increased to 2 217 000 hosts.

Harasim [HARA93] lists the features provided by the Internet to be:

- E-mail
- Bulletin boards
- Library catalogues

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[2]A mailing list is a list of recipients of one or many E-mail messages or files.

- Databases
- Chat lines
- Multi-user domains
- Discussion groups
- Access to supercomputers for scientists and researchers

Ellsworth [ELLS94] suggests that the characteristics of the Internet which make it suitable for use in distance education include the following:

- The characteristics of the Internet make it suitable for facilitating computer mediated communications (a means by which distance learners can overcome communication constraints imposed by distance learning).
- Not time reliant - Messages can be composed, read and sent at a convenient time. Students and lecturers need not be tied to schedules, e.g. they can contact each other early in the day or after midnight.
- Not place reliant - Messages and materials can be obtained and exchanged world wide, while travelling, at conferences, at home or the office.
- Synchronous communication - Occurs in real time, where users are communicating at the same time using Internet Relay Chat (IRC), Talk, etc. Ellsworth states that this form of communication would be ideal for student counselling.
- Asynchronous communication - This refers to communication that does not require each participant to be participating at the very instant that the communication is taking place, e.g. E-mail. Asynchronous communication makes communication across time zones much easier.
- Learning can be structured by the teacher or the student or both.

In addition to the characteristics listed by Ellsworth, Berghel [BERG96] notes a number of Internet "resources" which distance learners would be able to use to access information on the Internet easily. The most common of these is the World Wide Web (WWW or Web). According to Tittel [TITT95], an advantage that the Web has over other Internet "search resources" is that it is based on hypertext-style links. Furthermore, the Web facilitates searches of both documents and indexes as opposed to just searching indexes.

In order to use the Web one would need to have client software running on a machine which will in turn communicate with one or more servers. By using the Web distance learners will be able to search through documents and data throughout the world on a particular topic.

According to Ellsworth [ELLS94] it is essential to vary learning activities when it comes to distance education. The Internet facilitates such variation by providing tools for learning via the following methods:

- Collaborative learning
- Demonstrations
- Didactic learning
- Discovery
- Drill and practice
- Gaming
- Interactive/discussion
- Problem-solving
- Simulation
- Tutorials

Ellsworth stresses that in order to use the Internet as a tool in the instruction of courses, careful planning is required. Instructional materials must be created in a manner which reflects the uses and strengths of the Internet.

2.2.4 Summary

As mentioned above the most common communication networks used are the Internet and a UUPC dialup network.

Using the Internet as the communication network for the implementation of the CMC system would require that each student pays a subscription fee . This would create additional costs for students involved in the study. According to Mason [MASO89] economic barriers often

prevent students from utilizing CMC systems. Hence, these additional cost would possibly discourage students from participating in the study. Furthermore, although there are number of software packages freely available for use with the Internet, these packages are not neccessarily tailored to meet the needs of novice computer users.

On the other hand if a UUPC dial-up network is used, software to use such a network is freely available and hence can be freely distributed to students. Furthermore, the source code is also readily available and hence it would be possible to make any changes to the software if necessary in order to meet the needs of novice computer users studying at a distance in a South African distance education environment. However, both networks were considered in this study.

3 ATTITUDE SURVEYS CONDUCTED

3.1 INTRODUCTION

One of the objectives of the study presented in this thesis is to determine the relationship between students' attitudes towards computers and their use of the system, as well as the effect of the CMC system on students' attitudes towards computers. Literature on attitude surveys conducted to determine attitudes towards computers was reviewed in order to ascertain what methods could be employed to conduct and evaluate attitude surveys necessary for this study.

An account of the literature surveyed in this area is presented in this chapter. Many attitude surveys have been conducted during the past ten to fifteen years. An attitude survey was conducted by Robey [ROBE79] to determine the attitudes of sales persons towards the management information system used by them to keep track of daily sales. A similar study was conducted by Young [YOUN80] at the University of Connecticut, Starrs to determine the effect that a MIS component of an MBA course had on the attitudes of students towards job preferences and the use of computers in certain areas of management.

Other surveys include a survey carried out by Oliver [OLIV93] in 1993 to determine the attitudes of secondary school pupils towards computers. The literature surveyed in this area also included discussions on the relationship between "locus of control" and positive and negative attitudes towards computers. However, the attitude surveys that are most relevant to the study presented in this thesis are those carried out by Finnie [FINN87], Lee [LEE70] and Morrison [MORR83]. An account of each of these surveys is presented below.

3.2 TERMINOLOGY

The purpose of this subsection is to clarify some of the terminology used in the descriptions of the attitude surveys presented in the sections that follow.

3.2.1 Likert Scales

Questionnaires used to measure attitudes towards computers usually contain a number of negative and positive statements regarding the use of computers. Subjects may have to respond to these statements by indicating whether they *agree* or *disagree* with them. In some cases subjects have to specify whether they *agree*, *disagree*, or are *uncertain*. In the former case the experimenter is using what is known as a two point Likert scale while in the latter case a three point Likert scale is being used. According to Oppenheim [OPPE66] the most commonly used Likert scales are five and seven point Likert scales. A seven point scale has the options *strongly agree*, *agree*, *mildly agree*, *uncertain*, *mildly disagree*, *disagree* and *strongly disagree* while a five point scale has the options *strongly agree*, *agree*, *uncertain*, *disagree*, *strongly disagree*.

3.2.2 Factor Analysis

Factor analysis is a multivariate statistical method used to interpret large volumes of data more effectively. Loosely speaking it does so in the following manner. Suppose that fifty subjects responded to attitudinal statements regarding computers. It would be quite a task to study these responses to determine the general attitude of the subjects as a group. However a factor analysis of the data would define the categories into which the responses fall, e.g. *fear of computers*, *fascination of computers*, etc. A factor analysis may reveal two or more such factors.

In order to carry out a factor analysis a statistical process called *principle components analysis (PCA)* is performed. In some cases researchers stop at the end of principle components analysis and use the components derived by PCA to determine the dimensions of users' attitudes. Alternatively, these components are treated as input to the process of factor analysis which results in two or more factors being derived. PCA and hence, factor analysis requires the calculation of the correlation or covariance matrix of the responses to the statements in the questionnaire.

A number of statistical packages can be used to carry out factor analysis, e.g. Genstat, Statgraphics, NCSS, SPSS, etc. The input to such programs is usually a file containing the responses to attitudinal statements. The output from these programs is what is known as factor loadings. The factors are derived from these loadings. In order to make the factor loadings more interpretible the researcher can specify that a process called *varimax rotation* must be carried out by the program.

3.3 A STUDY OF THE ATTITUDES OF THE AMERICAN POPULATION TOWARDS COMPUTERS

In 1970 Lee [LEE70] conducted a study to determine the attitudes of the American population towards computers. At that stage computers were still a fairly new concept.

Based on a psychological analysis of computer cartoons found in popular American magazines as well as interviews conducted with the public regarding their feelings about computers, a set of hypotheses regarding the attitudes of the population were formulated. These hypotheses were used to construct a questionnaire comprising twenty attitudinal statements. These twenty statements were used to measure the public's beliefs and ideas about computers. Subjects had to respond to these statements by means of a Likert scale. The questionnaire also required the subjects to provide certain demographic details.

This questionnaire was administered to a sample of three thousand Americans, eighteen years or older. The responses obtained from the questionnaires were factor analysed using varimax rotation. Two factors emerged.

Statements such as "They work at lightning speeds" and "They are extremely accurate and exact" loaded[1] positively on the first factor. This factor consisted of a set of beliefs indicating that the computer was seen as a beneficial tool to man. Hence, Lee named this dimension of the public's attitudes, the "Beneficial Tool of Man Perspective".

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[1]Loaded positively means that this statement has a factor loading of 0.4 or above.

The second factor expressed the public's awe and fascination of computers. Lee felt that this factor captured the "science-fiction view of the computer" and indicated that people saw the computer as "a relatively autonomous machine that can perform any function of human thinking". Statements that loaded positively on this factor included "They think like a human being can". This dimension of attitudes was referred to by Lee as the "awesome thinking machine perspective". It was found that the majority of the population who viewed the computer as an "awesome thinking machine" came from a low income, low occupational level and poor educational backgrounds.

3.4 A STUDY OF AUSTRALIAN FULL TIME, PART TIME AND DISTANCE LEARNING STUDENTS' ATTITUDES TOWARDS COMPUTERS

The study described below was conducted by Morrison [MORR83] at the University of New England. The students that participated in this study can be categorized into two groups:

- Internal students - These were full time students between the ages of seventeen and thirty years who resided close to the university.

- External students - These were correspondence students who resided in areas that were situated at a distance from the university. They attended only one week of lectures for each course. The rest of the course was completed through correspondence.

Of the 412 students involved in the study 133 were internal students and 279 were external students. The mean age of internal females was 18.9 and internal males 20.4. The average age for external students was 28.2 and 29.8 for females and males respectively.

These 412 students were divided into two groups of 206 students each. Each group contained both males and females. A questionnaire containing Lee's attitudinal statements was issued to each student.

A principal components analysis of the responses from the first group revealed five factors with eigenvalues greater than one. Upon varimax rotation a four factor solution which accounted for 49.25% of the variance was found to be the most acceptable.

According to Morrison the first factor extracted expressed students' negative attitudes towards computers. Morrison labelled this the "negative factor". The second factor obtained was a positive factor. All the statements which loaded on this factor had loaded positively on Lee's [LEE70] "awesome thinking machine" factor. Morrison goes on to explain that the third factor expressed an inadequate understanding of computers. The last factor extracted expressed the concern of students with respect to both the positive and negative implications of the widespread use of computers. Morrison labelled this factor "application".

Initially, a seven factor solution was found for the second group of responses upon principal components analysis. This was reduced to a five factor solution. The first two factors extracted were the same as those extracted in the first study. The third factor extracted in the second study was identical to the fourth factor of the first study while the forth factor obtained in the second study corresponded to the third factor extracted in the first study. Morrison describes the last factor in the second study to be a positive factor which reflected the students' acceptance of computers.

The four factor solution for the first group was then compared with the five factor solution for the second group. The four factor solution was found to be most feasible to describe the attitudes of these internal and external Australian students.

3.5 A STUDY OF THE ATTITUDES OF FIRST YEAR FULL TIME BUSINESS INFORMATION SYSTEM STUDENTS TOWARDS COMPUTERS

Finnie [FINN87] conducted a study at the University of Natal, Pietermaritzburg to measure the attitudes of undergraduate Commerce students towards computers. The study also examined the effect that a first year Business Computing course had on these students' attitudes towards computers.

The syllabus of Business Information Systems 1 covered the following topics:

- An introduction to computing concepts in a business context
- COBOL programming
- Basic systems analysis
- Financial modelling using a DSS (Decision Support System) package

An adaptation of the attitudinal statements used by Lee [LEE70] to determine the attitudes of the American population towards computers was used by Finnie. The questionnaire was administered to 378 students and consisted of twenty attitudinal statements to which students had to respond using a seven point Likert scale.

The responses were factor analysed using the SPSS FACTOR routine. A four factor solution was found to be the most feasible. A two factor solution was also computed in order to compare the results of this study with that carried out by Lee [LEE70]. Pearson's *r* and Catell's salient *s* test indicated that there was a strong correlation between the first two factors obtained by Lee and those obtained by Finnie in this study.

The first factor of the four factor solution found by Finnie was a positive factor and indicated that the students saw the computer as a "beneficial tool to man". This factor accounted for 16.9% of the variance.

The second factor was reflective of a fear of computers and accounted for 13.4% of the total variance.

The third factor was indicative of students fascination of computers. This factor accounted for 6.6% of the variance.

Finnie feels that the fourth factor "reflects a technical appreciation of computers" and is hence, a positive factor accounting for 6.5% of the variance.

The four factor solution obtained in this study was also compared with that obtained by

Morrison [MORR83]. It was found that there was a positive correlation between the first three factors found in this study and that conducted by Morrison. There was no significant correlation between both the fourth factors. The order of extraction of factors in this study differed to that of Morrison. The first factor in Morrison's study was negative while the first factor in Finnie's study was positive. This indicates that while Finnie's study showed the greatest variance on positive aspects of computing a majority of the variance in the study conducted by Morrison accounted for negative aspects of computing.

A second sample of 142 students was used to determine the effect that the course Business Information Systems 1 had on the attitudes of these students. For this purpose student's attitudes towards computers were tested at three different stages:

- At the first lecture.
- Four weeks later upon completion of their first financial modelling case study.
- Upon completion of the course.

142 students completed the first questionnaire while 94 students completed the second questionnaire and 120 the third questionnaire.

The change in attitude score was computed as follows. Suppose that a student scored seven for a particular attitudinal statement in the first questionnaire and three in the second questionnaire the change in attitude was calculated to be -4. Each set of differences was then multiped by the corresponding loadings for each factor. A t-test was carried out to test the significance of any change in attitude score.

It was found that after the first case study students were less positive about computers. Students also seemed to be less "fearful" of computers at this stage. However, after the completion of the COBOL programming module, students' attitudes became negative again. After the first study students no longer viewed the computer with "awe and fascination" and this opinion was retained until the end of the course.

An analysis of variance of the data was conducted in order to determine whether there was any difference in attitude with respect to the sex of the student. At the beginning of the course males seemed to have a more positive attitude towards computers than females. However, at the end of the course there was no significant difference between male and female attitudes. It was found that there was an increase in the positiveness of female attitudes while there was a decrease in male attitude scores. Finnie attributes this to the fact that males had a higher expectation of the capabilities of computers compared to females at the beginning of the course.

3.6 SUMMARY

Based on the literature surveyed it was decided that the attitude questionnaire administered to students would consist of the twenty attitudinal statements used by Finnie [FINN87] (an adaption of those statements which formed Lee's model). In addition to these twenty statements additional statements were added to the questionnaire to test students' attitudes towards the use of computers and CMC in education and distance education respectively. Students were required to respond to these statements by means of a seven point Likert scale.

This questionnaire was administered to students prior to using the CMC system and again at the end of the course using CMC in its delivery. In order to determine the students' attitudes towards computers it was decided that responses to these statements would be factor analysed using varimax rotation.

To ensure that students' responses to this questionnaire were honest and hence, a true reflection of their attitudes towards computers, students were not required to state their names or any other information that they could be identified by on the questionnaire. Hence, it was not possible to measure the change in attitudes towards computers on an individual basis as done in the study implemented by Finnie [FINN87]. Instead an overall change in attitude was measured. Consequently, not all the statistical methods used by Finnie could be used in the analysis of the change in attitude and further methods were examined. These are outlined in **Chapter 8**.

4 USING COMPUTER MEDIATED COMMUNICATIONS IN DISTANCE EDUCATION

4.1 INTRODUCTION

The implementation and evaluation of the CMC system developed in this study is to a large extent, based on the systems implemented and evaluated by distance education institutions world wide. An account of the experiences that some of these institutions have had with CMC is presented below. Each description has the following format:

- Background of the institution and students.
- Expectations of CMC (if any).
- Implementation of the system.
- Evaluation of the system.
- Problems encountered.
- Revised system.

4.2 THE OPEN UNIVERSITY EXPERIENCE WITH CMC

This distance education institution is referred to as the "Open University" (OU) due to the fact that there are no entrance requirements or acceptance criteria for a student to be admitted to the OU. The majority of the students enrolled at the OU are adult learners with both work and family commitments.

The Open University in the UK has done a considerable amount of research on the use of CMC in the instruction of their courses. This research began in 1977 with the MERLIN system and was followed by the CYCLOPS system in 1981. These were followed by CoSy CMC system which was used in the instruction of the course "An Introduction to Information Technology" in 1988.

4.2.1 The MERLIN System

Every [JONE87] states that the MERLIN system was developed specifically for use in the instruction of the course "Images and Information" offered by the OU. This course covered the Fourier transform theory of optics and an application of this theory to topics such as lasers, holography and medical imaging. An average of four to five hundred students enrolled for this course yearly.

The OU employed tutors in different parts of the country to hold face-to-face tutorials for each course that it offered. However, Every states that for this particular course the OU found it difficult to find tutors with the necessary background to run these tutorials. This lead to the development of the MERLIN system which was used to replace face-to-face tutorials in certain areas where tutors were not available.

Every describes the MERLIN system as a combination of CAL (Computer Assisted Learning) programs in the form of computer tutorials and telephone tutorials given by tutors. MERLIN was installed on a DEC System-20 at the OU. At study centres throughout Britain a total of 250 terminals were connected to the DEC system by means of modems and telephone lines. These were available for use by all OU students. Access to these terminals was by means of a booking system.

Students taking this course were required to complete exercises in the printed study material posted to each student. Upon logging into the system via a terminal they then ran MERLIN which prompted them for the solutions to the exercises. These solutions provided by students were used to determine students' weaknesses and strengths and hence, to plan the further dialogue between the student and the computer program.

Every states that some evenings were regarded as "supervised evenings". On these evenings tutors on main sites monitored the students use of MERLIN by means of a program called TUTPAC. TUTPAC enabled the tutor to generate a report on each student's progress. Furthermore, TUTPAC could also produce a list of difficulties that a particular student was experiencing and indicate whether a student would benefit from contact with a tutor. If this

was the case the MERLIN program was then halted and both the tutor and the student were asked to switch to voice transmission.

According to Every the comments made by students with respect to the use of MERLIN indicated that they were extremely enthusiastic about the MERLIN system. Students generally seemed to prefer interacting with the computer tutor rather than the human tutor. Only five to 10% of the tutorial runs involved any interaction with the human tutor.

Every defines the main problem experienced by students to be access to computers. Students had to make a special trip to the study centre to book a time slot to utilize a terminal and this discouraged students from using terminals.

Certain technical problems were experienced. The telephone lines were unreliable. Furthermore, there were certain malfunctions in computer hardware resulting in students not being able to connect to the system.

A telephonic booking system was implemented by which students could book the use of terminals. Every states that the OU felt that the technical problems experienced were beyond their control. It was decided that the OU should look at a home computing policy for students. Every explains that it was felt that fewer technical problems would be experienced if students worked from computers at home rather than from terminals at study centres.

4.2.2 The CYCLOPS System

Sharples [JONE87] defines a user friendly system to be one that is menu driven or provides users with very simple commands to carry out whatever functions they need to. CYCLOPS was designed at the Open University specifically for novice computer users. This system was used to tutor 350 students from 1981 to 1983. Students used the CYCLOPS system to communicate with tutors.

According to Sharples CYCLOPS was installed on microcomputers at regional centres. Tutors and students went to regional centres closest to them and tutorials were held between them via the CYCLOPS system. Sharples states that during a particular session up to ten centres could be connected.

Each centre had two separate telephone links, one for voice communication and the other for the transfer of "picture data". The CYCLOPS interface divided the user's screen into two portions. One was a picture area and the students usually wrote with a light sensitive pen in this area. Whatever was written in this area was transmitted to the screens of all tutors and fellow students that were connected by means of the system at that particular time. Hence, the tutor and the other users would see the same image on the picture area on their screens.

The second portion of the user's screen consisted of a menu of commands. The user could choose specific menu commands to erase parts of or the whole image on the picture area.

Many technical and operational difficulties were experienced by users in trying to connect to the CYCLOPS system. Students were required to complete feedback sheets at the end of each tutorial. The responses indicated that students were unable to manage the equipment. One of the problems experienced was when one telephone line operated, the other often did not. Sharples reports that in some cases three quarters of a one hour of a tutorial was lost due to students misoperating the equipment.

He goes on to stress that some students ignored instructions for CYCLOPS completely and set the equipment up in a manner that seemed second nature to them. According to Sharples one case which stands out was that of a student who, instead of following instructions to wheel the CYCLOPS trolley to the tutorial room, sat all evening in the store cupboard waiting to be connected.

Sharples indicates that the coordinators felt that they did not have sufficient time for testing the equipment and were unable to run carefully monitored field trials during which some of the problems could have been detected.

One of the problems outlined by Sharples is that of the telephone linkup. This linkup was carried out by operators at the British Telecom conference bridge. In spite of the fact that study centres were connected via voice and data lines there was no guarantee that students were able to operate the equipment or that they were present at the tutorial. Furthermore, the conference bridge manager did not see CYCLOPS as being important enough to retrain their operators. As a result of this operators used ad-hoc and often inappropriate linkup procedures.

In using CYCLOPS the user could work in one of a number of states, e.g. DRAW, WIPE, etc. The state that the user was working in at a particular stage was not clearly indicated by the CYCLOPS system.

Sharples describes the CYCLOPS system as operating in one of two modes at a particular time, namely the local mode or the connect mode. Users reported that they experienced some difficulty in determining which mode CYCLOPS was in.

According to Sharples, the following steps were taken in an attempt to solve to these problems:

- Additional status instructions were provided so that the user was always aware of the state of the system.
- In order for the user to determine what mode CYCLOPS was in, a bulb was attached to the terminal. This bulb glowed each time the system was in connect mode.
- A handbook describing the CYCLOPS system was sent to each student and tutor.
- The course coordinators decided that students required more assistance. As a result project members attended study centres to assist students with the tutorial, and suggest solutions to operational problems that they may be experiencing.
- A conference bridge was set up at the OU regional office in Nottingham. Operators were trained to provide the necessary linkup procedures.

Sharples reports that the CYCLOPS project was seen as a success. The system was used in the instruction of courses in the years that followed.

4.2.3 Using CMC in the Instruction of a Distance Education Course

In his paper entitled "An Evaluation of CoSy on a Open University Course" Mason [MASO89] describes the Open University's first encounter with the CoSy system. According to Mason the OU purchased the CoSy system from the University of Guelph, Ontario in 1986. He states that the system was used for the first time in 1988 as an aid in the instruction of the course, " An Introduction to Information Technology".

The bulk of this course was presented in the form of printed material (study guides). Students were required to rent or purchase an IBM compatible computer and printer for home use. Four software packages were covered in the course, namely word processing, database management, spreadsheet analysis and a data communications package. The practical component of the course accounted for 20% of the work.

Mason states that a number of steps were taken to prevent the use of the CoSy system from being seen as an added extra. From past experience it was a known fact that students only regarded work which formed part of an assignment to be important. According to the literature 1 364 students originally enrolled for the course. Of these students 1006 were males and 358 were females. A hundred students dropped out almost immediately and 250 of the remaining students did not write the exam. All students were over the age of 21 and about a half of these students were between the ages of thirty and forty.

Of these students 5% were studying for the first time. Mason indicates that 12% of the students had considerable experience with electronic communications. Mason goes on to report that 20% of the students had no experience with microcomputers before the course.

The OU expectations of the CoSy system as defined by Mason were:

- Students would find computer conferencing much more convenient than travelling to face-to-face meetings with tutors and fellow students.

- Students might find conferencing or E-mail more convenient than telephoning their tutor who could be unavailable when called.
- Tutors might find they could answer a common query once in a conference which all their students could read, rather than many times to individual students.
- The use of CMC would greatly increase access to help and expertise than was previously available to students as distance learners.
- Many students would welcome the equal status of the conferencing environment and the opportunity to contribute from their previous experiences as adult students.
- Interaction with other students.
- Moral support.
- The mail facility would be successful but computer conferencing would not be as popular.
- A significant number of students would experience difficulties. This would include problems with telephone lines, work stations or the conferencing system which would result in them abandoning the use of the system.
- A smaller percentage would drop out because they could not adapt their learning style to this medium.

The literature describes the CoSy system as providing three different areas of communication:

- An electronic mail facility for one-to-one and one-to-many communication.
- A "conversation area" - This is usually depicted by a graphic of an informal group of people. Choosing this graphic is equivalent to choosing an option to submit a message to an informal conference.
- A conference area which allows for many-to-many communication.

Mason stresses that in order to facilitate the ease of use of the system the OU developed its own interface to the CoSy system. This interface provided automated log on facilities as well as an off-line editor for the preparation of messages to reduce connection costs. This interface also included an optional menu bar to help new users execute commands and easily carry out any of the available activities. This interface was developed specifically for use with a Pace Linnet modem. Each student was lent a modem for the duration of the course.

The literature indicates that the quantitative data used to evaluate the use of the system was obtained from three sources:

- The statistics generated by the system.
- A database of 55 questions answered by 75% of the initial number of students.
- Background information collected by the administration section of the university.

After analysing this data, the OU came to the following conclusions regarding the use of the CoSy system:

- About 60% to 70% of the students who returned the questionnaires found computer conferencing less effective for contacting their tutor, getting help, socialising and saving time and money in travelling. Mason feels that this could be attributed to the fact that not many students had logged on at this stage (at the middle of the course) or had just logged on and were still recovering from technical problems of getting connected.
- Mason found that for those students who had made use of the system the availability of increased help was greatly valued. He states that the "Gremlins" conference, where students reported practical problems, become the most popular and helpful conference. Students who were experts could help those that struggled.
- A systems ID called 'coco' was set up to which students could send their queries. During the first three months coco was handling twenty to thirty messages per day and typically replying to queries within 24 hours.
- Students made unequal use of the system. A number of students felt that CMC allowed them to participate more equally than face to face communication. Nearly five hundred of the 875 students who responded to this question agreed with the statement that "individuals can participate more equally in electronic than in face-to-face communication".
- The conference "Forum" was set up for communication between tutors, students and lecturers. However, not many students participated in this conference. Interviews conducted by Mason and messages on CoSy reveal that reasons for non-participation included the following:

- Most of the OU students felt that there was a lack of time when it came to participating. The majority of the students were in full time employment and were married with children. The course itself was quite demanding and students were required to learn new software packages at regular intervals.
- The students were instructed to use the system in the second part of the course and could complete the project at the end of the course with a minimum use of the system.
- The volume of messages in the Forum conference overwhelmed some of the students.
- The nature of messages in the Forum conference on the whole allowed for a broader rather than a deeper understanding of the course issues.
- The sense of addressing a large public audience prevented a number of students from contributing to the Forum.

- Consistent with expectations, students preferred to use the electronic mail facility rather than the conferencing option.
- The technical problems experienced by students are listed in **Table 4.1**.

Mason reports that technical staff found it difficult to manage the degree of technical difficulties experienced by students during the first two months of access. A help desk was set up and students could phone through and obtain assistance. Approximately three hundred calls were received for assistance with CoSy.

One of the persistent problems which frustrated students was the inability to access the computer at Milton Keynes. Faults on the network and poor telephone lines accounted for this. The most frustrating technical problems were those for which no solution could be found.

TABLE 4.1: Technical Problems Experienced by Users of the CoSy CMC System

DESCRIPTION OF PROBLEM	**PERCENTAGE OF USERS WHO EXPERIENCED THE PROBLEM**
Modem set up and dialling	34%
Dialled but no answer	53%
Answered by no "connect"	78%
Stuck at "Select service / username "	35%
No carrier after connected	60%
Stuck at DT200	24%

Mason feels that the fact that these students were able to use the system and overcome problems while setting up the system is justification enough that the system should be implemented as an aid in the instruction of such courses. According to Mason [MASO94] the Open University has subsequently used computer conferencing as an aid in their courses on a large scale.

In 1992 a short course on renewable energy technology was instructed via the use of the FirstClass conferencing system.

In 1994 computer conferencing formed an integral component of an Arts course in Philosophy of Ethics. In his account of computer conferencing at the OU, Mason [MASO94] describes a course currently being offered by the Institute of Educational Technology at the OU in collaboration with the Institute of Educational Technology at London University. This course, entitled "Online education and training", is similar to that offered by CECOMM (see **Section 4.5 pg. 45**) in that both these courses are aimed at educationalists and trainers who want to use CMC in their own educational contexts. The CoSy conferencing system was used in the delivery of this course.

4.3 THE USE OF CMC IN THE INSTRUCTION OF COMPUTER-BASED INFORMATION SYSTEM COURSES

Muzio [MASO89] provides an account of the use of CMC in the instruction of some of the courses for the certificate in Computer-based Information Systems (CBI) offered by the University of Victoria (UVic), Columbia in conjunction with the British Columbia Systems Corporation. This course is basically aimed at managers and professionals. Some of the courses of the CBI were offered at a distance in 1984. In 1988 it was decided that instruction of the CBI course "Computing Tools for Management" would include the use of CMC. This involved students using data communications to send messages and transfer files to fellow students and lecturers.

According to Muzio 24 students enrolled for the course. Of these students 23 were from areas within British Columbia. One student was from Ottawa (2 500 miles from Victoria).

Muzio states that students had to have access to an IBM PC or compatible with two floppy disk drives. Students were required to communicate with the IBM 3080 mainframe at UVic. In order to facilitate such communication each student had to have access to an internal modem or a serial port (RS2320), a connector cable and an external modem. Grandalt series 24 A modems were provided at no charge to students, if required. According to Muzio the data communications software package used was Kermit version 2.2.9.6 b. Students had to use either Lotus 1-2-3 or VP-Planner to submit spreadsheet assignments.

The data communication package used on the mainframe at UVic was MAIL which is described by Muzio as having been developed by Price University, Houston, Texas. To access the network students used the public telephone service. Muzio reports that students who lived in Victoria dialled into the mainframe directly while those living out of Victoria used BCTel's DATAPAC packet switched network.

Muzio defines this course as being a truly distance education course as no face-to-face courses were held to teach students how to operate equipment or how to manage the data communications component of the course. However, a comprehensive program manual was

written that described the necessary data communications procedures. This was distributed to students.

Six of the eight assignments submitted by students involved the transferring of spreadsheet files to the respective markers.

A comprehensive evaluation of the use of data communications was conducted during and after the course. Muzio lists two tools that were used in the evaluation process. Firstly, students were required to complete questionnaires regarding their experiences of CMC. In addition, the use of the system was monitored.

From 19 January to 22 April 571 messages were logged. Of these messages instructors sent 344, students 183 and course coordinators 44. According to Muzio these messages included notes from students supplementing assignment files to the markers indicating that the assignment was sent or explaining why it was late. Markers and instructors used E-mail to send grades and comments on assignments to students.

The greatest concentration of connections to the mainframe were made in the early evenings and near midnight.

Muzio describes the response of the students towards the use of CMC to be the following: Students felt that the data communications experience was invaluable and suggested that it be incorporated into all CBI distance education courses. However, the majority of the students felt that they spent more time mastering the use of electronic mail and file transfer usage than they had anticipated.

It was found that E-mail reduced the time involved in mailing assignments and this was seen as a great advantage. Furthermore, students could obtain assistance from lecturers more quickly than previously.

Course instructors, markers and administrators found E-mail to be an excellent tool for communicating among themselves and students. However, some students did not read or

respond to E-mail messages.

Muzio stresses that students experienced many technical difficulties in attempting to connect to the mainframe. At the beginning of the course 120 hours were spent by the program coordinator and program assistant in troubleshooting. Thereafter ten hours per week was spent on this. Due to the fact that a wide variety of PC's and modems were used some technical problems were impossible to predict. Hence, it was generally difficult to assist students with problems. Some students found the Kermit software inflexible and difficult to use. In spite of this the overall outcome of the project was positive.

According to Muzio a decision was made to use data communications in all CBI courses. This began with the office automation course in September 1988. Certain changes were made to the CMC system. The packet size of the data transmission was decreased. Furthermore, Kermit was rewritten to make it more user-friendly. A user-friendly "configuration program" was written to make the logon procedure easier. Status messages indicating the progress of the logon procedure were included in the new version of Kermit which helped when troubleshooting student problems.

4.4 THE USE OF CMC AT JUTLAND OPEN UNIVERSITY

Lorentsen [MASO89] describes the project 'Picnic' which was initiated by the University of Aalborg, Denmark in order to evaluate the use of computer conferencing in distance education. This project involved implementing the use of CMC as an aid in the instruction of distance education courses at Jutland Open University (JOU), a distance education institution in Denmark. CMC was used for this purpose in the delivery of two arts foundation courses and one archaeology course.

Lorentsen defines JOU's expectations of the use of CMC to be the following:

- CMC would support education by facilitating interaction and dialogue by students based on particular learning processes.

- CMC would provide support for social interaction and strengthen students' identity.
- CMC would provide a means of supporting equality within education.

According to Lorentsen the use of CMC was evaluated in the light of:

- Communication and interaction.
- Learning processes and pedagogical organization.
- Whether CMC promoted exchanging experiences and knowledge among students.
- Whether CMC promoted collaboration.
- Whether CMC helped students overcome any learning barriers that existed prior to its use or instead created new barriers for certain groups of students.

In order to evaluate the use of the CMC system, the staff at JOU ensured that the following system usage data was collected:

- Statistics on the use of the system information.
- Statistics on student participation in particular conferences.
- Statistics on students' interaction with the system.

In addition to this, students had to complete questionnaires on their experience of using the system. Lorentsen describes other forms of evaluation to be: small essays on student background, family and communication experiences and preferences, and interviews conducted with the students.

Lorentsen states that freshmen tended to use the system more than older students. She attributes this to the fact that as the older students had already determined a means of studying at a distance without the use of CMC they did not find it of much benefit.

Lorentsen came to the conclusion that in order for the CMC system to be utilized to its fullest potential by students it had to be integrated into the course. Factors that affected system use were the following:

- Access - Students who used a terminal at one of the study centres used the system less as the system was not as easily accessible as it was to students who had computers at home.
- Introduction to the system - At the beginning of the course the coordinators should stress the potentials and procedures of CMC.
- System design - A lot of effort must be put into this process to clearly define the needs of a particular group of students.

4.5 THE USE OF CMC IN THE INSTRUCTION OF A COURSE ON COMPUTER MEDIATED COMMUNICATIONS

According to Gray [MASO89] in 1988 the Centre for Electronic Communications and Open Support Systems in Education (CECOMM) offered a course on CMC. This course was aimed at teachers and lecturers who wished to learn about the concept of CMC and how it could be applied in their specific educational contexts. Gray emphasises that this course was instructed via the use of a CMC system.

Thirty four educationalists enrolled for this course. The participants resided in areas within and outside of the UK, including Sweden and the Republic of Ireland.

The course was supported by using the CAUCUS conferencing system which was supplied by Times Network Systems Limited. Participants were required to purchase the hardware and had to cover the telephone costs of dialling into the system. In order to provide coherent technical support students were required to purchase either BBC Microcomputers or IBM PC compatibles.

According to Gray the course was initiated by a face-to-face session held at the Times Network Building in London. The purposes of this meeting were:

- Introducing the students to the course itself.
- To train students to some extent on how to use the CAUCUS system.

- To get students to meet each other to initiate group relationships.

A two-week induction period followed this face-to-face meeting. During this period students were required to connect to the system from their own remote locations. Gray describes this period as being a time during which students could overcome technical difficulties and familiarize themselves with the system. One of the tasks that had to be completed by the students involved constructing an autobiography and mailing it to a conference specifically set up for this purpose. Gray states that this was a means by which students got to know each other.

The course consisted of six modules, each being one week long. Lecture notes and exercises were uploaded by tutors and in turn downloaded by students. A conference was set up for each module of the course. Once a conference module was initiated it was not closed.

According to Gray a second face-to-face meeting was held at the end of the fourth module. During this meeting any technical or administrative problems experienced by students could be discussed. Certain concepts mentioned in the course notes were clarified at this meeting.

A number of support conferences were set up and students were required to join them. Gray defines these to be:

- An ADMIN section for course administration.
- A help line for technical queries.
- A "café" section for social and non-course related discussion.

Gray states that students experienced difficulties in accessing the system via the public telephone network. Difficulties were also encountered in using the communications software to download and upload text material.

Gray lists the following additional problems experienced by students:

- CAUCUS automatically reformatted all the text in order to minimise the number of lines used. This became frustrating for users as it resulted in all paragraph alignment being lost.
- Null entries were used as end of text markers. As a result of this any blank lines including those that were used to separate text were treated as end of text markers, hence, any information included after a blank line was left out.
- Any response sent to a conference could consist of at most twenty lines.

In spite of this, feedback from the students was generally positive. An evaluation questionnaire was administered to students in order to determine their experiences with the course and the use of the CMC system. Generally students were pleased about the flexibility in terms of location and yet still being able to obtain support from tutors and peers.

Students felt that "the sense of isolation which is a familiar problem with traditional distance education courses appeared to be minimised".

Gray divides the levels of participation by students into three categories:

- Some students could not cope with unfamiliar working methods or failed to find the time to participate and "dropped out".
- Some students logged in regularly to download information and tutor's comments, but contributed very little or not at all to the conferences.
- The last group of students were those who logged on regularly and contributed regularly to conferences.

Several months after the course participants still kept in contact with each other. Gray feels that on a whole the course proved to be a success and states that CECOMM is continuing to develop the use of computer conferencing in the delivery of its courses.

4.6 THE USE OF CMC IN THE INSTRUCTION OF AN BSc. Econ. COURSE

Nelson [NELS94] describes the experience of the Department of Information and Library Studies at the University of Wales with the use of CMC. The Department of Information and Library Studies (DILS) at the University of Wales, Aberystwyth have run Masters courses via distance education since 1985.

In 1993 the Opening Learning Unit at DILS developed an undergraduate course : BSc. Econ. in Information and Library Studies (including modules on information technology, information retrieval, information systems and advanced information access) which was to be taught at a distance. The course was aimed at people following careers in information service who needed a further qualification in order to progress in their careers. A pre-requisite for the course was relevant work experience and the required academic ability.

The course could be completed within five or three years. At the beginning of the course again at the beginning of their second and third years of study the students attended a residential school. The purpose of these schools was to enable students to meet fellow students and lecturers.

According to Nelson students were required to have access to a computer and printer upon enroling for the course. The use of software formed part of the course. This increased the cost of the course. Nelson lists the tasks for which students were required to use computers:

- The use of CAL packages.
- Student communication.

The first intake of students in 1993 consisted of twenty two females and five males. The average age of students was 39 years. Nelson states that, on average, students taking the course had twelve years of working experience. Students were employed at public and academic libraries as assistants through to managers.

Modems and communications software were only introduced into the course after it was determined how well students coped with IT modules. Nelson explains that "the integrated software package Microsoft Works for Windows" was used for the course. This package consists of a word processor, a data management program, a spreadsheet program, and a data communications program.

During the first residential school students were given the chance to familiarize themselves with the different programs integrated into MSWORKS. Students used the data communications program provided by MSWORKS to send E-mail messages via the Internet.

Nelson states that students indicated that more contact meetings were required. The residential schools were found to be extremely valuable. Unfortunately, the time that it took students to familiarize themselves with the software was underestimated. In conclusion, Nelson felt that the use of CMC in the instruction of this course could be regarded as being a learning experience.

4.7 THE LANCASTER UNIVERSITY EXPERIENCE WITH CMC

The University of Lancaster offers a Masters Degree in Information Technology on both a full time and a part time basis. Goodyear [GOOD94] describes the university's experience with using CMC in the instruction of both the full time and part time Msc courses.

4.7.1 The Full-Time MSc ITL

This degree on courseware design consisted of twelve modules and began in 1989/90. The course involved the design of interactive multimedia learning resources and included training analysis, courseware development, evaluation, training policy and project management. Students had to complete an assignment for each module. This was their main study activity. Students were required to spend 45 minutes on each module. It was expected that a majority of this time would be spent on the assignment component. Students taking the full time course

did not have any or had little prior knowledge of the concepts covered in this course. Students followed three modules in parallel for a five to six week period. This included an intensive one week residential period at Lancaster at the beginning of each session followed by five weeks of home-based study periods.

During these periods students had to contact their lecturers or tutors at least once a week via E-mail. Communication between students and lecturers and tutors was via telematics, i.e. E-mail or computer conferencing.

Goodyear lists the expectations that the staff at Lancaster University had with respect to the use of CMC to be the following:

- To allow students to ask tutors for specific help and guidance, e.g. in clarifying the meaning of something in the study pack.
- To allow electronic seminars, i.e. computer conferences to be held, as a substitute for face to face discussions on campus.
- To facilitate communication about administrative matters.

Students felt that the most valuable contribution of the E-mail network was for moral support among the student group.

Home-based study gave students a great amount of flexibility in how they organised their work. Students were able to send private messages to each other easily, without staff being able to see what was being sent. This built good group solidarity and helped individual students to air their problems, worries and grievances. While the E-mail facility was used less frequently than anticipated, the developers still felt that without this component the course would not have been such a success.

Certain technical problems were experienced by students in the first year in connecting to the computer at Lancaster from home at 300 baud. In spite of this, Goodyear states that the full time program was seen as a success. Of the 74 students who had taken the course, 65 passed, 14 with distinction.

4.7.2 The Part-Time MSc in ITL

Goodyear states that in January 1992 the part time MSc degree was offered. Students included people from commerce and staff from higher and further education institutions. Instead of using the E-mail system as with the full time MSc, the CAUCUS conferencing system was used. According to Goodyear each module began with a 24-hour residential session. This was followed by eight weeks of home based study, followed by another 24-hour residential session. This session was optional and covered assignment tasks. This was followed by another four weeks of home based study at the end of which completed assignments were submitted. Six modules were offered each year so that it took a minimum of 24 months to complete the programme. Students were able to join the programme at any point and 3-4 students joined the programme every two months or so.

Student use of CAUCUS was voluntary. Goodyear lists the following factors that affected students decision to use CAUCUS or not:

- If the main reason for enroling for the course was to get an MSc rather than to benefit as a whole from the program they tended not to use Caucus.
- Whether they were frequent users of E-mail and/or computer conferencing. "Although the basics of Caucus are not hard to learn, it is a rather clumsy menu or command driven system, which feels antiquated to many Windows or Macintosh users."
- Whether they had access to a PC or Mac in their preferred place of study.

An analysis of the usage of the system indicated that the facilities provided by the CMC system were not used on a large scale. Goodyear attributes this to the following factors:

- There appeared to be little need to login to the electronic conferences. Course materials, input from residential sessions and work colleagues provided adequate resources for the majority of participants.
- Many students could manage very well without the CAUCUS system. They could obtain a distinction for an assignment without using the system.

4.8 A STUDENT'S PERSPECTIVE ON CMC

Nicholson [NICH94] describes her experiences with using CMC which formed an integral part of the MSc course offered at Lancaster University. This was a two year course.

Nicholson feels that although traditional distance education courses do not require students to travel to a centralized institution they are inflexible. Furthermore, she states that face-to-face meetings should form an essential part of distance education courses as it gives students some support and prevents them from feeling isolated. However, she found that travelling to an institution for lectures makes these sessions stressful.

Nicholson feels that CMC removes all the problems related to studying at a distance. In addition to this she sees CMC as a facilitator of discussions with tutors and other course members at a time which suits the individual student.

Nicholson had access to the CMC system via the network "JANET" which she used from work. She explains that some students, like herself, had access from work while others had modem links at home. This led to certain compatibility problems. She states that a common problem experienced by her and other students was the "nature" of the mainframe systems that they logged onto. They found these systems, in particular the editors, difficult to use and the interfaces were not sufficiently user friendly. Nicholson states that this led to the disillusionment of students.

According to Nicholson an ideal system should have the following attributes:

- Access must be easy. However, she feels that this is something which organisers may have little control of at their own institutions or at the students' location.
- Once accessed, the system must be easy to use.
- The first introduction of the system to students must proceed faultlessly or the students' confidence will be lost.

Nicholson stresses that students have to be encouraged to use the system. To ensure this she

states that the system should be incorporated into patterns of work from the beginning of the course. Furthermore, she stresses that students must be convinced that the CMC system is worthwhile to use.

She lists the following ways of encouraging students to use the system:

- Tutors should require students to submit a piece of work that will contribute to a general discussion.
- Informal communication should be encouraged, e.g. the café conference.
- Short biographies of each student should be set up. This would provide a means by which students can introduce themselves.

4.9 SUMMARY

From the literature reviewed in this chapter it is evident that the use of a CMC system in each of the distance education institutions described has helped students overcome some of the problems that they have experienced as distance learners. Muzio [MASO89] states that the study on the use of CMC that she conducted at the University of Victoria revealed that the use of CMC reduced the time involved in mailing assignments and hence, reduced the turnaround time associated with the submission of assignments. Furthermore, students felt that by using the CMC system they were able to obtain assistance from teachers quicker than they did previously.

In addition to this CMC has been seen as a facilitator of communication. This is emphasised by following responses obtained from students in the study conducted by Gray [MASO89]. According to Gray students were pleased at being able to obtain support from tutors and peers. Furthermore, Gray states that students felt that "the sense of isolation which is a familiar problem with traditional distance education courses appeared to be minimised".

These findings are confirmed by feedback obtained by Goodyear [GOOD94]: "Students felt that the most highly valued contribution of the E-mail network was for moral support among

the student group".

Clearly, in spite of the difficulties experienced in setting up a CMC system, the use of CMC in distance education has proved to be a means of facilitating communication in a distance education environment.

The purpose of the study presented in this thesis was to determine the technical feasibility of the implementation of a CMC in a South African distance education environment in order to provide a solution to the communication problems experienced by South African distance learners. The first step in this study was to develop a CMC system. Based on the literature surveyed the following points were used as a basis for the development and implementation of the CMC system:

- It is evident from the implementation of all the CMC systems discussed that technical problems have appeared to be inevitable. Developers of the Merlin system state that students experienced numerous technical problems. They feel that if students worked from a computer at home rather than from a study centre there would have been a reduction in the number of technical problems encountered.

  At times students using the CYCLOPS system spent three quarters of a tutorial attempting to get the equipment to work. The technical difficulties experienced in implementing CMC systems are further stressed by Mason [MASO89] who states that the technical problems experienced by users of the CoSy system were difficult to handle. A help desk had to be set up in order to assist students with technical problems. This is yet further emphasised by Muzio's remark that at the beginning of a course instructed using CMC 120 hours were spent troubleshooting.

  Consequently, it was anticipated that in the study presented here students would experience certain technical problems. Based on the results of the Merlin study it was decided that students should work from computers at home rather than from a study centre. It was also decided that a support system should be set up to assist students with any technical problems that they may experience. The support system comprised

the following:

- After students were given a chance to experiment with the CMC system a face-to-face meeting, similar to those described by Gray in the CECOMM study, was held with students. Students were able to bring their computers to these meetings in order to obtain assistance with any technical or other problem that they were experiencing with using the system.
- A help line - a telephonic help line was set up. Students could phone in between 6:00 pm and 10:00 pm during the week and at any time during weekends to obtain assistance with any problems they may be experiencing.
- Students living within Pietermaritzburg area were visited in order to assist them with their problems.

- Sharples [JONE87] in his description of the CYCLOPS system found that it was necessary to send students handbooks describing how the CYCLOPS system was used. Thus comprehensive installation and user manuals were sent to students in the present study.

- The configuration of the CMC system developed in this study was based on the CMC systems presented in this chapter. An in depth discussion of this is provided in **Chapter 5 (Section 5.3: Systems Overview)**.

- According to Nichlson [NICH94] it is essential for the CMC system to be integrated into the course for which it is being used. This is further emphasised by Lorensten's [MASO89] remark that in order for CMC to be used to its fullest potential it should be integrated into the course for which it is being used. This was kept in mind in the implementation of the CMC system. However, it was anticipated that some difficulties may arise in an attempt to do this as one person ran the course and another person implemented and managed the use of the system.

- Mason [MASO89] states that steps were taken to prevent CoSy from being seen as an added extra. Students only regarded work which formed part of a assignment to be

important. Hence, it is evident that the use of the CMC system should be integrated into whichever course it is used in teh delivery of as a compulsory component. This would normallt require a change in organizational structures which again was anticipated as a possible problem as the person running the course and the person implementing the system was not the same person.

- In the studies conducted by Mason [MASO89] and Muzio [MASO89] feedback was obtained by means of questionnaires and statistics generated from the system. For purposes of the study presented in this thesis it was decided that a questionnaire would be administered to students to obtain feedback on their experience with using the CMC system. In addition, monitoring mechanisms were built into the CMC system in order to obtain statistics on the use of the system.

5 PRELIMINARY STUDY

5.1 STUDENT AND INSTITUTION BACKGROUND

In order to determine the implications and technical feasibility of using CMC in distance education, a CMC system was implemented as an aid in the instruction of courses offered by Natal College of Education (NCE), a distance education institution in Pietermaritzburg. NCE provides courses for qualified teachers in the primary and junior secondary sectors who wish to further their studies in education. The majority of the students enrolled at the college reside in the rural areas of Kwa-Zulu Natal. The college offers three diplomas:

- A DIPLOMA IN EDUCATION (D.E.) - Students that register for this diploma must have at least a two year teaching diploma or certificate.
- A HIGHER DIPLOMA IN EDUCATION (H.D.E.) - In order to register for this diploma students must have a three year teaching diploma.
- A FURTHER DIPLOMA IN EDUCATION (F.D.E.) - Students are allowed to register for this diploma provided that they have obtained at least a D.E. or a H.D.E.

The only forms of communication between students and lecturers are:

- The postal service - The majority of the communication between students and lecturers is via this medium. Students are sent "tutorial letters" specifying dates for assignments, other important dates and information regarding each course for which they are enrolled. In addition to this, all study material is printed and mailed to students via the postal service. Students submit three assignments per year. These assignments are posted to the college where they are marked and posted back to the students.
- The telephone - Students phone lecturers to make certain enquiries regarding the course.
- Regional meetings - These involve lecturers travelling to regional centres (i.e. Empangeni, Port Shepstone, Newcastle, Durban, and Pietermaritzburg) at which they deliver lectures to students. There are approximately three such meetings per year. Not all students attend these meetings due to travelling inconveniences or work and

family commitments.

- Weekend courses - These are on-campus courses which involve students attending lectures at NCE over a Friday and Saturday or on a Saturday only. Accommodation is provided by means of residences on the campus. There are one or two such meetings per year.

Both weekend courses and regional meetings are infrequent and when they are held, lectures are intense and students are bombarded with an abundance of new ideas simultaneously. Another constraint which prevents frequent communication is that a large number of students enrolled at the college reside in outlying areas such as Empangeni, Port Shepstone, and Newcastle. Furthermore, the working hours of both college staff and students are the same, hence, times during which lecturers are available to provide assistance are times during which the students themselves are at work.

5.2 COURSE BACKGROUND

NCE offers a two year Further Diploma in Computer Literacy. The syllabus for this diploma includes topics such as LOGO programming, DOS, word processing, databases, spreadsheets, computer crime, and viruses during the first year of study. Topics such as computer didactics, evaluation of software, and advanced LOGO programming are studied during the second year of study.

An appreciable amount of LOGO programming is covered in both years of study which usually requires much interaction between students and lecturers in order for students to cope with the course.

5.3 SYSTEMS OVERVIEW

In Mason's [MASO89] discussion of the OU's first encounter with the CoSy system he states that students used the E-mail option more frequently than the computer conferencing option

of CoSy. In some cases the computer conferencing option was not used at all. Mason attributes this to two factors:

- Students were overwhelmed by the large volume of messages received.
- Contributing to a computer conference made students feel as if they were addressing a large public audience.

This is reinforced by the remark made by Alexander et al. [MASO89] that with respect to computer conferencing "users are often faced with information overload". Thus based on the literature surveyed and on the fact that the prospective users of the CMC system were novice computer users it was decided that initially the CMC system would only provide an E-mail and file transfer option.

Bacsich [JONE87] defines two methods of implementing E-mail, namely the *point-to-point* and *store and collect* methods. These methods were outlined in **Chapter 2**. The CMC system implemented in the study used the store and collect method. The reason for this was, firstly, according to Bacsich the procedures involved in using the point-to-point based system are much more complex than those involved in using a system developed using the store and collect method. Secondly, the store-and-collect method reduces the cost involved in using the system. Hence, a client/server network configuration was implemented. A mail server *APOLLO* was set up at the Department of Computer Science and Information Systems, University of Natal, Pietermaritzburg. To send a message or a file to a fellow student or lecturer the user had to implement the following:

- Compose the message or file on his or her machine.
- Dial into the server upon which the message was transferred to the server and stored in the recipient's mail subdirectory.

Upon the recipient dialling into the server *APOLLO* the message or file would be transferred to his or her machine.

5.3.1 Mail Server Software and Hardware

The mail server *APOLLO* was a 386 SX 25 with 4 megabytes of RAM and a 100 megabyte hard drive. The operating system running on *APOLLO* was a pared down version of Linux. The Taylor implementation of UUCP (**U**nix to **U**nix **C**opy **P**rogram) controlled the data communication activities on *APOLLO*. Two telephone lines were connected to *APOLLO* via two 2400 baud internal modems.

5.3.2 Client Hardware

In order to enrol for the F.D.E. in Computer Literacy each student had to have access to an IBM compatible computer with at least version 3.3 of MSDOS installed on it. The configuration of the clients ranged from XT's with 640 kilobytes of RAM, 20MB hard drives and DOS 3.3 through to 486's with at least 4MB of RAM, 210 MB hard drives and Windows 3.1 with DOS 6.2.

Four of the 106 students enrolled for this course had modems installed on the machines they were using before registering for this F.D.E. The rest of the class either purchased or hired 2400 baud internal Zoltrix modems from NCE.

The reasons for choosing this modem configuration for use by the students were:

- These modem cards were more affordable than external modems and modems with a higher baud rate.
- It was felt that 2400 baud modem cards would have the capacity to adequately transport the anticipated traffic to and from the mail server *APOLLO*.

5.3.3 Client Software

It was decided that the data communications package used on each client would be DOS based

rather than Windows based. This was due to the following reasons:

- Students were required to have access to at least version 3.3 of DOS.
- PC's used by students ranged from XT's and 286's through to 486's. Hence, some of the computers used by the students were not powerful enough in terms of processing speed, the amount of RAM, and the amount of disk space necessary to run the Windows operating system.

The following software-communication network combinations were considered:

- UUPC using a UUPC dialup network.
- SNUUPM using a UUPC dialup network.
- PCBEL using Telkom's BELTEL facility.
- MSWORKS using the Internet.

Mason [MASO89] states that an adaption of the Cosy system which was developed at the University of Guelph, Ontario was used in the implementation of the CMC at the Open University in the UK. An interface that met the needs of students at the OU was developed to the original version of CoSy. Hence, a possible software option would be to use one of the existing packages, but develop an interface to the system that would meet the needs of novice computer users. All the packages above, with the exception of UUPC, already have user interfaces. It was felt that instead of trying to adapt an existing interface to meet the needs of users it would be more effective to create a new interface. Furthermore, the source code for the packages mentioned above were not readily available. Consequently, it was decided that another software option would be to use an adaptation of UUPC which would include an interface with the following features:

- The interface would automate installation procedures.
- The interface would include a help facility which would assist students to use the options provided.
- Options that would be used regularly by students would be at the first level of menus and appear at the beginning of the menu lists.

- An editor would be provided in which students could compile and edit mail.

In the discussion below this software package will be referred to as **NCETELENET**.

These data communication packages were evaluated in order to find a package that would be suitable for use by novice computer users studying at a distance within a South African distance education environment. Based on the literature reviewed a set of criteria were developed for evaluation purposes.

In order for a CMC system to be feasible in a South African distance education environment the cost involved in the use of such a system would have to be minimized. The importance of a CMC system being cost effective is further emphasised by Kaye [MASO89] who states that users have to overcome certain economic barriers before they can see the potential of CMC.

According to Nicholson [NICH94] CMC systems that are neither user friendly nor easy to use often lead to the disillusionment of users. A majority of South African distance learners would not have used a computer previously and hence, it is essential that the CMC system is easy to use.

Consequently, ease of use and cost effectiveness were the two areas used to derive the criteria used to select a software package which would form part of the CMC system.

5.3.3.1 Derivation of Criteria

The following criteria were derived:

Ease of Use:

1. The package must be menu driven as opposed to using command line instructions.

According to Alexander [JONE92] some CMC systems still use command line interfaces

requiring the user to know a specific set of commands. Alexander points out that this can put quite a load on a novice user.

Furthermore, Sharples [JONE87] defines a user-friendly system for novice users as one that is menu-driven. This is further emphasised by Mason's [MASO89] remark that it was essential that the interface to the CMC system CoSy be menu driven in order to assist users to utilize the package.

The users of the CMC system implemented in this study were novice computer users, hence it was essential that the software package used on each client was menu driven. Furthermore, it was anticipated that a menu-driven environment would simplify the user procedures involved in performing certain functions.

2. *Easily Extendable*

According to Fernberg [MASO89] a CMC system should be tailored to meet the needs of a particular group of users. The software package originally implemented as a component of the CMC system must be adaptable in the long run.

3. *Options commonly used by users should be easily accessible*

According to Fernberg [MASO89] options that users are likely to use often should be clearly identifiable and easily accessible, e.g. users should not have to go through two or three levels of menus in order to choose an option that is used frequently.

4. *The software package must be easy to install*

A majority of the software packages require the user to have some knowledge of data communication in order to install the package successfully. Users usually have to provide details such as the baud rate at which the modem operates, an initialization string, the communication port on which the modem is installed, etc. Incorrectly specified details could possibly lead to users experiencing a number of technical problems.

As the users of the CMC system were novice computer users the package would have to be easy to install and require the student to have a minimal knowledge of data communications. This in turn would to reduce the "inevitable" technical problems experienced by users.

5. *Menu guidance or a help facility should possibly be provided*

According to Mason [MASO89] in order to facilitate ease of use the CoSy interface provided different degrees of menu guidance. As the users of the system presented in this thesis were novice computer users it was decided that the software program should provide such a facility.

Cost Effectiveness

6. The software package must be cost effective in terms of operational costs.

7. According to Alexander et al. [MASO89] time spent online is expensive and hence should be kept to a minimum in the implementation of the CMC system. Mason states that in order to reduce costs the interface to CoSy included an off-line editor. To minimize the cost involved in using the system and so possibly encourage user involvement it was felt that the software package must facilitate the use of an off-line editor to compile E-mail messages and files.

Table 5.1 provides a summary of these criteria. The following packages were evaluated according to these criteria:

- UUPC
- SNUUPM
- PCBEL
- MSWORKS
- NCETELENET

TABLE 5.1: Criteria For Evaluation of CMC Software

1.	The software must be menu-driven.
2.	The software must be easily extendable.
3.	Options commonly used should be easily accessible.
4.	The software package must be simple to install.
5.	Menu guidance or a help facility for novice users should be provided.
6.	Operational costs, e.g. price of software, etc must be low.
7.	The system must facilitate off-line compiling of messages and files.

5.3.3.2 UUPC

UUPC is the PC version of the UUCP (**U**nix to **U**nix **C**opy **P**rogram) suite of programs. These programs provide the user with options for E-mail and file transfers.

An evaluation of UUPC according to the criteria in **Table 5.1** is provided below.

1. UUPC is not menu-driven. Users are required to type in commands at the DOS prompt.

2. The UUPC suite of programs is public domain software and hence, the source code is available. Consequently, UUPC is easily adaptable.

3. Options that users are likely to use are not easily accessible. As mentioned above in order to perform a particular function the user has to type in the corresponding command at the command line.

4. As mentioned above UUPC is a public domain suite of programs and is hence, available free of charge.

5. UUPC allows for the off-line compilation of messages and files.

6. The UUPC suite of programs is not easy for the novice computer user to install as it requires the user to rewrite or make a number of changes to the UUPC configuration files listed in **Appendix A**. From an examination of these files it is clear that in order to compile or even change the details in these files students must have some knowledge of data communications.

7. UUPC does not provide much in the way of a help facility.

5.3.3.3 SNUUPM

SNUUPM (**S**imple **N**ews **U**nix to **U**nix **P**egasus **M**ail) which was developed by Rhodes University [LAWR94], is a DOS based interface to the UUPC and UNews suite of programs. SNUUPM provides both an E-mail and file transfer option via Pegasus mail. In addition to these, SNUUPM also facilitates access to newsgroups.

An evaluation of SNUUPM is provided below:

1. SNUUPM is menu-driven.

2. With the exception of Pegasus Mail, the SNUUPM source code is readily available. Hence, SNUUPM is extendable to some extent. However, Pegasus Mail is a crucial component of the system as it facilitates the sending of E-mail messages, files, etc. It would be the main component of SNUUPM utilized by students. Consequently, it would be necessary to make changes to the Pegasus mail interface and this would not be possible.

3. Options that would be used frequently are easily accessible from the SNUUPM menu. However, in addition to providing users with the facilities provided by the UUPC suite of programs, SNUUPM also provides access to newsgroups which would not be used

by the students. Thus, SNUUPM is not dedicated to the functions required by the CMC system and provides additional functions which may lead to students becoming overwhelmed.

4. The SNUUPM installation process is easier than the UUPC process in that it is menu driven. However, the information that has to be provided by users requires the user to have some knowledge of data communications. Furthermore, users are required to make changes to the *autoexec.bat*, *config.sys* and modem configuration files. This would involved editing each file in order to make the necessary changes.

5. SNUUPM provides the user with menu guidance. Menu guidance is provided by means of a help facility.

6. SNUUPM is public domain software and hence, can be distributed freely. Thus, operational costs are reduced.

7. SNUUPM provides a facility for the compilation of E-mail messages and files off-line.

5.3.3.4 PCBEL

PCBEL is a data communication software package developed by TELKOM. PCBEL provides an interface to TELKOM's BELTEL facility. Some of the facilities provided by BELTEL include:

- Access to E-mail.
- Electronic shopping.
- Electronic banking and payment of accounts.
- A daily news, weather and sport update.

An evaluation of the BELTEL facility using the package PCBEL is provided below:

1. Both the PCBEL and BELTEL interfaces are menu-driven.

2. PCBEL is not extendable and adaptable as the source code for this program is not available.

3. The E-mail facility provided by BELTEL is easily accessible from the menu. However the bulk of the options provided by BELTEL are not necessary for the implementation of the CMC system described in this study. E-mail is one of at least eighty options on the BELTEL menu. Students could become overwhelmed and confused by these other options.

4. The procedures involved in installing PCBEL are menu-driven. However users are required to have a knowledge of data communications in order to provide the details that have to be supplied for the installation of PCBEL.

5. Limited menu guidance is provided.

6. Initially students would have to purchase the BELTEL software. Thereafter students will have to pay a monthly subscription fee for BELTEL access.

7. BELTEL is essentially an online facility however, E-mail can be prepared off-line and retrieved once the user is online.

5.3.3.5 MSWORKS

MSWORKS (Microsoft Works) is an integrated package which is studied as part of the practical component of the F.D.E. offered by NCE. The programs incorporated into this package include :

- A word processing program.
- A database program.

- A spreadsheet program.
- A data communications program.

An evaluation of the data communications program for use in the CMC system is provided below:

1. The program is menu-driven. However, according to Nelson [NELS94] students took an "unfortunately" longer period than estimated to familiarize themselves with the MSWORKS package.

2. The data communications program cannot be easily adapted or extended as the source code for the program was not available.

3. The data communications program is not easily accessible. In order to connect to another machine the user has to firstly load a file containing the telephone number to the other machine and other data communication details into memory. When this file is loaded into memory the menu bar at the top of the screen is adapted to provide certain data communication options such as "Connect".

4. The configuration procedures involved in getting the data communications component of MSWORKS up and running are not simple for a novice user. The user has to create a file specifying the telephone number of the line of the machine into which it will dial as well as whether the dial type is pulse or tone. Furthermore, users are required to change the default communication settings via a menu. The details that have to be changed include the serial port the modem is installed on, the baud rate of the modem, the number of data bits, stop bits and parity bits that would be used during the transfer of data, the type of handshake, etc. Hence, in order to install the data communications component of MSWORKS, users have to have some knowledge of data communications.

5. Menu guidance is provided by means of a help facility.

6. Students would not incur any additional costs with respect to purchasing an additional software package as MSWORKS is prescribed for purposes of the course. However, in order to use MSWORKS students would need to subscribe to the Internet which would result in additional cost.

7. MSWORKS does provide for off-line editing.

5.3.3.6 NCETELENET

1. The program is menu driven.

2. UUPC and the interface would be extendable.

3. Options that are frequently used by students would be easily accessible.

4. The installation procedures would be automated. Furthermore, students would not be required to supply details such as the serial port number on which the modem is installed.

5. Various forms of help would be considered in order to assist students with their use of the system.

6. This software package would be freely available to students.

7. NCETELENET would facilitate off-line compilation and editing of mail.

5.3.3.7 Comparison of Packages

In order to obtain a quantitative comparison of the software packages the following scale was developed:

- 0 - criterion not satisfied
- 1 - criterion partially satisfied
- 2 - criterion satisfied

As all the criteria are equally important it was not necessary to assign a weighting to any of the criteria. Based on the evaluations discussed above each package was assigned a value as displayed in **Table 5.2**.

From **Table 5.2** SNUUPM appears to meet most of the criteria. However, it is crucial that the criteria not met by SNUUPM are satisfied in order to facilitate ease of use of the system. It is essential that the CMC system be extendable. This is not possible in the case of SNUUPM as the source code for Pegasus Mail is not available. Furthermore, although SNUUPM is menu-driven and options that would be frequently used by students are easily accessible SNUUPM is not dedicated to the essential functions necessary for the CMC implemented in the study resented.

TABLE 5.2: Comparision of Software Packages

PACKAGE	1	2	3	4	5	6	7	TOT
1. UUPC	0	2	0	0	0	2	2	**6**
2. SNUUPM	2	1	1	0	2	2	2	**10**
3. PCBEL	2	0	1	1	0	1	1	**6**
4. MSWORKS	2	0	0	1	2	0	1	**6**
5.NCETELENET	2	2	2	2	2	2	2	**14**

Finally, although certain installation procedures are automated there are still functions that have to be implemented manually by users. Hence, it was decided that SNUUPM would not be suitable for use in the implementation of the CMC system.

As NCETELENET would be developed specifically to meet the needs of South African distance learners, it meets all the criteria. Consequently, it was decided that an interface to the

UUPC suite of programs would have to be developed.

5.4 PILOT STUDY CONDUCTED AT NCE

A pilot study was conducted at NCE in July 1994 in order to evaluate the prototype NCETELENET. NCETELENET was implemented for use by students enrolled for the LOGO programming module of the first year of the F.D.E. and lecturers. While it was crucial that students do not perceive the use of a CMC system as an added extra, it was not possible to change the organizational structures of the course to make the use of the CMC system compulsory at the time the pilot study was carried out. Hence, students were asked to volunteer to take part in this pilot study.

Students enrolled for the F.D.E. were qualified teachers in practice, possessing either a three year teaching diploma or a university degree plus diploma. All first-year students were sent questionnaires to test students' attitudes towards the use of computers in general and to determine which of the students wished to participate in the pilot study. The questionnaire also required the students to fill in certain demographic details in order to categorize their answers statistically.

55% percent of a class of a 106 students responded to the questionnaire. Out of the 57 students that returned the questionnaire 26 students indicated that they wished to take part in the pilot study. A weekend course was arranged for these students in order for them to experiment with the prototype NCETELENET and to demonstrate to them how to install their internal modem cards.

Fernberg [HARA93] describes the WBSI (Western Behavioural Sciences Institute) experience with the use of CMC by means of the EIES (Electronic Information Exchange System) system which was used in the delivery of distance education courses aimed at business men as follows. The attendance at the first face-to-face meeting was not good. Fernberg states that more staff and faculty attended the first face-to-face meeting than students. The same problem was experienced regarding the first weekend course at NCE. Only two of the 26 students attended

this course. A second course was held especially for the students that missed the first course. Again only two students attended this course.

Unfortunately, while one of the four students had access to a computer and a telephone line at home, he taught at a school in a rural area, away from home, where there was no access to a telephone system that facilitated data communications. As a result he did not use the system.

After the course the remaining three students communicated with lecturers and each other using NCETELENET. Most of the messages received from these students by lecturers discussed problems that students were experiencing with assignments and certain components of the course. Although the system was to be used initially as an aid in the instruction of the LOGO programming module, in reality the messages covered most of the syllabus. Furthermore, students were issued with weekly exercises covering various aspects of the course via the CMC system. These exercises covered areas which students found difficult and also served as a means for preparation for their examinations. Students also E-mailed completed exercises to lecturers and, in turn, the marked exercises were E-mailed back to them.

5.5 RESULTS OF THE PILOT STUDY CONDUCTED AT NCE

As mentioned previously students had to state whether they were interested in participating in the project on the questionnaire. Comments made by some of the 57 students who returned the questionnaire as to why they did not want to participate in the study included:

"Can't afford it, sorry!"
"Once it can be afforded"
"No. (Due to lack of time at present)"
"I do not have a computer at home but would be interested in getting a modem for the school"

Based on comments made on the questionnaires and the telephonic discussions held with the 26 students who originally indicated that they were interested in participating in the research it was felt that the students' lack of participation could be attributed to the following:

- **Time** - Students, being teachers as well, found that they only had time to concentrate on work that contributed to the final course mark.
- **Availability of computers** - Some students did not have access to their own computers but used computers at schools at which they taught. As a result they did not have unlimited access to these computers.
- **Economic barriers** - The cost of the modem as well as the telephone charges involved discouraged students from participating in the project.
- **Socio-psychological factors** - For the majority of the class this was the first time they had used a computer (i.e. for the F.D.E.) and hence, they felt that they were not computer literate enough to participate in this study.
- The CMC system was introduced to students as an added extra to the course which contributed to non-participation in the study. According to Mason [MASO89] a number of steps were taken to ensure that the OU students did not see the use of the CMC system CoSy as an added extra. Mason states that from past experience it was known that distance learners only regard work which forms part of an assignment to be important.

The three students who participated in the pilot study experienced the following problems with the prototype:

- In order for students living out of Pietermaritzburg to dial into the server it was necessary for the telephone number to be prefixed by the relevant dialling code. The students had to edit the configuration file and prefix the telephone number with the code.
- Students wanted to be able to save messages received to a file. NCETELENET did not provide them with such an option.
- Students had to provide the number of the communication port on which the modem was installed.
- Students wanted to refer back to messages sent. NCETELENET did not keep copies of "sent" mail.

5.6 CONCLUSIONS

Upon collaboration with NCE it was decided that in order to reduce the costs involved for students they would be able to loan a modem from NCE (or purchase one if they wished). However, students were responsible for telephone costs. Furthermore, students who enrolled for the second year LOGO programming module in 1995 would be required to use the CMC system to communicate with lecturers and fellow students. It was felt that second year students would have more confidence in their computing skills and hence, be more enthusiastic about using the system. Based on the feedback obtained from students, major adaptations were made to NCETELENET. This led to the development of the interface TELETUTOR.

6 IMPLEMENTATION OF THE CMC SYSTEM

6.1 INTRODUCTION

No changes were made to the hardware and software specifications of the mail server *APOLLO* in the final implementation of the system compared to the pilot study. Similarly, the hardware configurations of the clients were unchanged except that students could now hire modems from NCE at a favourable rate instead of having to purchase the modems.

Based on the pilot study, changes were made to NCETELENET which led to the development of the E-mail and file transfer interface TELETUTOR. This chapter describes the procedures involved in implementing and utilizing the TELETUTOR system. However, as TELETUTOR is built on top of the UUPC programs *rmail*, *uuxqt*, *uucico*, *uuencode* and *uudecode,* the discussion begins with a description of these programs.

6.2 UUPC

UUPC is the PC version of the UUCP (**U**nix to **U**nix **C**opy **P**rogram) suite of programs which traditionally facilitated communication between Unix based machines. UUPC allows for host-to-host communication. In this study each host functions as a client connected to a central mail server. The specifications outlined in the UUPC Installation and User Reference manual indicate that, although each client on the network can operate using UUPC, the operating system of the mail server must facilitate multitasking. The UUPC programs *rmail*, *uucico*, *uuencode* and *uudecode* require certain working files to be stored on the hard drive of each client. The directory structure used by these programs is illustrated in **Figure 6.1**.

6.2.1 UUPC Directory Structure

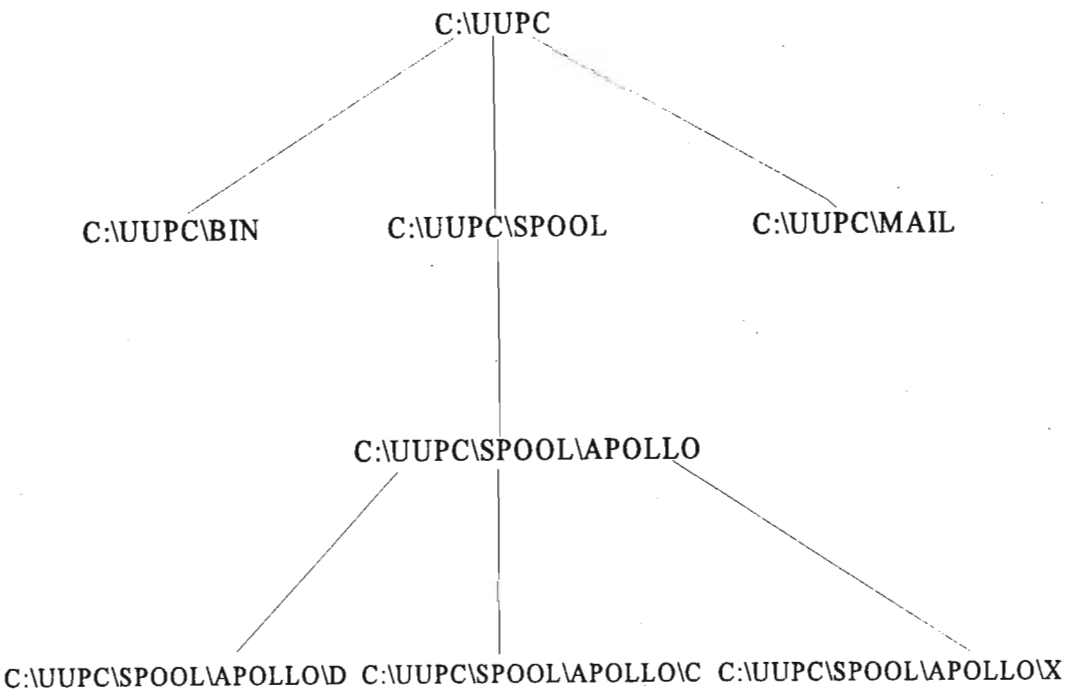

Figure 6.1: UUPC Directory Structure

6.2.1.1 C:\UUPC

From the diagram in **Figure 6.1** it is clear that within the subdirectory C:\UUPC three other subdirectories exist namely BIN, SPOOL and MAIL. Two additional subdirectories PUBLIC and TMP hold temporary files needed by the UUPC suite of programs. Furthermore, the UUPC subdirectory stores a number of working files required by the UUPC programs. The configuration of these files differs from one implementation to another. A listing of the typical contents of each of these files for this particular study can be found in **Appendix A**. A description of each file is provided below.

- *uupc.rc*

Each client can facilitate one or more users. This file contains keyed details common to all users. The keys **nodename**, **domain** and **postmaster** will have to differ from client to client. Consequently, these values need to be identified and written to the file *uupc.rc* during the installation process. A brief description of these fields is presented in **Table 6.1**.

TABLE 6.1 : Description of *uupc.rc* Keys

KEY	DESCRIPTION
Nodename	Each client is identified by the server by a "nodename". In this study the nodenames of clients were nce0001 through to nce00072 (one for each user).
Domain	A domain value has to be specified for each client. For the purposes of this study the domain of each client has been specified in the form: *nodename.cs.unp.ac.za* The domain value plays a major role in the specification of a users' E-mail address. For example suppose that Smith is a user on the client nce0002 then Smith's E-mail address would be : *smith@nce0002.cs.unp.ac.za*
Postmaster	If there are a number of users on a particular client one user needs to play the role of "postmaster". However, in this study each client had at most one user and thus the key postmaster was assigned the user's [1]user-id.

[1]The user-id is usually a user's surname or combination of the surname and initials. The user-id forms the first part of the E-mail address, e.g. in smith@ncelogo.cs.unp.ac.za smith is the userid-id.

- *[userid].rc*

Each client can have more than one user. For each user a *[userid].rc* file must be created on the client. For example, if Smith is a user on a particular client the file *smith.rc* must be present on that client.

The contents of an example of this file, namely *npillay.rc,* is listed in **Appendix A**. The values of the keys **mailbox** and **name** differ from client to client as defined in **Table 6.2**.

TABLE 6.2: Description of *[userid].rc* Keys

KEY	DESCRIPTION
Mailbox	The value assigned to this variable is the user's user-id.
Name	The name and surname of the user is generally assigned to this variable

- *modem.mdm*

This file contains configuration information required by the modem in order for it to connect to the server. When *uucico* (disussed in section **6.2.2**) obtains the necessary details from the *systems* file to connect to the server, *uucico* uses the configuration specified in the *modem.mdm* file. In this study the values of two keys, namely the **device** and **dialprefix** keys differed from one client to another and hence had to be specified during the installation procedure. A description of these keys is provided in **Table 6.3**.

TABLE 6.3: Description of *modem.mdm* Keys

Key	DESCRIPTION
Device	The value assigned to this key is the number of the communications port on which the modem is installed, e.g. COM3.
DialPrefix	When *uucico* dials in to a server via the modem the number of the line connected to the server is prefixed by what is known as a "dial prefix", e.g. /pATDP. The /p represents a delay of four tenths of a second. The AT is a command which stands for "attention" and prefixes any command given to the modem. The DP indicates that the dial type is pulse. Alternatively the dial type could be tone in which case the dial prefiex will be: /pATDT

- *systems*

This file specifies the systems which can be dialed, one per line. Each line typically specifies:

1. The name of the server.
2. Times at which the client can connect to the server.
3. "Device " - in this case refers to the *modem.mdm* file.
4. The phone number of the line connected to the server.
5. The login script that needs to be used when calling another system. This includes a UUCP login name and password. For the purposes of this study all clients used the same UUCP login and password.

The same *systems* file was used for each client. During the installation process this file is created and stored on the hard drive of the client.

- *passwd*

This file defines the user-ids, names and home directories of each user on a particular client. In this study each user was defined as a "Super User" (see **Appendix A**). During the installation process the user's user-id needs to be written to this file and specified to be that of a "Super User".

- *permissn*

This file defines:

1. The access rights that the server or other remote system has on a particular client.
2. The programs or commands that the server or other remote system can direct *uuxqt* (see **pg. 82**) to run on the client on its behalf.

The *permissn* file written to each client during the installation process contained the specifications listed in **Appendix A**.

6.2.1.2 C:\UUPC\BIN

The files *rmail.exe*, *uucico.exe*, *uuxqt.exe*, (described in **6.2.2**), *uuencode.exe* and *uudecode.exe* (described in **6.3.4.2**) are stored in this subdirectory.

6.2.1.3 C:\UUPC\MAIL

A file is maintained for each user on the client in this directory. Mail received by a client for a specific user is held in this file until it is read. For example, if Smith is a user on a particular client the file *smith* will be stored in this subdirectory on the client. Any mail transferred from the server to the client for this particular user will be spooled to this file by *uuxqt*. In the

discussions that follow this file is referred to as the "mail" file of a particular user.

6.2.1.4 C:\UUPC\SPOOL

The subdirectory SPOOL contains the log files *uucico.log*, *uuxqt.log* and *rmail.log*. The SPOOL subdirectory also contains a subdirectory for each mail server to which the client can connect. In this case only one subdirectory, namely APOLLO, was created.

6.2.1.5 C:\UUPC\SPOOL\APOLLO

This subdirectory contains the D, C, and X subdirectories. The D and C subdirectories temporarily store mail to be transferred to the server. When mail is transferred to the client two files are transferred for each mail message or file sent. One file contains the actual content of the message or file sent and is stored in the D subdirectory. The other file contains commands specifying how the remote *uuxqt* should process the associated message file. This file containing commands is stored in the X subdirectory.

6.2.2 Rmail, Uuxqt, and Uucico

When a user types in an E-mail message TELETUTOR saves this as a text file which is passed to the program *rmail*. Similarly, if the user wishes to send a file to another user, if this file is a text file it is passed to the *rmail* program. If this file is a binary file it is firstly encoded, using the *uuencode*(see **Section 6.2.3**) program, and then passed to the *rmail* program. In each of these cases the E-mail addresses of the recipient/s is/are also passed to *rmail*. From the files, *uupc.rc* and *[userid].rc rmail* identifies the sender of the file or message. *Rmail* then creates a header specifying:

- The name of the recipient of the message or file.
- The name of the sender of the mail or file.

- The server/s the message or file should be routed through.
- The date and time at which the message or file was sent.
- The subject of the message or file sent.

Two data files and a command file are also created by *rmail* in the D and C subdirectories respectively. The first data file created contains the actual message or file contents to be mailed. The second data file contains instructions regarding the actions that must be taken by the *uuxqt* program on the mail server. The command file specifies how *uucico* should transfer the data files. These three files remain on the hard drive of the client until *uucico* is activated by the user choosing the **Dial** option from the **Phone** submenu provided by TELETUTOR.

When *uucico* is loaded into memory, *uucico* firstly checks the C subdirectory for any command files. There is usually one command file for each message or file to be transmitted to the server. The command file indicates to *uucico* how to transmit the corresponding data files. The following steps are then carried out by *uucico*:

- *Uucico* dials into the mail server based on the information stored in the *systems* and *modem.mdm* files.
- *Uucico* logs into the mail server using the login name and password specified in the *systems* file.
- Both the client and the server *uucico* programs must agree on a protocol. In this case the "g" protocol is used.
- The *uucico* program of the client assumes the role of the master and the *uucico* program on the server assumes the role of slave. The master *uucico* program transmits both the data files across to the server according to the instructions in the command file.
- If there is any mail waiting for the client on the server, the server *uucico* program becomes the master and the client *uucico* the slave. This mail is transferred across to the client.
- The client *uucico* then hangs up and makes the necessary entries in the *uucico.log* file.
- Any mail sent to the client from the server will be in the form of data files. For each message or file sent to the client, two data files are transferred. One of these files

contains the actual message or file contents and is stored in the D subdirectory. The other file contains instructions to the *uuxqt* program and is stored in the X subdirectory. These files remain in these subdirectories until *uuxqt* is activated. *Uuxqt* places the mail message in a particular user's "mail" file in the MAIL subdirectory by running the *rmail* program.

6.2.3 Uuencode and Uudecode

The *uuencode* program is used to convert a binary file, e.g. a wordprocessing file into a text file in order for it to be transferred to the mail server and in turn to the recipient of the file. When the recipient receives the file the *uudecode* program is used to decode it, i.e. convert it back to binary form.

6.3 CLIENT SOFTWARE

The software distributed to students consisted of three components:

- An installation program
- TELETUTOR
- The UUPC programs *rmail*, *uuxqt*, *uucico*, *uuencode* and *uudecode*.

The interface TELETUTOR and the interface to the installation program were both developed using Turbo Vision version 1. Consequently, these interfaces are similar to those provided by Borland's Turbo Pascal and C++.

6.3.1 Accessing Menu Options

A pull-down menu appears at the top of both the installation program and TELETUTOR. An example of such a menu appears in **Figure 6.2**. These menus can be accessed by a mouse as

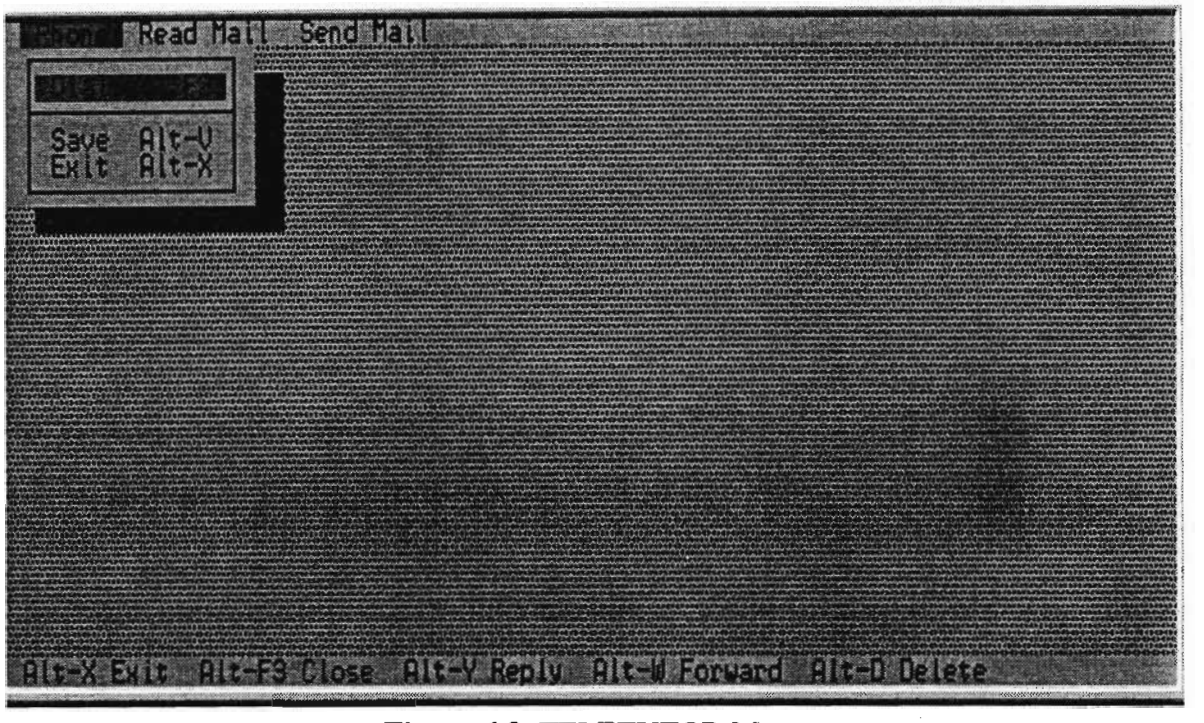

Figure 6.2: TELETUTOR Menu

well as a keyboard. If the user is using a keyboard there are two means by which he or she can choose an option. The user can press **F10** to access the menu bar. Alternatively, the user can press the **ALT** key together with the highlighted letter of the submenu he or she wants to select from, e.g. to access the **P**hone option the user would press **ALT+P**. Using the arrow keys the user can move the highlighted bar to a particular option on the menu, e.g. **D**ial and press the **ENTER** key.

Figure 6.2 shows how hot keys associated with menu options, e.g. an alternative means of choosing the **D**ial option would be by pressing **F2**. A novice having not used a mouse, might find it easier to press the hot key or key combination necessary to access an option. The hot key associated with each menu option appears next to the option on each submenu to assist users to learn the keys.

Figure 6.3:An Example of a Dialog Box

6.3.2 Dialog and Message Boxes

Whenever TELETUTOR requires certain information the user is prompted for these details by means of a dialog box similar to that indicated in **Figure 6.3**. By pressing the **TAB** key the user can move through the fields to enter the necessary information.

Error messages are reported by means of a message box similar to that illustrated in **Figure 6.4**.

6.3.3 Installing TELETUTOR

An installation program was distributed to each student as part of the client software. In order to load the installation program into memory, the user must type *install* at the relevant DOS prompt.

The installation program provides the user with the following options:

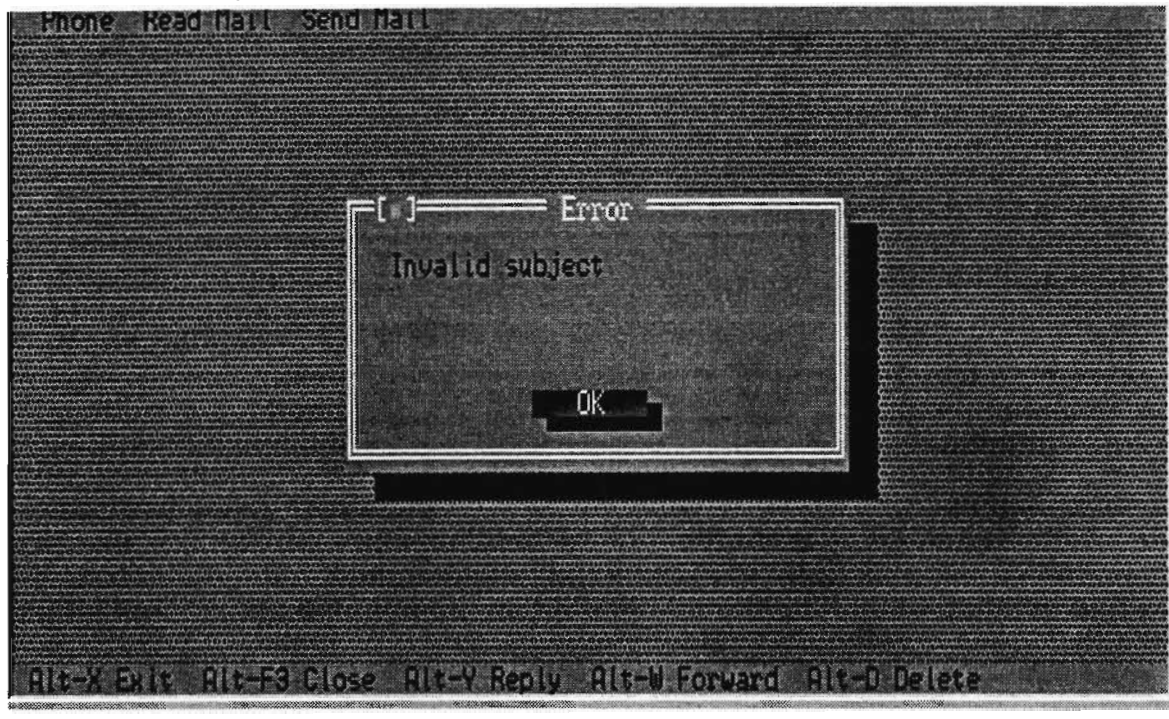

Figure 6.4: An Example of a Message Box

- Modem Installation
- Software Installation
- Data Communications
- A Reinstallation Option

The installation program provides users with an extensive context sensitive help facility. By pressing **F1** at any stage the user can obtain help with:

- any menu option,
- the installation process, or
- an error message received.

6.3.3.1 Modem Installation

Before installing the software, users are required to physically install an internal modem card in their machine. The **Modem Installation** option provides the users with a means of checking whether the modem has been correctly installed.

The **Modem Installation** option informs the user as to which communications port the modem is installed on. If the dip switches on the modem are set for the modem to be installed on a port to which another serial device is attached, a message will appear on the screen informing the user of this. A diagram indicating how the user can install the modem on another port will be displayed on the screen. An example of such a diagram is indicated in **Figure 6.5**.

If the installation program detects a modem on one of the communication ports, the **Device** variable in the *modem.mdm* file is assigned this value. For example, if the modem is found to be installed on COM4, the statement Device = COM4 is written to the *modem.mdm* file.

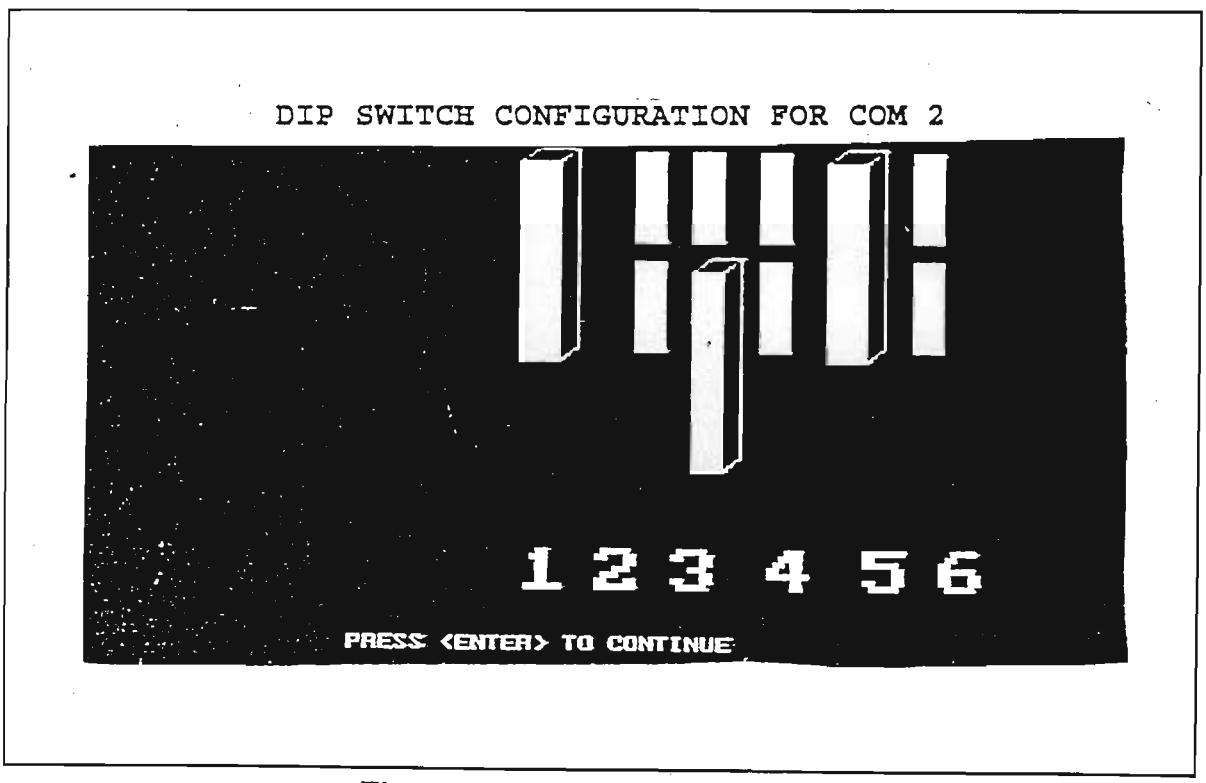

Figure 6.5:Dip Switch Configuration

6.3.3.2 The Software Installation Option

Choosing the **Software Installation** option results in the interface TELETUTOR being installed on the user's hard drive, togehter with the files (with login scripts, modem configuration, etc) needed by the UUPC suite of programs.

Upon a user choosing the **Software Installation** option the installation program conducts the following checks:

- Firstly the installation program determines whether the modem is correctly installed. If the user has not installed or has incorrectly installed the modem card an error message will appear on the screen informing the user of this.
- Secondly the installation program ensures that the machine on which TELETUTOR is being installed possesses a hard drive and is not a diskless workstation. If the latter is the case the user is informed by means of a message box indicating that TELETUTOR can not be installed on a machine without a hard drive.

As the majority of these students were novice computer users, attempts were made to make the installation process as simple as possible. Most data communication packages require certain technical details to be provided by the user upon installation. **Figure 6.6** shows the screen used by TELETUTOR to obtain the following four details, from the user.

- The telephone line dial type.
- The region, i.e whether the user resided within or out of Pietermaritzburg.
- The user's user-id.
- The user's name and surname.

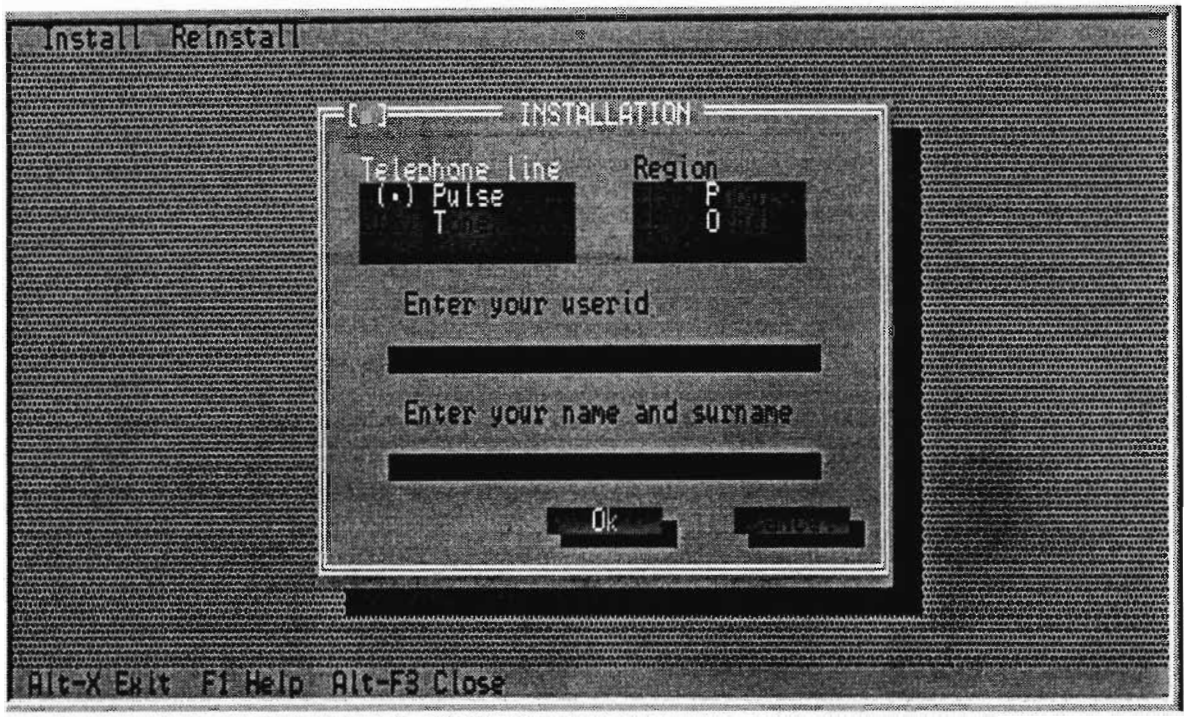

Figure 6.6:Software Installation Dialog Box

An error check is carried out by the installation program in order to determine whether the user-id entered is valid. The user-id entered by the user is matched against a list of id's and if an invalid user-id is detected, an error message appears.

The installation program ensures that the user specifies a name and surname. If the user has not entered a name and surname a message appears on the screen prompting the user to specify these.

Provided that the user's name, surname and a valid user-id are specified, the following steps are conducted by the installation program:

- The UUPC directory structure illustrated in **Figure 6.1** (pg.77) is created.
- The *modem.mdm* file is created. The telephone line dial type specified by the user is used to construct the dial prefix. The program determines which port the modem has been installed on and this file is written to the *modem.mdm* file.

- The *systems* file is created on the hard drive of the client. One of the values which has to be specified by the user is whether he or she resides in Pietermaritzburg. If the user chooses "Other" with respect to the region option the number of the line connected to *APOLLO* is prefixed with the Pietermaritzburg dialling code.
- The *uupc.rc* file is created. As mentioned in **Section 6.2** the values of three keys have to be identified for each client during the installation process namely:

    - nodename
    - domain
    - postmaster

In this study each student had a different surname. As a result the user-id of each student was the student's surname. The installation program generates a different nodename for each valid user-id entered. This value is assigned to the key **nodename**. This value is also used to specify the domain of a particular client. The key **postmaster** is assigned the user-id specified by the user.

- The *[userid].rc* file is created. The **mailbox** key written to this file is the user-id specified by the user.
  The key **name** is assigned the name and surname provided by the user.
- The *passwd* file is created. The user-id provided is specified as being that of a "Super User".
- The *permissn* file is created on the client.
- The *update.bat* file is created. The most recent user-id, telephone dial type, region, and the user's name and surname values are stored in this file. This file is used in the re-installation process if required.
- The UUPC programs require two MSDOS environment variables, namely ***uupcsysrc*** and ***uupcusrrc*** to be defined when the UUPC programs are used. ***Uupcsysrc*** is assigned the path of the *uupc.rc* file and ***uupcusrrc*** is assigned the path of the *[userid].rc* file. The installation program declares both these variables by modifying *autoexec.bat* file on the client.

- The uupc and uupc/bin subdirectories are specified by means of a "path" statement in the *autoexec.bat* file on the client.
- The number of file handles in the *config.sys* file is set to fifty. This is necessary since UUPC requires that a number of files are open at the same time.

6.3.3.3 Data Communications

It was anticipated that some students may be more computer literate than others and hence be interested in understanding how the modem installation process worked. Thus an option was made available for this purpose. The **Data Communications** option provides the user with information on concepts such as "COM port" and "dip switches", etc. This option can be selected byselecting **Install** from the pull down menu, followed by choosing the **Data Communications** option. Alternatively, the user could just press **F5**. **Figure 6.7** lists some of the information provided.

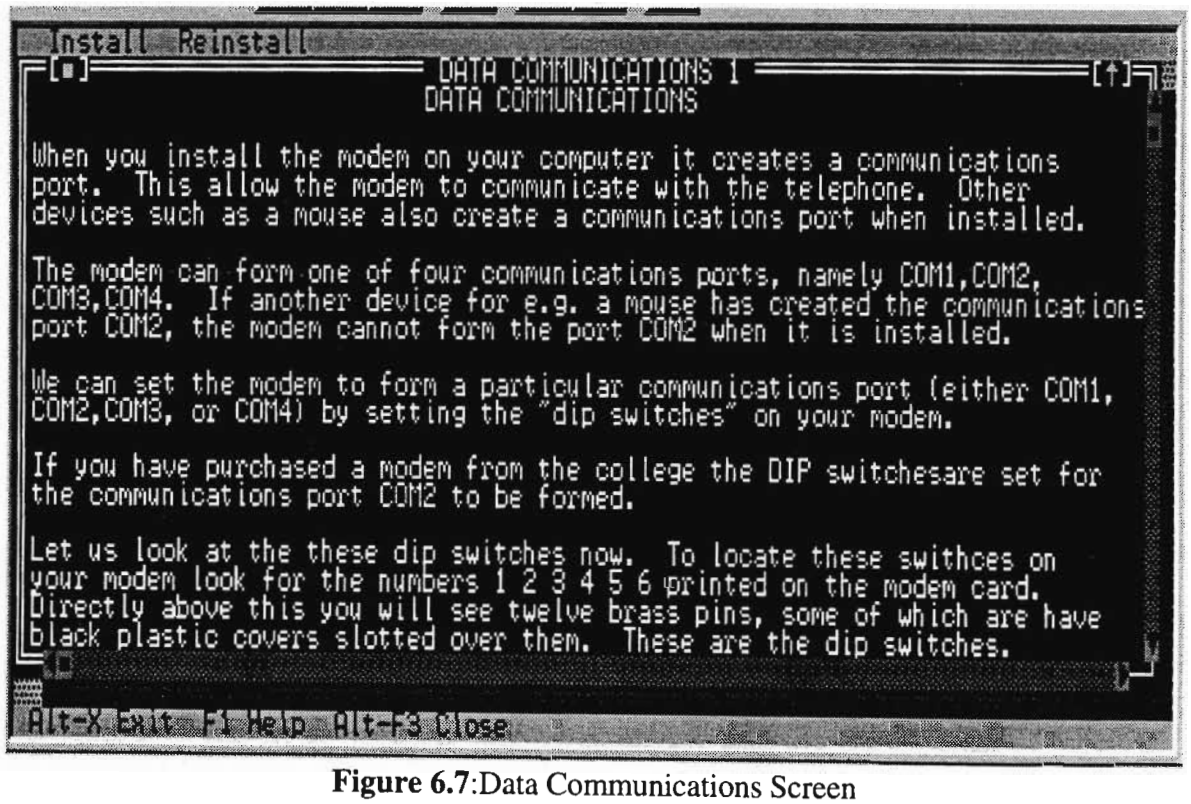

Figure 6.7:Data Communications Screen

6.3.3.4 Reinstallation

The values entered by the user for "Telephone Line" or "Region" can easily be changed through the **Reinstall** option (by choosing **Reinstall** and then **Software** or by pressing **F4**) which allows the user to make the necessary changes.

During the initial installation of the software, the details entered by the user are stored in a file (*update.bat*). As illustrated in **Figure 6.8**, the **Reinstall** option indicates to the user what the current values are and prompts the user to change these.

6.3.4 Using TELETUTOR

Once TELETUTOR is installed on the hard drive of each client it can be accessed via the users' menu or from the DOS prompt.

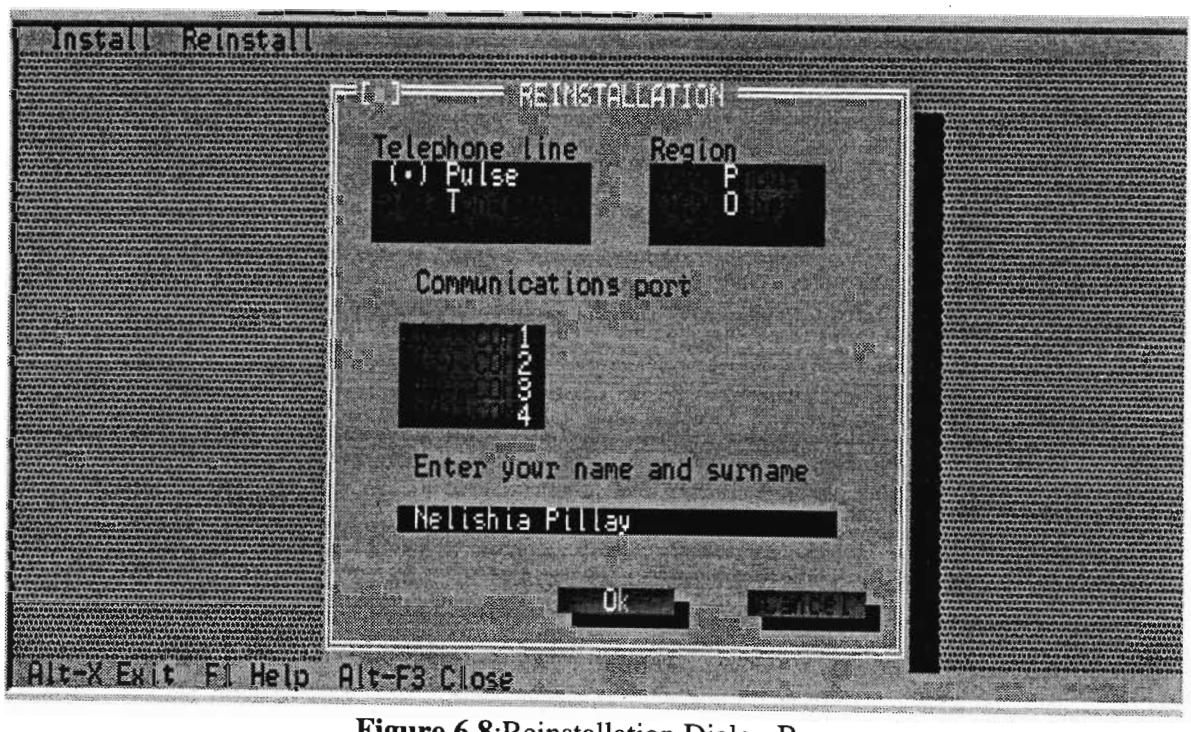

Figure 6.8:Reinstallation Dialog Box

The options provided by TELETUTOR allows users to compile, edit, and read mail offline, thereby reducing the cost involved in using the system.

As the system was going to be used for the submission of assignments it was essential that the time and date stamps on each item transferred were correct. This was necessary so that lecturers could determine when assignments and exercises were submitted. Furthermore, in order to examine the use of the system at a later stage certain records were kept on each client which required that the date and time of each connection made to the mail server be accurate. To ensure the accuracy of these details, date and time dialog boxes prompted the user to enter the time and date each time TELETUTOR was accessed.

TELETUTOR enables users to send **mail messages**, **text and binary files** to fellow students or lecturers. Furthermore, it provides users with an environment within which they can read and access files sent to them, saving mail to a particular file if they want to. In addition, TELETUTOR enables users to **reply** to messages received, **forward** messages received to fellow students, and attatch files to the end of messages sent via the **include file** option.

6.3.4.1 Mail Messages

In order to send a mail message the user has to choose the **Send Mail** option from the pull down menu. Choosing this option results in a submenu appearing on the screen which provides the user with three options, namely **Message**, **Files**, and **Include Files**.

Upon choosing the **Message** option the dialog box in **Figure 6.9** prompts the user to enter the surname of the recipient and the subject of the message. The system maintains a list of the surname of each of the lecturers and sixty eight students taking the LOGO programming module and their respective electronic mail addresses. If the surname entered by the user is spelt incorrectly or is not that of a fellow student or lecturer the user is informed of this by means of an error message. Based on a "correct" surname, the system then automatically generates the E-mail address of the recipient. As a result students did not have the problem of

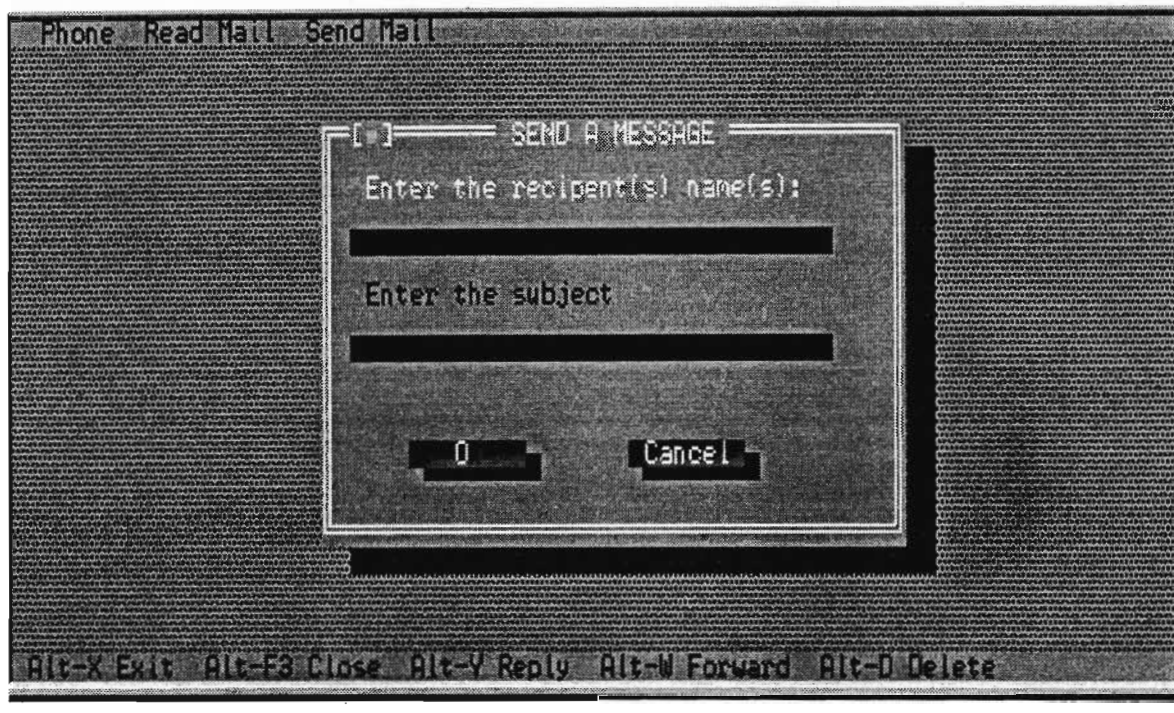

Figure 6.9:Dialog box which prompts the user for the details required to send a message

to remember a particular E-mail address or have the problem of entering the incorrect electronic mail address and thus having mail "bouncing" back to them.

An error message appears whenever a user does not specify the subject of the message or the name of the recipient, indicating that it is essential for him or her to supply this information.

After the user has provided the required information he or she is then taken into a simple editor created as part of the TELETUTOR software. **Figure 6.10** provides an illustration of this editor which enables the user to compose and edit a message. This message is stored in a temporary file in the UUPC subdirectory. TELETUTOR then calls the UUPC program *rmail* which spools the contents of the temporary file to the user's hard drive by creating the corresponding data and command files. These files remain on the user's hard drive until the *uucico* program is activated.

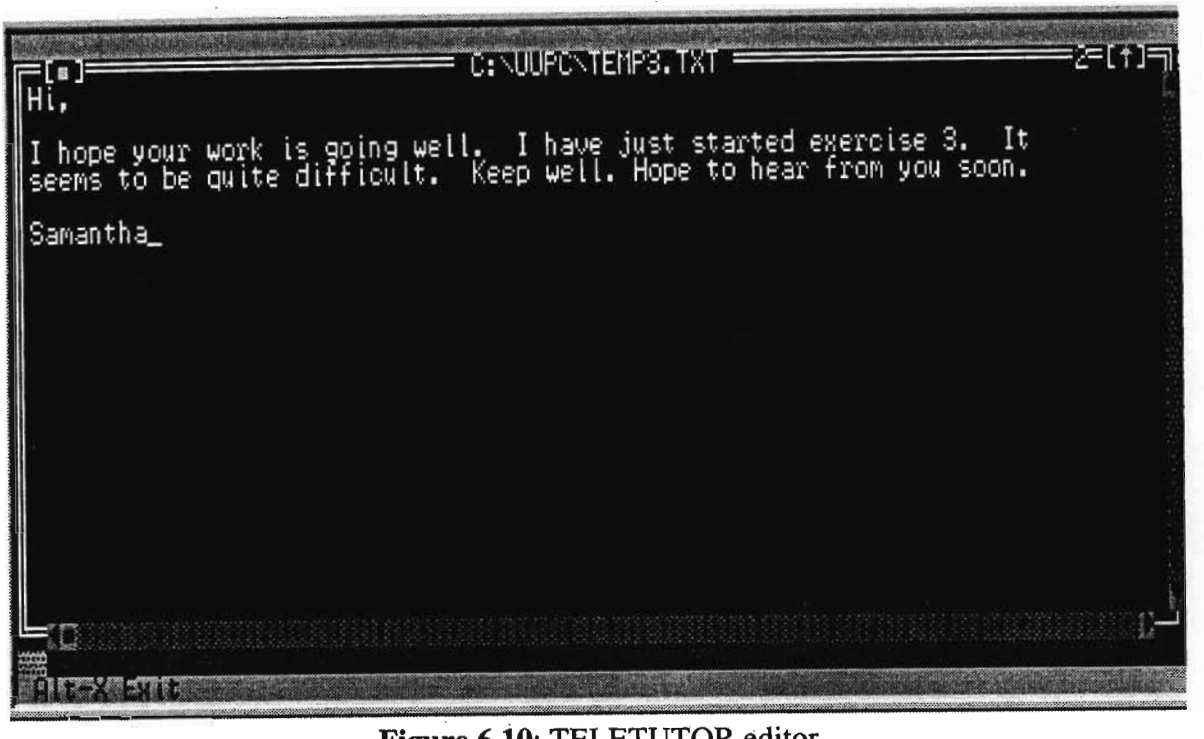

Figure 6.10: TELETUTOR editor

6.3.4.2 Files

Users are provided with an option of sending text, word processing, database, spreadsheet or executable files. To send a file the user can press **ALT+F** or alternatively choose the **Send Mail** and then the **File** option. This results in the dialog box in **Figure 6.11** appearing on the screen, requesting the following details:

- The type of file to be mailed, e.g. a word processing file
- The name of the file and where it is stored, i.e. the path. If the system is unable to locate the file specified an error message is displayed informing the user of this.
- The subject of the matter contained in the file.

Spreadsheet, database, and executable files are first converted to text files by the UUPC program *uuencode* before being spooled to the users' hard drive. When the recipient of a file tries to read the encoded file the message box in **Figure 6.12** appears informing the user as to what type of file has been received and prompting the user for a filename to save the information to. TELETUTOR then decodes the message using *uudecode*.

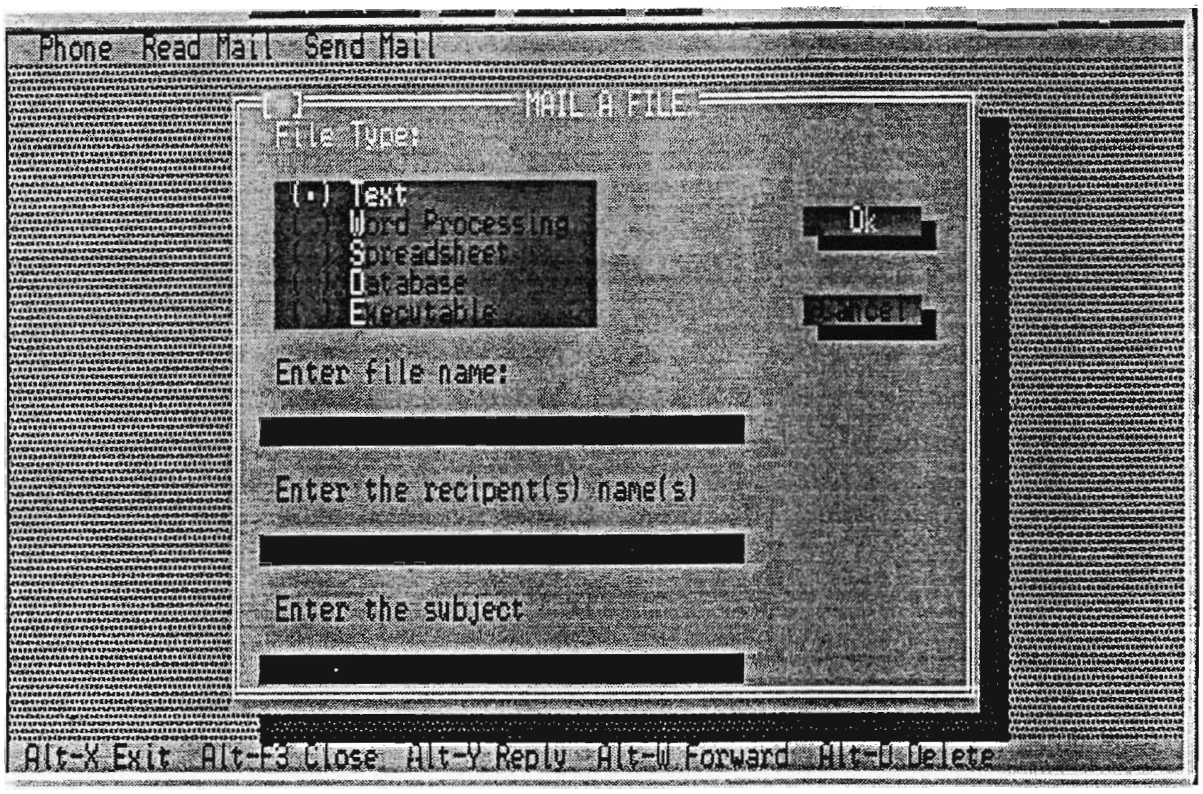

Figure 6.11: Dialog Box which prompts users for the details required to mail a file

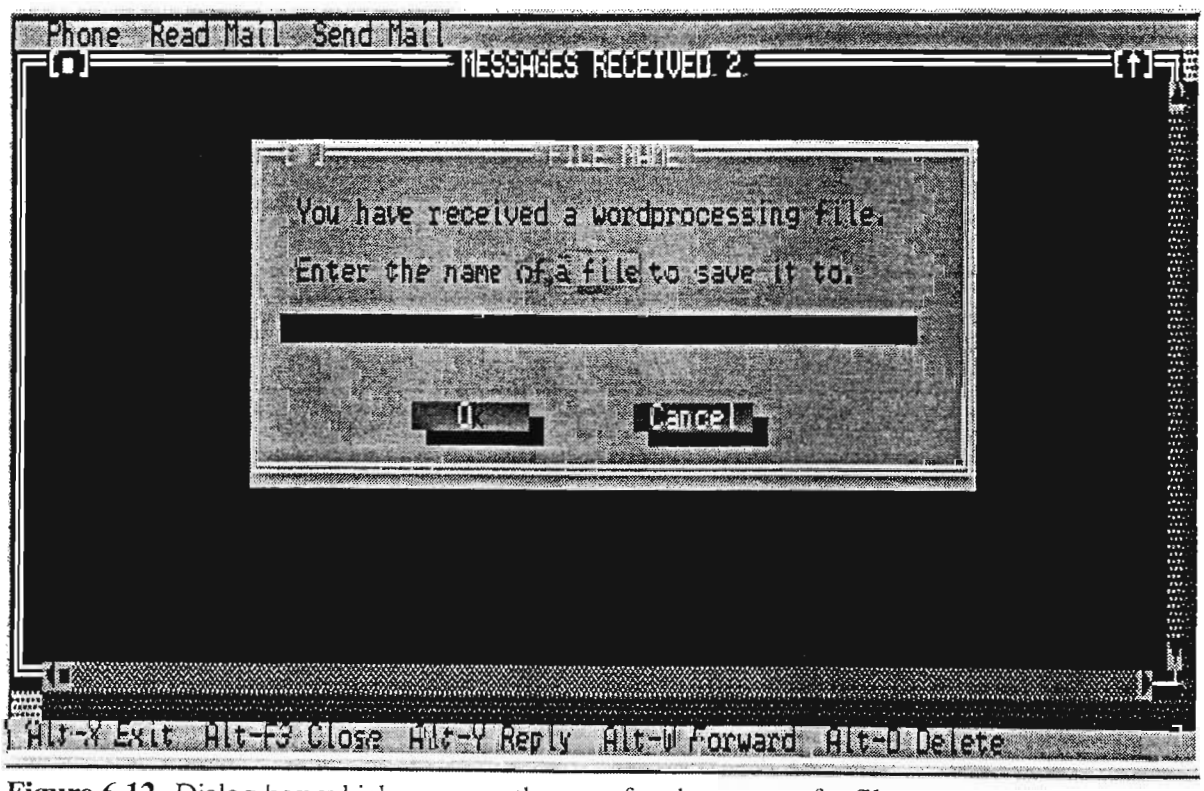

Figure 6.12 : Dialog box which prompts the user for the name of a file to save an encoded file received to

The **Include File** option allows the user to send a message with a file **attached** to it. This file could be a text, word processing, spreadsheet , database, or executable file. All files with the exception of text files are encoded before being attached to the message. By selecting the **Send Mail** submenu and then choosing the option **Include File** the user can append a file to a message before it is sent. Alternatively, the user could press **F7** to choose this option.

6.3.4.3 Accessing files and messages received and sent

TELETUTOR stores all the messages that a user sends to other users in a file called *mail.sen* in the MAIL subdirectory. Similarly, all files and messages received by a user upon connecting to the mail server are stored in the MAIL subdirectory in the user's "mail" file. For example, if SMITH is a user on a particular client all the mail sent to him or her will be stored in a file called *smith* in the MAIL subdirectory. After a user has read new mail messages and files transferred across to the client via the TELETUTOR interface, this mail is stored in the *old.mai* file in the MAIL subdirectory.

The **Read Mail** submenu provides three options, namely **Mail Sent**, **New Mail**, and **Old Mail**. Upon choosing the **Mail Sent** option a list of the messages contained in the *mail.sen* file is displayed on the screen. Similarly, if the **New Mail** or the **Old Mail** option is chosen a list of the messages stored in the user's "mail" file and the *old.mai* respectively is displayed on the screen. The list of messages is numbered. To read a particular message the user has to select the **Choose** option from the **Read Mail** submenu (alternatively the user could press **F4**) and specify the number of the message to be read. If the user no longer wants to keep a record of the messages sent or received, the record, and the corresponding message can be deleted by pressing **ALT+D**.

While reading an E-mail message the user could perform any of the following processes:

- The user could save the message or file to disk. Upon choosing the Save option from the **Phone** submenu the dialog box in **Figure 6.13** prompts the user for the name of the file to save the message to.

Figure 6.13:Dialog Box prompting the user for a name of a file to save a message or file received to

- By choosing the **Reply** option (pressing **ALT+Y**), the user can reply to a message. The user is given the option of including the message received in the reply.
- If the user received a message that may be of value to a fellow student this message can be "forwarded" to the student by selecting the **Forward** option (pressing **ALT+W**) and supplying the surname of the recipient.

6.3.4.4 Dialling in to the mail server

By choosing the **Dial** option from the pull down menu **Phone** (or by pressing **F2**) users can dial in to *APOLLO*. To simplify the system, the telephone number of the line connected to the mail server is embedded in the system and hence the user does not need to supply it. Upon choosing this option, users are prompted for their reason for dialling into *APOLLO*. The dialog box in **Figure 6.14** is used for this purpose. This is one of the monitoring mechanisms that was built into the software to analyse the utilization of the CMC system later.

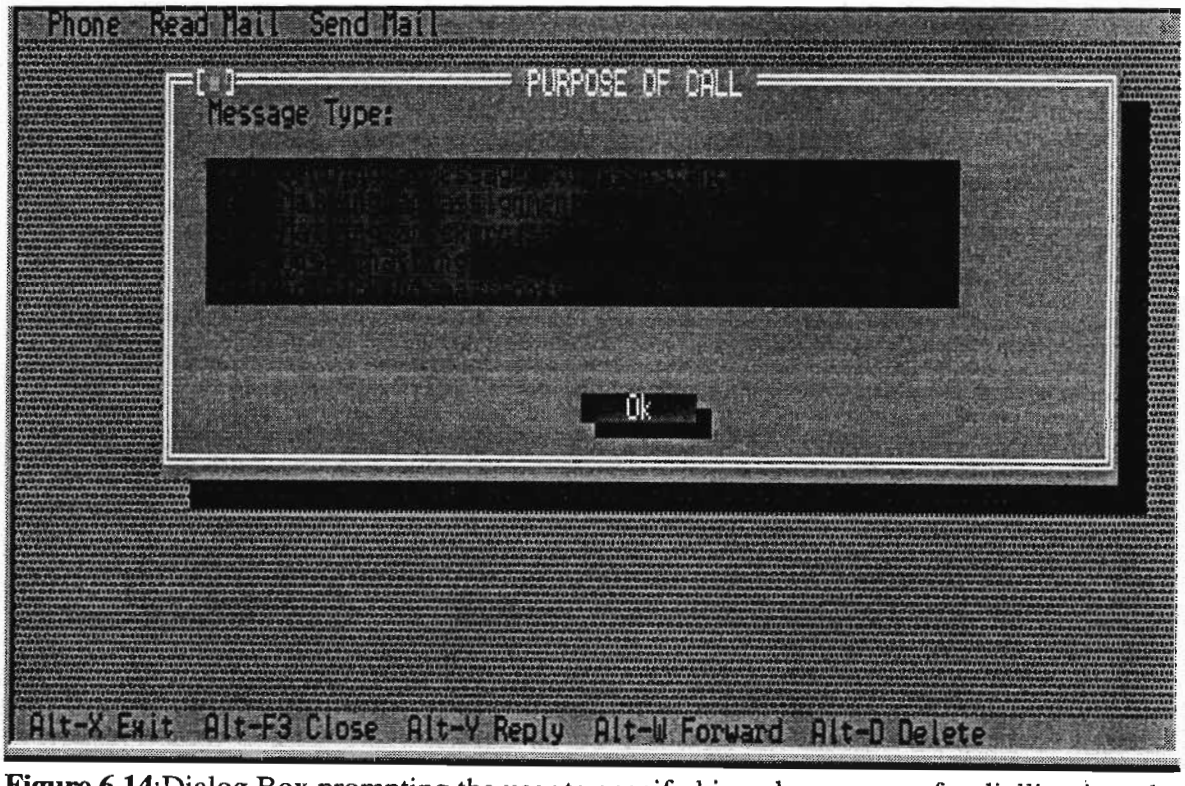

Figure 6.14:Dialog Box prompting the user to specify his or her purpose for dialling into the server

The UUPC program *uucico* informs the user as to the status of the connection to the mail server. A message appears on the screen indicating when the user has successfully connected to *APOLLO*. If an error has occured in the attempt to connect to the server e.g. a "busy line" the user is informed. *Uucico* provides the user with a status report describing the technical details of a successful connection.

6.3.5 Monitoring mechanisms

Certain mechanisms to monitor the use of the CMC system have been built into TELETUTOR. The data collected is stored in log files which are automatically mailed to the system administrator when the client connects to the mail server.

Information regarding mail sent and received from and by each client is stored in a file called *rmail.log*. Each time a user chooses to dial into *APOLLO* he or she has to specify the purpose of the message. This information is stored in *rmail.log* on the users' hard drive. *Rmail.log* also keeps a brief record of the details regarding mail delivered to the user. An example of the contents of the file *rmail.log* is presented in **Figure 6.15**.

A second log file, a file named *uucico.log*, stores details of the status of each connection made by the client to the mail server. These details included:

- When the user logged onto the mail server
- The number of files transferred upon connection
- The number of bytes transferred upon connection
- The connection time

A sample of the contents of a *uucico.log* file can be seen in **Figure 6.16**.

6.3.6 Support service

Students were provided with a telephonic help line (between 6:00pm and 10:00pm). Students experiencing difficulties with either installation procedures or with the usage of the package could obtain assistance by means of this service.

```
01/05-12:21  rmail:  UUPC/extended  1.12b  (Oct  04  1993
12:44:43)
01/05-12:22  rmail:  UUPC/extended  1.12b  (Oct  04  1993
12:44:43)
rmail
01/05-12:24  rmail:  UUPC/extended  1.12b  (Oct  04  1993
12:44:43)
help
01/05-12:28  rmail:  UUPC/extended  1.12b  (Oct  04  1993
12:44:43)
01/05-12:29  rmail:  UUPC/extended  1.12b  (Oct  04  1993
12:44:43)
01/05-12:45 Delivering mail from berg@nce0005.cs.unp.ac.za
to npillay
01/05-12:30  rmail:  UUPC/extended  1.12b  (Oct  04  1993
12:44:43)
exercise
```

Figure 6.15:Contents of the *rmail.log* file

```
06/03-07:35  uucico:  UUPC/extended  1.12b  (Oct  04  1993
12:43:32)
06/03-07:35 callup: Calling apollo via modem at 2400 on Sat,
03  Jun 1995 07:35:06 EDT
06/03-07:35 wanted "OK"
06/03-07:35 got ??? "AT&FE1V1X4&C1D2S0=0S2=43"
06/03-07:35 sending alternate
06/03-07:35  nce0004  connected  to  apollo:  2400  bps,  g
protocol, z grade
06/03-07:36 6 files sent, 0 files received, 3522 bytes sent,
39 bytes received
06/03-07:36  80  packets  transferred,  0  errors,  connection
time 0:29, 122 bytes/second
```

Figure 6.16:Contents of the *uucico.log* file

6.4 Chapter Summary

This chapter has presented a description of the CMC system that was developed to enable students to mail files and messages to each other and to lecturers. **Chapter 7** provides a discussion of:

- the use of the system
- a technical evaluation of the system.

7 EVALUATION OF THE CMC SYSTEM

7.1 INTRODUCTION

Sixty eight students enrolled for the second year of the FDE in 1995. This was the first group of second year students to enrol for this diploma. These students resided throughout the province of Kwa-Zulu Natal including Pietermaritzburg, Newcastle, Empangeni, and Durban. One particular student lived in Johannesburg.

The software package TELETUTOR was distributed to students during their regional meeting in March. Students were initially required to send messages of a social nature to each other and lecturers and hence to experiment and familiarize themselves with the system. During the first week in April, a contact session was held in Pietermaritzburg and the Durban regional centres. The purpose of the course was to:

- Assist students with problems they were experiencing with the LOGO programming module.
- Provide students with a list of LOGO exercises to complete and submit via the CMC system.
- Assist students with the installation of the modem and communication software required for the course.
- Provide students with a hands-on session with TELETUTOR to help them solve any problems.

Fifteen students attended the course in Durban and ten students in Pietermaritzburg. A set of LOGO exercises and notes were developed especially for use with the CMC system. These were distributed to students at this meeting. Students that did not attend the meeting but were connected to the system were E-mailed the notes and exercises issued at the course. Students were required to complete the exercises and E-mail them back to the tutor. These were marked by the tutor and returned via the CMC system. Lecturers also required students to E-mail the LOGO section of the first assignment to NCE. By the time this assignment was due (8 May 1995) thirty students were able to connect to the mail server. By the end of the course (end

of May) 35 students out of 68 had successfully connected to the server.

As mentioned earlier the use of the system was monitored by means of log files E-mailed to the system administrator. An evaluation program was written in Turbo Pascal to analyse the data contained in these files. The results of the analysis are presented in this chapter.

7.2 UTILIZATION OF THE SYSTEM

Students were allowed to dial into the mail server *APOLLO* between 6 pm and 6 am during the week and at any time during the weekend. The reason for restricting access to *APOLLO* was that the telephone lines connected to *APOLLO* were used for normal telephone communication during the day. Analysis of the data revealed that the majority of the connections to *APOLLO* were made between seven and eight in the evening.

Figure 7.1 illustrates that the majority of the connections made to *APOLLO* were made during April and May. This can be attributed to the following:

- Although the software was distributed in March most of the students, due to work commitments, only had time to attempt to make the necessary connections to *APOLLO* during the April school holidays.
- It was also during this time that a number of students attempted their assignments which were due on 8 May and hence, needed to contact lecturers and fellow students to discuss any problems areas.
- During the month of May assignments were submitted and students sent E-mail messages to lecturers in order to confirm that their assignments had been received. During the latter part of May and the month of June, marked assignments were mailed back to students.

Users had to specify the purpose of each connection to the mail server *APOLLO*. **Figure 7.2** illustrates the different purposes for which the system was used. The majority of the connections to *APOLLO*, i.e. 41.82 % or 491 connections were made in order to pick up mail

for the client. 24.87% (292 connections) of the connections made were for the purpose of requesting assistance from lecturers with either the LOGO programming module or questions in the first assignment.

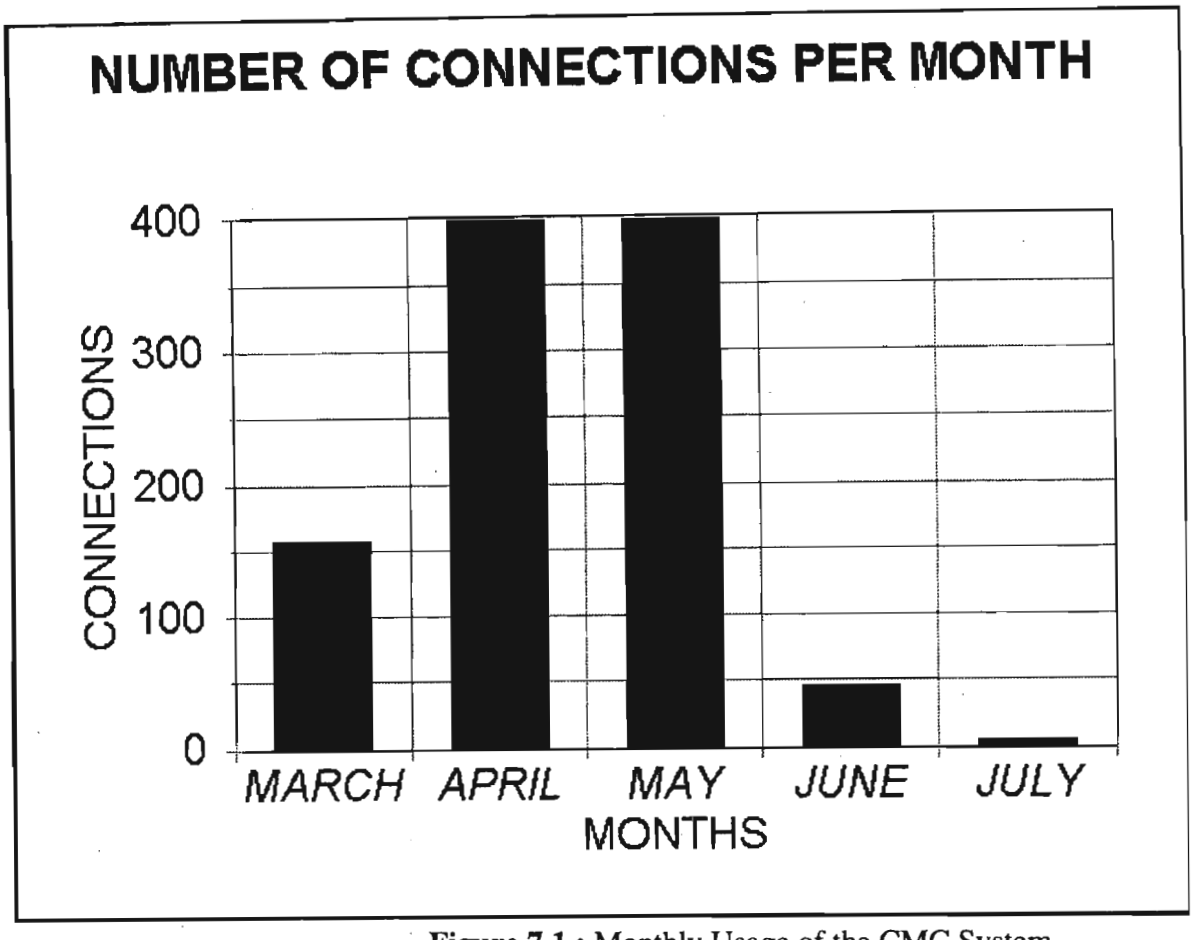

Figure 7.1 : Monthly Usage of the CMC System

There was also an appreciable amount of communication between students, i.e. 20.53% (241) of the connections made to *APOLLO* were for this purpose.

Students received three assignments for the year. The first assignment included a section which tested the student's knowledge of the concepts covered in the LOGO programming module of the course. Students were asked to E-mail this section to NCE where it would be marked and returned to the student electronically. Five students mailed other sections of the assignment using the system. This involved the transfer of word processing files and spreadsheet files. Unfortunately, not all students had the system working by the time the assignment was due.

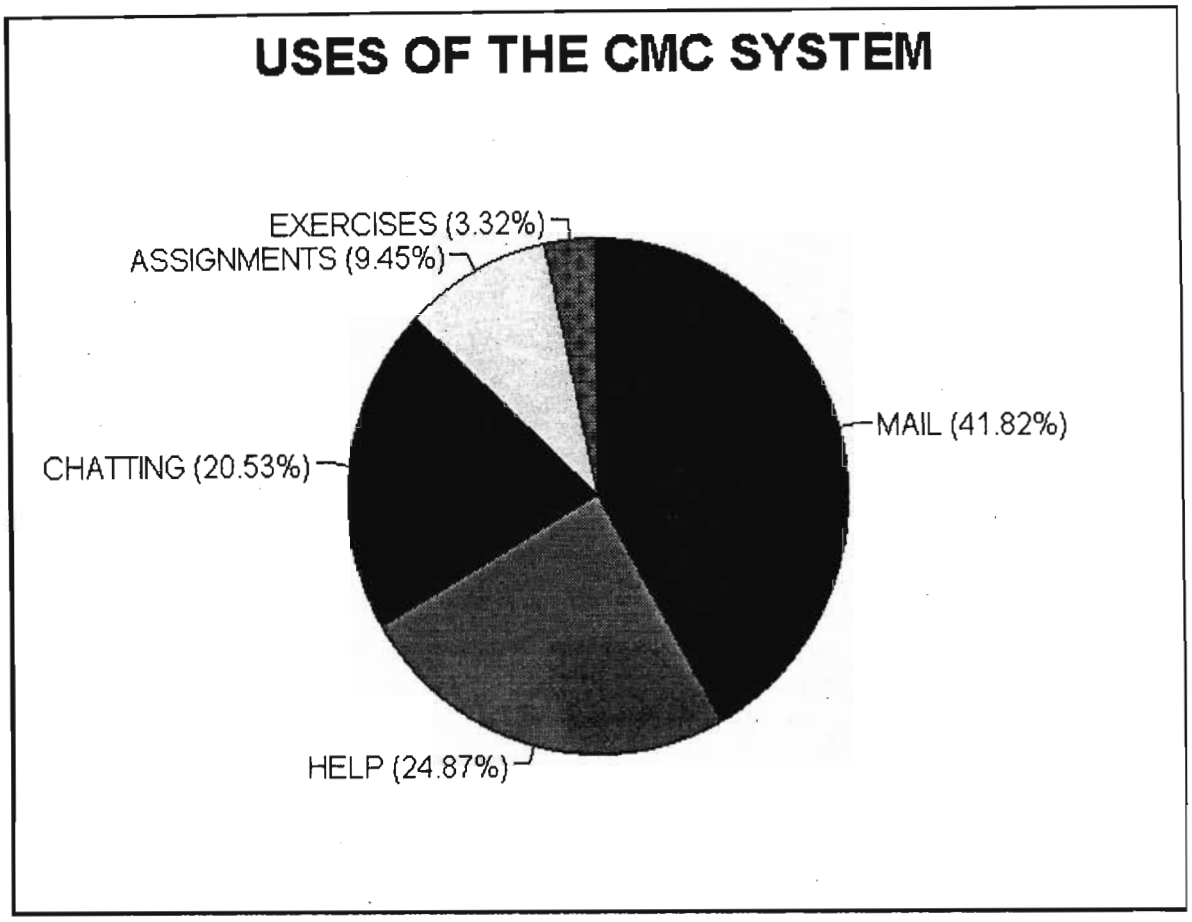

Figure 7.2:Uses of the CMC System

Furthermore, although approximately thirty students could connect to the mail server at this stage, some students did not have sufficient confidence in the system and mailed their assignments to NCE via the postal service.

Only fifteen of the 68 students in total used CMC to submit their assignments. Hence only 9.45% (111 connections) of the connections made to *APOLLO* were for the purpose of submitting assignments.

Notes and exercises on various aspects of LOGO were distributed to students. The LOGO exercises had to be submitted to the tutor by means of the CMC system. The response to these exercises was not good and only 3.32% (39 connections) of the connections made to the server were for this purpose.

By the end of May 35 students had managed to successfully connect to *APOLLO*. The users of the CMC system can be divided into categories based on their use of the system.

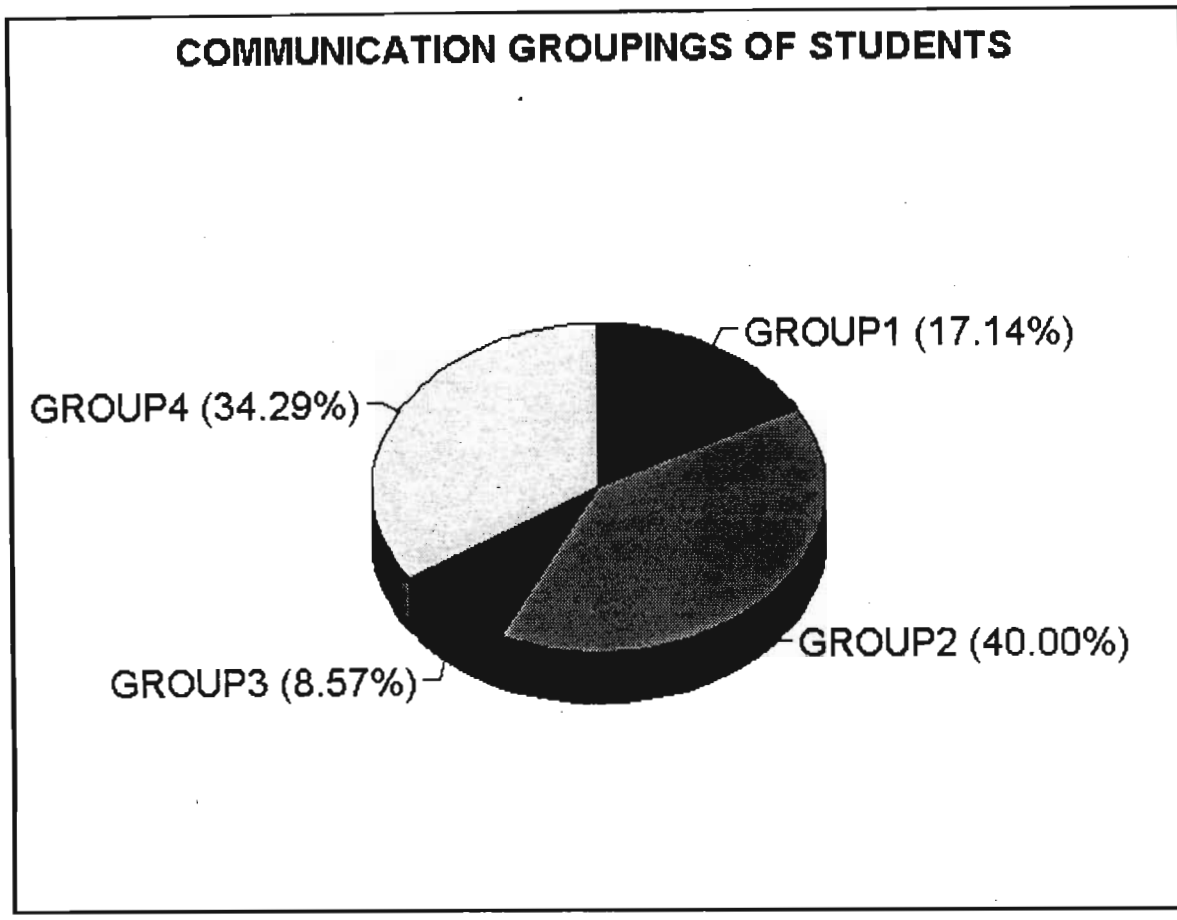

Figure 7.3:Pie Chart Illustrating the Categories of CMC Users

The groups or categories derived for the study presented here are illustrated by the pie chart in **Figure 7.3**. These groups are similar to those described by Gray [MASO89] in his account of the study carried out by CECOMM (see **pg. 45**).

According to Gray, CECOMM ran a course via CMC in 1988 for educators and trainers on the use of CMC in education. The first group of students described by Gray were those who "dropped out" due to work and other pressures. Similarly Group 1 in **Figure 7.3** represents those students who dialled into the server to get the system working, after which they did not log into the system. 17.14% of the students (i.e. six students) fell into this category.

The second group of students described by Gray were those who logged in to pick up mail but did not make any contributions themselves.

However, in the study presented in this thesis every student who connected to the server besides those in Group 1 communicated with either a lecturer or fellow student or both. These students were categorized into the three groups which are described below. These three groups collectively represent the third group of students defined by Gray, namely those who communicated frequently.

Group 2 represents those students who communicated with lecturers only. 40 % of students, i.e.fourteen students communicated with lecturers only.

Three students, i.e. 8.57% of the students communicated with students only. These students formed Group 3.

The last group of students, namely Group 4, communicated with both lecturers and students. Twelve students, i.e. 34.29% of the students fell into this category.

According to the literature surveyed, one of the functions of a CMC system is to promote learning by means of interaction between students and lecturers and students and their peers. In order to obtain a measure of the interaction that took place via the CMC system, four levels of interaction were defined:

- Level 1 - Communication with 2 other users.
- Level 2 - Communication with 3 to 4 other users.
- Level 3 - Communication with 5 to 6 other users.
- Level 4 - Communication with 7 to 8 other users.

From the bar chart in **Figure 7.4** it is clear that fifteen students communicated at Level 1, while eight students communicated at Level 2. Five students communicated at Level 3 and one student communicated at Level 4.

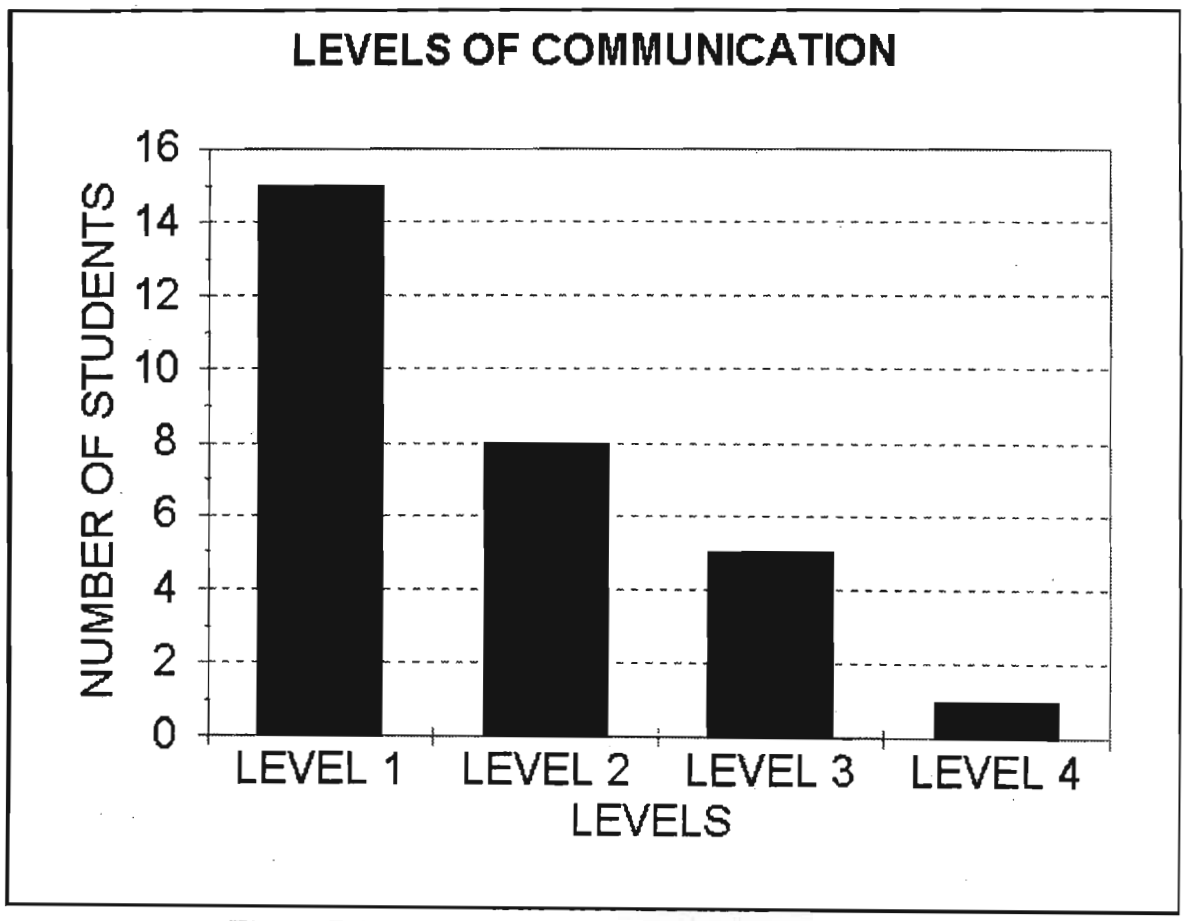

Figure 7.4:Bar Chart Illustrating the Level of Interaction

7.3 PROBLEMS ENCOUNTERED

7.3.1 Technical Problems

According to Davie [MASO89] the most difficult problems reported by students using CMC was connecting their modem to the computer and telephone line, the operation of their terminal software and achieving communication with OISE(Ontario Institute for Studies in Education). Goodyear [GOOD94] also states that students experienced technical difficulties in connecting to the University of Lancaster. From the literature surveyed it is evident that students generally experience a number of technical difficulties when first connecting to a CMC system. This section discusses some of the most common technical problems experienced by students in the study presented in this thesis.

7.3.1.1 Infrastructure

The telecommunications line that two students had access to was a shared farm line commonly know as a "party line". It was found that this type of telecommunication line did not facilitate data communication.

7.3.1.2 Modem Installation

Students experienced a number of problems with respect to the installation of the internal modem card. Two of the most common problems experienced were:

- The dip switches on the modem were initially set for a default communications port. However, if another serial device used the same interrupt as the modem, these dip switches had to be changed. In this case the installation program displayed a diagram of the dip switch configuration that had to be followed by the user. Students generally were not confident enough to change the configuration.

- In a number of cases the addresses of COM3 and COM4 on the computer were the addresses of COM4 and COM3 respectively on the modem. If this was a problem the *modem.mdm* file had to be edited by the user and the communications port had to be changed to be consistent with the addresses of the modem.

7.3.1.3 Log Files

In order to keep a record of the use of the system, each time a user dialled into the mail server three log files were automatically mailed to the system administrator. However, if the user did not get through due to a "BUSY" line or any other technical problem the backlog of log files accumulated on the user's hard drive and when the user did eventually connect to the mail server the files were transferred, increasing the user's connection time considerably in some cases.

7.3.1.4 Software Compatibility

Encoded files received by TELETUTOR could only be decoded by TELETUTOR if they had been sent using TELETUTOR, i.e. if an encoded file was sent via another data communications package such as Pegasus mail, TELETUTOR was unable to decode this file.

7.3.1.5 Connection Problems

71% of the attempts to connect to the mail server *APOLLO* were successful. The most common problems encountered are listed in **Table 7.1**. Note that the total number of connections to *APOLLO* was 1626.

Table 7.1: Technical Problems

DESCRIPTION	FREQUENCY
Busy Line - This indicated that the line was temporarily busy and that the user should try to dial in at a later stage.	151
*Modem is not initialized** - Whenever this message appeared it was due to one of the following: (a) Another serial device was installed on the same port as the modem. (b) The modem was sharing an interrupt with another device. (c) The modem initialization string needed to be changed.	79
*No dialtone** - The connection between the modem and the telephone line or exchange was not secure.	137
*Communications handler failed to initialize** - In this case the address for communication ports 3 and 4 on the computer were reversed for the modem. To alleviate this problem the modem configuration file was edited and the COM port numbers changed.	85

* - Could have occurred more than once for a particular user attempting to remedy the problem.

7.3.1.6 Evaluation of Questionnaire

Students were required to complete questionnaires on the evaluation of the CMC system used. **Appendix C** contains a copy of the evaluation questionnaire. Of the 35 students only nine students returned their questionnaires. Hence, no concrete conclusions could be drawn from these responses. However, some of the comments made by students proved to be valuable.

Of the nine responses, six indicated that the CMC system had made it possible to communicate more often than they had done previously.

Seven students indicated that using the CMC system had made it easier to obtain assistance from lecturers than previously. Students felt that more practical sessions should have been held in order to discuss difficulties that they were experiencing with the system. Users could only dial into the system between 6:00 pm and 6:00 am during the week. Students felt that this was restrictive.

Upon sending a message students felt uncertain as to whether "the system had worked" and the messages had been received. One student indicated that responses to messages depended on whether the recipient of the message logged on regularly or not.

Positive comments made by students regarding the CMC system included:

- Immediacy of reply
- "INVALUABLE when you need help"
- "I believe it should be an integral part of the course from day 1"
- "A definite advantage to a distance education student"

8 ATTITUDE SURVEY

8.1 INTRODUCTION

Attitude surveys were conducted in order to determine:

- The attitudes of adult distance learners towards computers in general.
- The attitudes of distance learners towards computers including the use of CMC and the use of computers in education.
- The effect that the use of CMC has on the attitudes of adult distance learners towards computers in general, the use of CMC and the use of computers in education.

8.2 ATTITUDES OF DISTANCE LEARNERS TOWARDS COMPUTERS

8.2.1 Data Collection

The pilot study conducted in 1994 included a survey of students' attitudes towards computers. The instrument used to test attitudes was a questionnaire comprising of thirty nine attitudinal statements. The first twenty statements were adapted from those presented by Lee [LEE79] to determine the attitudes of the American population towards computers. As the students in the study presented here were teachers, it was decided to include attitudinal statements in the questionnaire to test students' attitudes towards the use of computers in the classroom. Fifteen statements, taken from the questionnaire derived by Marriemuthu [MARR90], were included in the questionnaire. The last four statements in the questionnaire tested students attitudes towards the use of CMC in distance education. The questionnaire administered to students is presented in **Appendix B**. Students had to respond to these statements by means of the seven point Likert scale illustrated in **Table 8.1**.

Table 8.1 : Likert Scale

7 - STRONGLY AGREE
6 - MILDLY AGREE
5 - AGREE
4 - UNCERTAIN
3 - MIDLY DISAGREE
2 - DISAGREE
1 - STRONGLY DISAGREE

The attitude score attained by each student was computed as follows. Responses to statements that view computers in a positive light were merely added together. In order for the final total to reflect the positiveness of a subject's attitude, responses to a negative statements (e.g. "They can be used for evil purposes if they fall into the wrong hands") were converted in order to reflect the degree of positiveness of the responses. For example, if the response to a negative statement was 1 (representing total disagreement) this was converted to a 7 and added to the accumulated score. Similarly, if the response to the negative statement was 6, the value added to the cumulative score was 2.

53% of the class of 106 students responded to this questionnaire. A factor analysis using varimax rotation of the responses to the 39 statements was conducted. The GENSTAT statistical analysis program was used for this purpose. An eight factor solution was found to be the most feasible. A list of the factors and corresponding factor loadings can be found in **Appendix B**. A factor loading of 0.4 and above was considered to be significant.

8.2.2 Factor Analysis

The first factor extracted was a negative factor which represented the students' fear of computers. Statements which loaded significantly on this factor included "These machines

undermine the capabilities of humans" as well as "Someday in the future they will be running our lives for us".

The second factor indicates that students see the use of computers in education as being beneficial. The third factor extracted was a positive factor and is representative of students "awe" and "wonder" of computers. Furthermore, it stresses that students see computers as being beneficial.

The fourth factor emphasised the use of computers as a means of improving education and economic developments in the country. The fifth factor indicates that although students can see the benefit of computers to some extent they are uncertain as to the role that computers should play in education.

The sixth component extracted indicates that although the potential of computers can be seen by the students they are uncertain about the negative effect that the use of computers can have on mankind. The seventh factor emphasises students fear that computers are going to dictate to society and hence, run our lives.

Somekh in her paper "The Human Interface:Hidden Issues in CMC Affecting the Use in Schools" [MASO89] states that people tend to reject new technologies due to their "ritualistic behaviour". People are content doing things in the same way from day to day without deviating from this routine. Anything that threatens to upset routine is rejected. The eighth factor extracted emphasised that students view the use of computers as upsetting the normal ritualistic routine and hence view the use of computers in a negative light.

8.2.3 Comparison with Previous Studies

In an attempt to compare the results obtained in this study with those discussed in the literature, the responses to the first twenty statements (i.e. Lee's model) were factor analysed using varimax rotation. A four factor solution was developed which accounted for 50.3% of the variance. These factors were compared to the results obtained by Finnie [FINN90] and

Morrison [MORR83].

The first factor extracted in this four factor model was a positive factor. Statements which loaded positively on this factor include "They do things that stagger your imagination" and "They make it possible to speed up scientific progress and achievements". Consequently, this factor represents the students "awe" and "wonder" of computers. It also stresses that the students see the computer as a benefit to mankind. This factor is consistent with the first factor that emerged from the study conducted by Finnie [FINN90]. This factor was a positive factor. Variables which loaded positively on this factor included "These machines are exciting and fascinating" and "They bring about a better way of life for mankind". However, the first factor of the four factor solution obtained by Morrison [MORR83] was a negative factor.

The second factor extracted in the study presented was a negative factor which reflects the students' fear that computers will possess the locus of control instead of humans. The second factor extracted in the study conducted by Finnie was also a negative factor indicating people's fear of the power of computers over mankind. In Morrison's study the second factor extracted was a positive factor expressing students' fascination of computers.

The third factor derived in this study reflects that the potential of computers can be seen by the students despite the fact that they are weary and uncertain about the effect of the negative aspects that computing will have on society. However, the third factor extracted by Finnie is a positive factor representing students "awe" and "wonder" of computers. The third factor obtained by Morrison reflects an inadequate understanding of computers.

The fourth factor extracted stresses students' fear of the negative effect that the use of computers may have on society in the long term. This factor is similar to the fourth factor derived by Morrison which expressed students' concern with respect to both the positive and negative implications of the wide spread use of computers. The fourth factor derived by Finnie was a positive factor. Variables which loaded significantly on this factor included "They are exact and accurate".

8.2.4 Correlation with Computer Experience and Age

Pearson's coefficient was calculated in order to determine the relationship between the student scores and computer experience. The value obtained for Pearson's coefficient was 0.1595. This indicates that there is a weak relationship between the scores obtained by students and their experience with computers. However, this score also indicates that the more experience a student has, the higher the attitude score.

Pearson's coefficient was also calculated to determine the relationship between students' attitude score and age. The value obtained for Pearson's coefficient was -0.0843. Again this suggests a weak relationship between student attitude score and student age. The coefficient value of -0.0843 also suggests that an increase in age results in a decrease in the score obtained, i.e. the older a person is the less positive their attitude towards computers.

8.3 THE EFFECT OF CMC ON THE ATTITUDES OF DISTANCE LEARNERS TOWARDS COMPUTERS

A survey was also conducted in 1995 in order to determine whether the implementation of the CMC system had any effect on the attitudes of students (i.e. those taking the LOGO programming module) towards computers in general. The questionnaire decribed in **Section 8.2** was administered to students before they used the system (this will be referred to as Study 1) and again three months later upon completion of the LOGO programming module (this will be referred to as Study 2). 76% of the questionnaires were completed in Study 1 and 72% in Study 2. The students taking the course can be categorized into three groups:

- Those that participated fully in the research. This included using the CMC system and completing both questionnaires.
- Those that completed one or both of the questionnaires but did not use the CMC system.
- Those who neither used the CMC system nor completed any of the questionnaires.

A majority of the students who completed and submitted both questionnaires had also used the CMC system. As a result this sample is representative of those students who have used the CMC system.

In order to ensure that the responses made by students to the questionnaire were honest, students were not required to write their names or any other form of identification on the questionnaires. Consequently, the change in attitudes of students could not be computed individually as in the case of the study conducted by Finnie, but could only be assessed by looking at the group of students as a whole.

In order to determine the relationship between the sex of the student and the attitude score, a correlation analysis was carried out using the *point biserial method.* For the first study a correlation coefficient of 0.68 was obtained and a coefficient of 0.67 for the second study. This indicates that in both studies, males obtained a higher score than females.

From the histogram in **Figure 8.1** it is evident that for this sample there appears to be a mean increase in the attitude scores obtained in Study 2 compared with that obtained in Study 1. In order to determine whether this change was valid for the entire population, a Wilcoxon Matched-Pairs Signed Ranks test was conducted. A T value of 444.5 was computed with 46 degrees of freedom. A significance level of 0.1 was used. This indicates that the positive change in attitude scores is valid only for this particular sample and not the entire population.

The responses to each of the four statements on the use of CMC for both studies were compared. This comparison is illustrated in **Figures 8.2**, **8.3**, **8.4**, and **8.5**. These histograms were constructed using the converted negative scores described earlier. Hence, the higher the score the more positive the response.

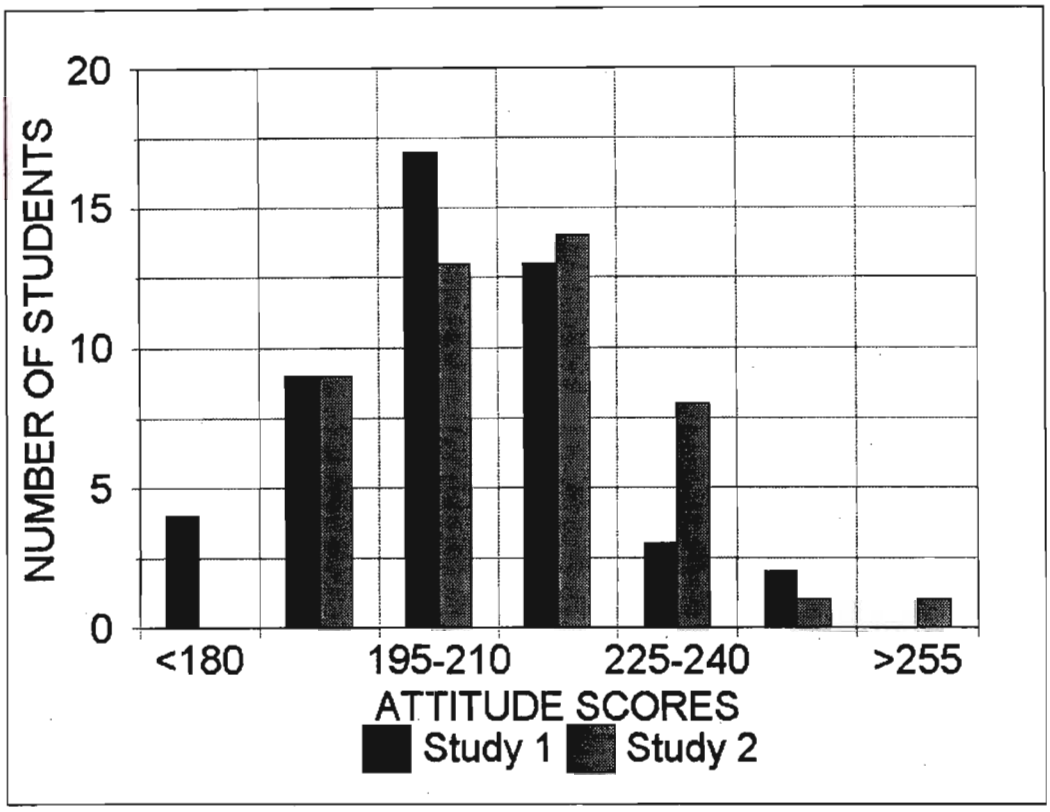

Figure 8.1: Comparison of Attitude Scores

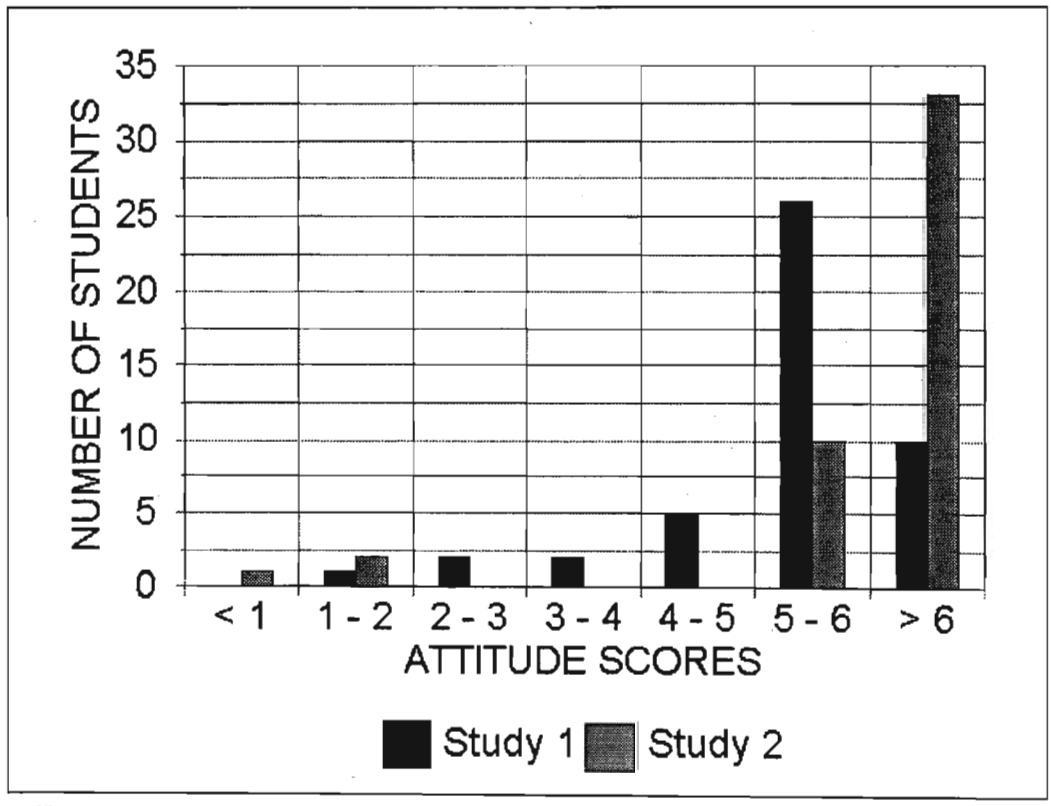

Figure 8.2:A Comparison of Responses to the Statement "It is possible to communicate via a computer with people in any part of the country."

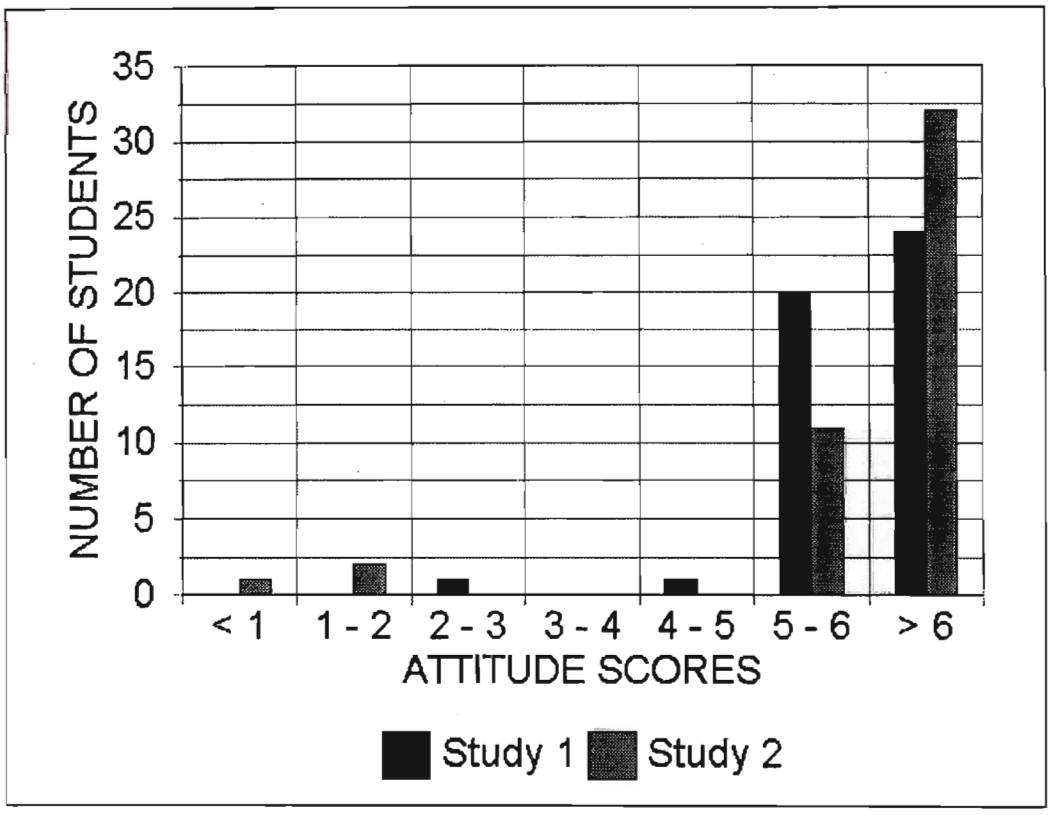

Figure 8.3:A Comparison of the Responses to the Statement "It is possible to communicate via a computer with people in any part of the world."

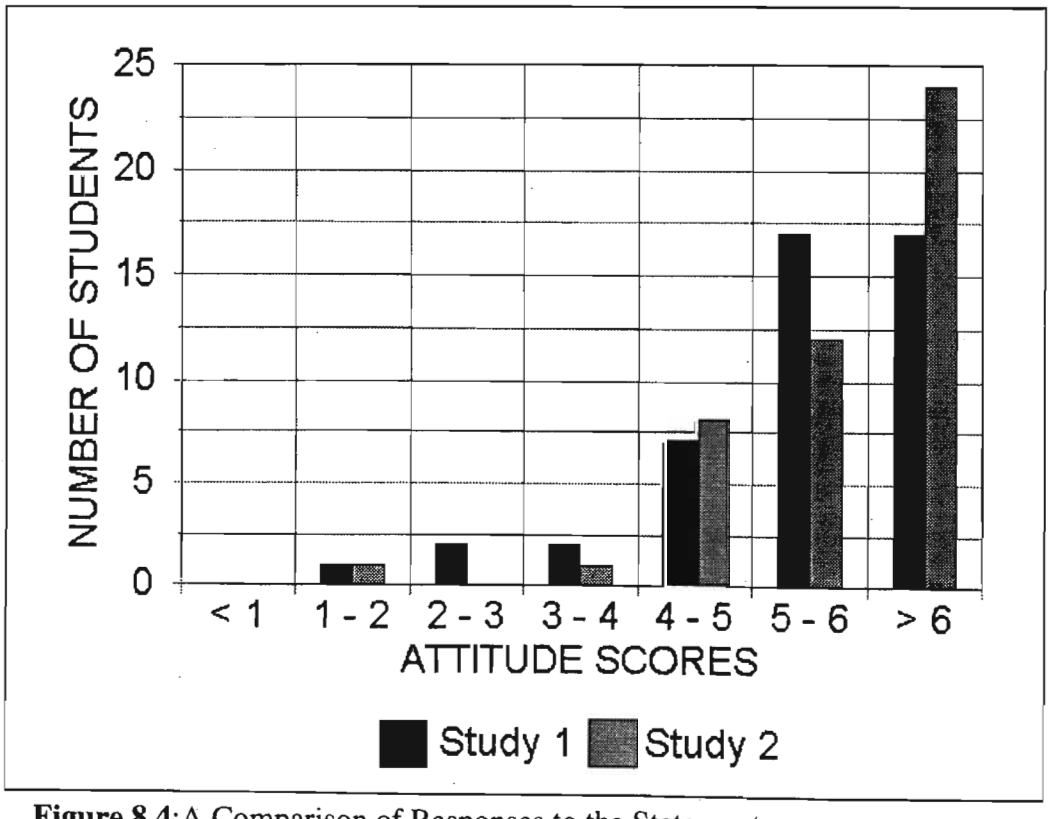

Figure 8.4:A Comparison of Responses to the Statement "Communication via computers should play an important role in distance education."

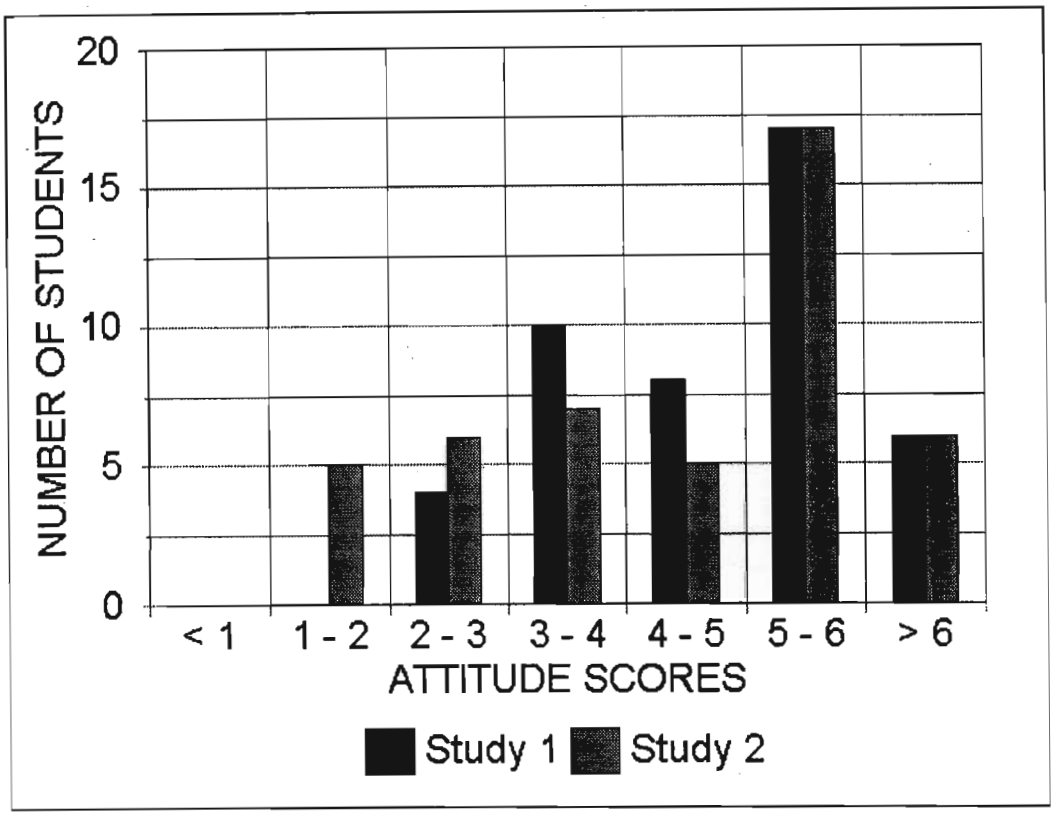

Figure 8.5: A Comparison of the Responses to the Statement "Costs involved in communication via computers is not worth the benefits of such communications."

From these histograms it is clear that there is an increase in the positiveness of the scores obtained in Study 2 compared to Study 1 for each of the statements for this particular sample. A Wilcoxon Matched-Pairs test was conducted in each case in order to determine whether these changes were representative of the entire population and not just the sample of students, the majority of which had used the CMC system. The T-values and the degrees of freedom are listed in **Table 8.1**. A *rho* value of 0.1 was used. From the values presented in this table it is clear that the change in the responses in Study 2 is not representative of the whole population and is significant for this sample only.

As illustrated in **Figure 8.6**, for this sample, responses to all but one of the statements were more positive in Study 2 than in Study 1. The one exception was the response to the statement "Teachers should be required to take a number of courses in programming" was more negative in Study 2 than Study 1.

Table 8.1: Results of the Wilcoxon Matched-Pairs Signed-Ranks Test for Responses of Students to statements Testing Attitudes towards CMC

STATEMENT	T-VALUE	DF
It is possible to communicate via a computer with people in any part of the country.	136.5	20
It is possible to communicate via a computer with people in any part of the world.	168.5	18
Communication via computers should play an important role in distance education.	207	14
Costs involved in communication via computers is not worth the benefits of such communication.	283	10

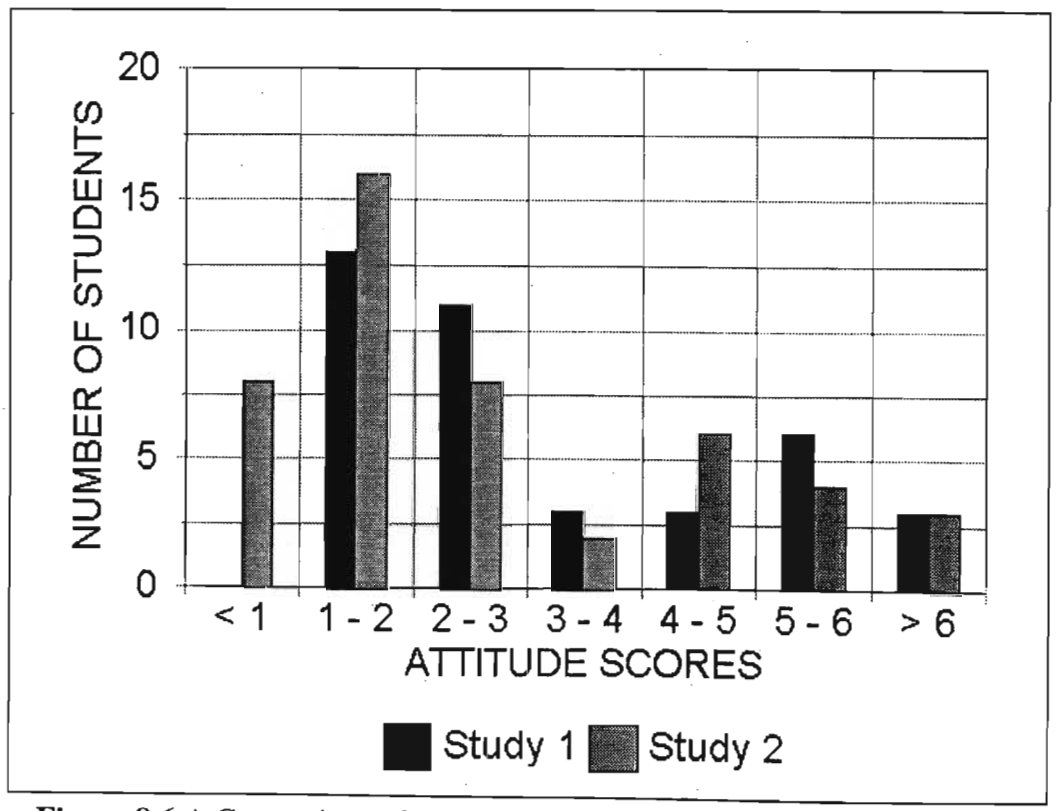

Figure 8.6:A Comparison of the Responses to the Statement "Teachers should be required to take a number of programming courses."

A Wilcoxon Matched-Pairs Ranked test was conducted in each case in order to determine whether the change in responses to each of the statements in Study 1 compared to Study 2 were valid for the entire population. The T-values and degrees of freedom computed are listed in **Appendix B**. A *rho* value of 0.1 was used. From these tests conducted it is clear that the change in response to each statement is not representative of the entire population.

9 REVISED SYSTEM

9.1 INTRODUCTION

Using the criteria listed in **Table 5.1 (pg. 65)** an evaluation of TELETUTOR was conducted:

1. TELETUTOR is menu driven. It was initially felt that if TELETUTOR was menu driven user procedures would be simplified. However, some user procedures could be further simplified. These are outlined in **Section 9.6**.
2. TELETUTOR can be easily adapted and extended.
3. Features that are commonly used are easily accessible.
4. The installation procedures were developed specifically for novice computer users. Installing TELETUTOR requires minimal knowledge of data communications. As described in **Chapter 6** students had to specify just four values namely:

    - A user-id
    - Dial type of the telephone line connected to the modem.
    - Whether the user resides in Pietermaritzburg or not.
    - The name and surname of the student.

    However, students still experienced problems with installing modems. Possible solutions to this problem are outlined in **Chapter 11**.
5. TELETUTOR does not provide menu guidance. However, user manuals specifying how to use the different menu options were compiled and issued to users. From the types of questions asked by students (e.g. how do you send a mail message) when they phoned in to the support service it was apparent that they had not consulted their user manuals. Hence, the user manuals were not found to be very effective.
6. TELETUTOR was freely distributed to students.
7. TELETUTOR provides for off-line compilation of messages and files.

A number of revisions were made to TELETUTOR based on:

- the above evaluation,
- the response obtained from students via questionnaires (see **Appendix C**) that they completed, and
- problems experienced by students.

This chapter presents a discussion of these revisions.

9.2 MECHANISM TO SWITCH BETWEEN TELEPHONE LINES

Table 7.1 (pg. 112) indicates that 151 of the 458 error messages logged were due to the line to *APOLLO* being "BUSY" when a user attempted to connect to the mail server. In an attempt to reduce the number of occurrences of this problem, a mechanism has been built in to TELETUTOR to detect a busy line. Upon detecting a busy line TELETUTOR attempts to dial the number of the second telephone line connected to *APOLLO*. Firstly the user is informed that the line is busy and prompted to indicate whether he or she would like to try dialling into the server again. If the response obtained is positive, TELETUTOR then dials the second number in an attempt to connect to the server. If this line is also busy the user is informed and it is suggested that the user tries again later.

9.3 ENCODING OF BINARY FILES

TELETUTOR was found to be incompatible with other data communications packages such as Pegasus mail in the sense that TELETUTOR could only decode uuencoded files that had been sent via TELETUTOR. TELETUTOR has been adapted to decode most encoded mail sent to a user using TELETUTOR from a user using another data communications package.

Initially, the size of the encoded files sent via TELETUTOR was limited. Although this did not present any problems in the use of the system during the study, TELETUTOR was adapted

to allow encoded files of any size to be transmitted.

9.4 UUCICO REPORT

When the UUPC program *uucico* connected a client to the server, a report on the status of the connection was written to the screen. Initially, it was thought that this would be ideal for trouble-shooting. However, due to the technical content of this report students were confused and doubted whether they had connected to the server or not.

As a result TELETUTOR has been adapted so that this report is now written to a file. Only the following messages now appear on the users' screen:

- A message indicating to the user that TELETUTOR is connecting to the server.
- A message indicating to the user that a successful connection to the mail server has been made.
- A message indicating that the mail sent by the user is being transferred to the server.
- A message indicating that mail is being transferred from the server to the users' hard drive.
- A message informing the user whether they have received new mail or not.

9.5 DOSSHELL

A DOS shell option is provided in the revised version of TELETUTOR. This is to enable the users to use DOS commands within the TELETUTOR environment instead of having to exit TELETUTOR in order to use DOS commands.

9.6 MECHANISMS TO FACILITATE EASE OF USE

9.6.1 Reading Mail messages

In order to read a mail message in the original version of TELETUTOR, the user had to choose between the **New Mail**, **Old Mail** or **Mail Sent** options. This resulted in a list of messages appearing on the screen. To choose a message the user had to enter the number of the message that he or she wished to read. Although there were no indications that students experienced difficulties with this method of choosing a message, it was decided that the process should be simplified.

The revised version of TELETUTOR allows the user to choose a particular message from a list of messages by moving the highlighted bar to the message and pressing **ENTER**.

9.6.2 Specifying the name of the recipient

One of the details that a user had to specify when sending a mail message or a file to another user was the **surname** of the recipient. The surname entered by the user was checked against a list of students and lecturers stored on the users' hard drive. If a match was not found an error message appeared on the user's screen. Hence, if a user had misspelt a surname an error message appeared on the screen until the correct surname was entered. In order to facilitate ease of use of the system, TELETUTOR now provides the user with a list of names from which the user can select a particular name.

9.6.3 Sending Files

In order for the user to mail a file, one of the details that had to be provided by the user was the name of the file. The user had to ensure that the drive, subdirectory (if applicable), the name of the file and the extension of the file were specified. The revised version of TELETUTOR provides the user with a list of file names and subdirectories on the working

directory. The user can:

- Choose a filename from the list.
- Choose a subdirectory which will result in TELETUTOR providing a list of the names of the files stored in the subdirectory. The user can then choose a file from this list.

9.7 UTILITY FACILITIES

9.7.1 Mailing List Facilities

The revised version of TELETUTOR provides the user with a mailing list from which to choose the name/s of recipient/s. TELETUTOR also provides the user with an option to delete a name from the mailing list, just view the mailing list and add a name to the list. In order to add a name to the mailing list, the user has to specify the name of the user and the E-mail address of the recipient.

9.7.2 Phone List Facilities

The two telephone lines connected to the server *APOLLO* were not dedicated lines. Should one of these lines be changed, this would require the phone number in the *systems* file on the client to be changed. The revised version of TELETUTOR provides the following options:

- Adding a phone number to the phone list.
- Viewing the phone list.
- Deleting a number from the phone list.

9.7.3 Signatures

The revised version of TELETUTOR automatically appends the name and E-mail address of

a user to every file and message sent by that particular user. Furthermore, TELETUTOR provides the user with the option of editing this signature file.

9.8 MECHANISMS TO ASSIST STUDENTS TO USE THE SYSTEM

9.8.1 The Help Facility

To assist students with using TELETUTOR the help system was substantially extended. At any stage the user can press F1 to obtain assistance. Topics on which assistance is provided include the following:

- Choosing menu options.
- Using dialog boxes.
- Each menu option.
- Each dialog box or message box.
- Each list box.
- Each data field of a dialog box.
- Each function provided by TELETUTOR.

9.8.2 The COACH Option

This option provides users with step by step instructions on how to perform a particular task. To change to coach mode the user must press CTRL+C. This results in a list of options including the following options appearing:

- Accessing a Study Guide Received
- Accessing a Tutorial Letter Received
- Accessing an Exercise Received
- Accessing an Assignment Received

- Attaching a file to a Message
- Editing the Mail List
- Editing the Phone Number List
- Editing the Signature
- Exiting the TELETUTOR program
- Exiting to DOS shell
- Forwarding a Message.
- Including a file
- Issuing Assignments
- Issuing Exercises
- Issuing Study Guides
- Issuing Tutorial Letters
- Printer Setup
- Printing a message.
- Reading Mail Sent
- Reading New Mail
- Reading Old Mail
- Replying to a message.
- Saving a message.
- Sending a File
- Sending a mail message
- Using the Coach option
- Using the Conferencing Option
- Using the Dial option
- Using the Mail Server option
- View the Mail List
- View the Phone List

Upon choosing one of these options the user is led step by step through the process involved in carrying out a particular function. To switch the coach option off at any stage the user can press CTRL+END.

9.9 CONFERENCING OPTION

The revised version of TELETUTOR provides the users with a conferencing option. Upon choosing this option from the **Send Mail** menu the user is prompted for the subject of the message. Thereafter, the user is taken into the editor to type in the message. Any message sent via the conferencing option is automatically mailed to every student and lecturer involved in the course.

9.10 THE COURSE OPTION

Two versions of the revised TELETUTOR system were produced, namely the tutor version and the student version. The student version of TELETUTOR has a **Course** submenu. This submenu enables students to access assignments, exercises, study guides, and tutorial letters that have been mailed to them.

The options of the Course submenu are:

- Assignments
- Exercises
- Study guides
- Tutorial letters

On each student client a subdirectory TUTOR is created within the subdirectory UUPC. Subdirectories created within TUTOR are:

- AS - all assignments received are stored in this subdirectory.
- EX - all exercises received are stored in this subdirectory.
- SG - all study guides received are stored in this subdirectory.
- TL - all tutorial letters received are stored in this subdirectory

Each time the student version of TELETUTOR is run or whenever the user dials in to the server a check is carried out to determine whether the user has received an assignment, a tutorial letter, a study guide or an exercise. If such material is received, a file is created containing this information and stored in the relevant subdirectory. A message box appears on the screen informing the user that a new tutorial letter, assignment, exercise or study guide has been received. At any stage the student can access assignments, exercises, study guides and tutorial letters received via the Course submenu.

9.11 BULK MAIL

The **tutor** version of TELETUTOR has a **Bulk** submenu. If the tutor or lecturer wishes to send an assignment to all registered students, he or she can do so by choosing the **Assignments** option from this submenu. Upon choosing this option, the user is prompted for the name of the file to be sent, the type of the file and the list of students to which the file must be sent. The options of the **Bulk Mail** submenu are:

- Assignments
- Exercises
- Study guides
- Tutorial letters

10 DISCUSSION

10.1 INTRODUCTION

The main aim of the study presented here is to determine the technical feasibility of using CMC as a means of assisting South African distance learners overcome certain constraints associated with studying at a distance. A CMC system was developed and implemented in the instruction of courses at a South African distance education institution, namely NCE.

This implementation has served as a means of:

- Re-defining the need for a CMC system in the instruction of distance education courses as seen by South African distance learners.
- Identifying technical problems experienced by users in the implementation of a CMC system in a South Africa and possible solutions to these problems.
- Defining the technical characteristics of a CMC system for novice computer users studying at a distance in a South African distance education environment.
- Determining the effect of the students' attitudes on their use of the system.
- Determining the effect of the CMC system on students' attitudes towards computers.

This chapter provides a discussion on each of the above points. The results of the attitude surveys presenteded in **Chapter 8** are also discussed. Finally, based on the study conducted, this chapter looks at additional factors that possibly need to be considered when implementing a CMC system at a South African distance education institution.

10.2 USE OF THE CMC SYSTEM

Of a class of 68 students, 35 students utilized the CMC system. Of these 35 students 29 students used the system regularly. The resuluts of this study show that for those students that used the CMC system, CMC has eliminated some of the problems that they have experienced with studying at a distance.

The use of the CMC system has definitely provided an alternative means of communication between students and lecturers. From the evaluation presented in **Chapter 7** we have seen that 26 of the 68 students have communicated with lecturers. Furthermore, the purpose of 292 of the 1174 connections to *APOLLO* by students was to send messages to lecturers to obtain assistance with areas of the course with which they were experiencing difficulties.

TELETUTOR also provided students with a means of communicating with each other. The discussion presented in **Chapter 7** indicates that fifteen students (from a class of sixty of which 35 students had connected to the server) communicated with each other. Of the connections made to *APOLLO,* 241 were for the purpose of sending messages to a peer.

As mentioned previously students had to submit the LOGO programming section of the assignment to the college via the CMC system. Fifteen students used the system to submit the LOGO programming section of the assignment.

Students that lived in areas out of Pietermaritzburg felt that in order for their assignments to reach NCE by the due date via the postal service these assignments usually had to be posted quite early thereby reducing the time available to complete the assignment. Using the CMC system to submit assignments provided these students with additional time to complete these assignments. Consequently, five students submitted their entire assignment (i.e. not just the LOGO programming section) via the CMC system.

In order to obtain some idea of the amount of interaction that took place, four levels of interaction have been defined in **Chapter 7**. From the bar chart illustrated in **Figure 7.4 (pg. 110)** it is clear that a significant amount of interaction took place with fifteen of the students communicating with at least two other users (i.e. students and lecturers) and one student communicating with at least seven other users.

Based on the discussion in this section the need for CMC as seen by South African distance learners can be described by the following prioritized list:

- From **Figure 7.2** (pg. 107) in **Chapter 7** 24.87% of the connections to *APOLLO* were made by students to obtain assistance from lecturers while 20.53% of the connections were for the purpose of chatting to students. Furthermore, from the discussion presented in **Chapter 7** it is apparent that 26 students communicated with lecturers while fifteen students communicated with peers. Hence, it is evident that South African distance learners see the primary purpose of the CMC system as a means of communicating with lecturers and obtaining assistance from lecturers.
- Secondly, students felt that using the CMC system enabled them to communicate with fellow students. This is apparent from the fact that the purpose of 241 of the 1174 connections to *APOLLO* was to communicate with a fellow student. Furthermore, fifteen students communicated with each other.
- It is evident from discussions held with those students who had used the CMC system to submit assignments that using the system gave them more time to work on the assignment and reduced the time required in mailing the assignment. This was especially true for those students that lived out of Pietermaritzburg.

10.3 TECHNICAL DIFFICULTIES

Chapter 7 outlines the technical difficulties experienced by students. In order to increase the feasibility of using CMC in a South African distance education environment, possible solutions to these problems need to be found. Such solutions are outlined in both **Chapter 9** and **Chapter 11**.

10.4 TECHNICAL AND ECONOMIC CHARACTERISTICS OF A CMC SYSTEM TO BE USED IN A SOUTH AFRICAN DISTANCE EDUCATION ENVIRONMENT

Based on the study presented in this thesis the technical charateristics of a CMC system for distance education in a South African context will be described in the form of a list of criteria

which must be met by a CMC system to ensure it's technical feasiblity in a South African distance education environment. As stressed in **Chapter 5** it is essential that the CMC system be both cost effective and easy to use in order to be feasible in a South African distance education environment. Based on the criteria derived in **Chapter 5** and the revisions that were made to the system the following set of criteria must be met by a CMC system in order for it to be feasible in a South African distance education environment as a solution to the communication problems experienced by distance learners.

Cost-effectiveness

1. The operational costs involved in using the system must be minimized.
2. The CMC system must facilitate off-line editing.

Hardware

3. From the literature review presented in **Chapter 4** and the discussion provided in **Chapter 7** it is evident that CMC users inevitably experience technical problems. It is essential that mechanisms are built into the CMC system in order to minimize these problems (for this particular study these are outlined in **Chapters 9** and **11**).

4. It is essential that a support service is set up to assist users with any problems they may experience in installing and using the system.

Software

5. In order to ensure that the system is easy to use the amount of information entered by users should be minimized. For example, instead of the users typing in the name of the recipient of a message, a list of possible names should appear on the screen from which the user can select a name.

6. The system should be extendable from a user point of view, e.g. users should be able

to edit mailing lists, phone lists, attach signatures to mail and edit such signatures, etc.

7. The system should provide an extensive context-sensitive help facility. A mechanism that assists users in utilizing the system should also be available, e.g. a coach option or a tutorial program.

8. The CMC system should cater for the method of instruction of the distance education courses taught using CMC. For example, at NCE a lot of emphasis was placed on the submission of assignments as a means of assessment. Furthermore, tutorial letters, study guides and exercises were usually mailed to students using the postal service. Thus, the **Course** option and **Bulk** mail option was added to the revised version of TELETUTOR.

9. The software should be menu-driven.

10. The software should be easily extendable.

11. Options that would be frequently used by users should be easily accessible.

10.5 DISCUSSION OF THE ATTITUDE SURVEYS CONDUCTED

As discussed in **Chapter 8** attitude surveys were conducted for the following reasons:

- Finnie [FINN87] states that the attitudes of users towards a system definitely plays a role in the successful implementation of the system. Thus, an attitude survey was conducted in order to determine the attitudes of these novice computer users studying at a distance in a South African context towards computers.
- In order to determine the effect of the use of the CMC system on students' attitudes towards computers.

Questionnaires (described in Chapter 8) were distributed to students. A factor analysis of the

responses to the questionnaires revealed that the attitudes of these students can be described by the following dimensions:

- A negative factor indicating the students' fear of computers.
- The usefulness of computers in education.
- A positive factor expressing the students' fascination of computers. It also stresses that users see computers as being a benefit to humans.
- Computers have the potential to bring about a better way of life for mankind by improving education and economic development in the country.
- A factor which stresses that the benefit of computers can be seen, but there is still some uncertainty as to the role that computers should play in education.
- Although the potential of computers can be seen, there is some uncertainty as to the negative effects that computers can have on mankind.
- The fear that computers are going to "control" people.
- The ritualistic behaviour of people resulting in them viewing the use of computers negatively.

According to Somekh, [MASO89] "The experience so far gained of CMC, at least in Britain, suggests that one of the main problems lies in getting people to use it." This is one of the problems that has been encountered in the study presented in this thesis. It was very difficult to get students to use the CMC facility. In Somekh's paper "The Human Interface: Hidden Issues in CMC Affecting the Use in Schools", she attributes such attitudes taken by students to the ritualistic behaviour of humans. People are generally content with doing things in a manner they are used to. "Rituals simplify life so that departing from them reduces time for other things". In this study it was difficult to get students to use the system. Furthermore, thirty students were connected to the system yet, due to a lack of confidence fifteen of these students submitted their assignments via the postal service. Consequently, the eighth factor appeared to be a prominent dimension of the students' attitudes towards computers and probably affected their decision as to whether to use the CMC system or not.

Further attitude surveys were conducted in order to determine the effect that using the CMC

system had on students' attitudes towards computers. Questionnaires were administered to students before using the system and again at the end of the course. As mentioned previously, the majority of the students who responded to both questionnaires were students who had used the CMC system. Hence, the sample of students who responded to both questionnaires were represented those students who had used the system. For this sample there was an increase in attitude scores indicating that the attitudes of the students were more positive after using the system. Students in this sample also appeared to have a more positive attitude towards the use of computers in education and the use of CMC in distance education after using the CMC system. A Wilcoxon Matched-Pairs Ranked test conducted indicated that this change in attitude was not valid for the entire population.

10.6 SOCIOLOGICAL, ORGANIZATIONAL AND EDUCATIONAL FACTORS

One of the major problems experienced was getting students to use the CMC system. Furthermore, although attempts were made to integrate the use of CMC into the course, these efforts appeared to be insufficient. The possibility of totally integrating the use of CMC into the instruction of a course is greater if the person (or group of people) involved in implementing and maintaining the system and the person (or a group of people) teaching the course is one and the same. This was not the case in this study and hence we found it very difficult to integrate CMC into the course so as to use all the benefits of CMC. In addition, these efforts were hampered by the fact that the course lecturer and the CMC co-ordinator was not the same person.

Hence, it is essential that sociological, organizational and educational factors be taken into consideration in the implementation of a CMC system. This section looks at sociological problems associated with using a CMC system. Organizational and educational issues are discussed in **Chapter 11.**

The main problem encountered in this study was getting students to use the system. This lack of participation can possibly be attributed to the following:

- Grint [MASO89] in his paper "Accounting for Failure: Participation and Non-participation in CMC" states that one of the reasons why students did not participate in CMC was time constraints. He explains that part-time students usually work according to a very "tight time budget" as they have work and/or family commitments and usually do not have the time to use the CMC system. This is emphasised by Mason [MASO89] who states that non-contribution to computer conferences was due to students not having sufficient time to participate.

  It was felt that in the present study, the time constraints also affected students' use of the CMC system. Students felt that being teachers as well as students, they did not have sufficient time to carry out the necessary installation procedures and learn yet another software package.

- According to Lorensten [MASO89] in order for a CMC system to be utilized to its fullest potential it has to be integrated into the course. This is stressed yet again by Nicholson [NICH94] who states that in order to encourage students to use the CMC system it must be integrated into the pattern of work from the beginning of the course.

  In the present study the CMC system was not well integrated into the course. Furthermore, although students were required to mail the LOGO component of their first assignment to lecturers via the CMC system this was not compulsory. Consequently, students could alternatively use the postal service for the submission of assignments and hence did not need to use the system.

  The exercises which students had to submit via the CMC system did not contribute to the final mark for the course, hence many students saw this as an added extra and did not complete these exercises.

Goodyear [GOOD94] reports that the study conducted at Lancaster University revealed that students whose main reason for enroling for a course was just to obtain the particular degree or diploma instead of wanting to benefit as a whole from the course tended not to use the CMC system. This also seemed to be the case with respect to the study conducted at NCE.

- Students were required to pay for the telephone costs incurred as a result of dialling into the CMC system. This discouraged students from using the system at all or frequently.

- As mentioned in **Chapter 7** not all students who were connected to the system at the time the assignment was due submitted the LOGO programming section of the assignment via the CMC system. This could possibly be attributed to the fact that these students were not confident in their use of the system. Furthermore, the use of CMC was still a fairly new concept to them at this stage and they were uncertain of the capabilities of the system.

It is apparent that the barriers which novice computer users must overcome in order to use CMC confidently are the same as those presented by Kaye [MASO89]:

- Economic barriers - Initial cost of necessary equipment.
  In this case it would involve the purchase or hire of a modem and possibly the cost of the large number of initial calls to get the system working.
- Technological barriers - Learning to use the equipment and software within the existing telecommunication infrastructure.
- Social and psychological barriers associated with learning to use a new and unfamiliar mode of written communication.

In the implementation of a CMC system at a South African distance education institution it is essential that precautions are taken to minimize the effect of these barriers.

11 FUTURE RESEARCH

CMC has been widely used in the instruction of distance education courses in the UK and USA during the past ten to twenty years. However, in South Africa this is a fairly new concept and hence there is a lot of scope for further study. This chapter looks at some possible areas that can be examined in future research programmes.

11.1 ORGANIZATIONAL AND EDUCATIONAL ISSUES

From the study presented in this thesis it is apparent that organizational and educational issues need to be taken into consideration when implementing a CMC system in a South African distance education institution. The importance of these issues is further emphasised by the statement made by Hall [SMIT87] that in order for "large-scale use of telecommunications technology to be effective, new organizational structures are required within universitates". Hall goes on to explain that technology does not automatically ensure effective learning. He states that a technology-pedagogy gap exists that needs to be overcome.

11.1.1 Educational issues

Based on the literature surveyed it is clear that the following educational issues need to be addressed:

- According to Sparkes [BATE84], it is essential that teaching methods and methods of feedback to be used in using CMC in the instruction of distance education courses needs to be determined. This is further emphasised by Hall [SMIT87] who suggests that investigations need to be conducted in order to determine how teachers can support learning, providing feedback and evaluation of student performance.
- How CMC can be used by teachers to guide students and facilitate access to resources needs to be examined [BATE84].
- Matiru [BATE84] states that some form of staff development for those teachers

involved in teaching courses using CMC needs to be provided. These teachers need to be taught how to use the CMC system and how to prepare and present lessons to be taught via the CMC system.

- According to Hall [SMIT87] "It is not enough for facts to be merely conveyed to students by the system; rational synthesis, application and finally valuation and judgement are the hallmarks of an educated person". Sparkes [BATE84] states that methods of teaching knowledge and understanding need to be developed.
- According to Jones et al. [JONE90] the use of CMC cannot simply be "added" on to a course in order for it to be successful, but it must be "structured" into the course.

11.1.2 Organizational Factors

From the literature surveyed it is evident that the organizational factors that need to be considered when implementing a CMC system should include the following:

- Mason [MASO89] states that although it was technically possible for students to submit assignments via the CoSy system it was too difficult to manage this administratively. Thus, certain administration structures need to be developed to manage the submission of assignments and other work via a CMC system.
- Structures and mechanisms to manage the distribution of study material, e.g. study guides, tutorial letters, etc via the CMC system need to exist.
- Additional staff may be required in order to handle both technical and academic student queries.
- Other administrative services need to be provided via the CMC system, e.g. the provision of registration information, the payment of fees, availability of examination results, counselling, etc.
- Decisions would have to be made regarding whether:

- students would be required to purchase hardware or whether hardware should be provided
- the use of the CMC system should be home-based or study centre-based

Depending on what decisions are made, support structures would need to be created.

11.2 MECHANISMS TO FACILITATE THE EASE OF USE OF A CMC SYSTEM

11.2.1 A Study of Learning Styles

According to Mason [MASO89] learning styles of adult students vary greatly, and essentially more than that of younger students and scholars. This may affect the adult learner's success or failure in using a CMC system.

In 1990 a study was conducted by Finnie [FINN90] to determine successful learning styles of novice Decision Support System (DSS) users. Finnie states that studying the learning styles of novice users of a system provides a means of:

- Designing the system.
- Designing a help facility.
- Designing documentation and training courses.
- Determining the learning styles of successful and unsuccessful users of the system.

A study of the learning styles of novice CMC system users needs to be conducted for the following reasons:

- According to Fernberg [MASO89] a CMC system must be adapted to meet the needs of a specific group. A study of learning styles would provide a means of determining the "needs" of a specific group of users.
- A study of students' learning styles will also determine the learning styles of successful and unsuccessful users of the system. Hence, it will be possible to build help mechanisms into the CMC system that accommodates the learning styles of unsuccessful users in order to assist them in utilizing the system.
- Adapting the help facility, user manuals and the design of face-to-face courses on CMC to suit the learning styles of a specific group.

A number of studies of learning styles should be conducted with different groups of distance learners. In this way it can be determined if any patterns exist with respect to the learning styles of successful and unsuccessful novice CMC users studying at a distance.

11.2.2 Developing Tools that Aid in the Modem Installation Process

In the present study most of the problems experienced with students were related to the installation of modems and successfully connecting to the mail server via the modem. These problems outlined in **Chapter 7** included difficulties experienced when the modem and another serial device attempted to use the same interrupt on a client. Furthermore, problems arose when the serial port addresses on the modem and microcomputer did not correspond.

Currently IBM and IBM compatible personal computers are being developed with a " plug and play" architecture. Windows 95 is an operating system that facilitates use of plug and play devices. Provided that your modem is a plug and play device, your machine has a plug and play architecture and your systems software supports the use of plug and play devices, the problems experienced in installing a modem can be reduced. For example, if you have installed your modem on a port that uses an interrupt that another port is currently using, you do not have to physically change dip switches; instead the system resolves this conflict.

This section looks at the possibility of developing tools that detect and correct such errors without the user having to provide any input.

11.2.2.1 Interrupt Converter

A common problem experienced was that of the modem and another serial device attempting to use the same interrupt, e.g. if the modem was installed on COM1 and another serial device was installed on COM3, both these devices would then use interrupt 4.

Whenever this occurred, the user had to change the dip switches on the modem and reinstall the modem. When choosing the **Modem Installation** option from the installation program menu, the user was informed as to which port the modem was installed on. However, if the above mentioned problem was detected, the installation program then displayed a diagram of the dip switch configuration that would result in the modem being installed on another port. Despite this, some students felt intimidated by the idea of having to change these switches.

Furthermore, in this particular study it was possible to provide students with assistance by means of a diagram displaying the dip switch configuration for the modem to be installed on a particular port. This was due to the fact that all the modems used by students (with an exception of about four) were Zoltrix modems. However, if the class had used a number of different modems, the provision of such assistance would not have been feasible.

Thus, it is necessary to develop a routine that automatically configures a modem for use by a particular port, e.g. in the example discussed above this routine could change the interrupt used by COM1 to be interrupt 4.

11.2.2.2 Developing An Expert System for Modem Diagnostics

This study has provided much insight regarding the problems experienced with the modem installation process and the solutions to these problems. Based on these experiences an expert system to diagnose modem installation problems could be developed and integrated into the TELETUTOR installation program.

This system should provide two modes of operation:

- The user could specify conditions which led to the problem after which the user is provided with a diagnosis upon which he or she must act.
- The system detects the error and automatically corrects it, informing the user.

11.2.2.3 An Initialization String Constructor

All the students, excepting four students, either purchased or hired 2400 baud internal Zoltrix modem cards. An initialization string compatible with these modems was derived and incorporated into the software.

It was decided that if any of the students who possessed modems before the course experienced any difficulties with incompatible initialization strings they could contact the system administrator who would assist them telephonically. It was found that assisting a user to change an initialization string telephonically was difficult and an inadequate means of providing assistance for this problem.

Difficulty with changing the initialization string was not a great problem in this study. However, in a situation where users own a variety of modems, this could become a major problem. A system that creates an initialization string based on the particular modem needs to be developed. However, here again it is possible that different problems may arise due to different infrastructures and types of modems.

11.2.3 CMC Interfaces

According to the literature surveyed a fair amount of research has been conducted in the area of:

- CMC user interfaces for novice computer users.
- User interfaces to promote collaborative learning.

According to Jennings [JENN94] in order to facilitate the ease of use of the CMC system, a graphical interface based on visual metaphors should be used. To illustrate this idea he describes the interface of the CMC system used in the instruction of language courses offered by the Multimedia Teleschool (MTS).

Figure 11.1 displays the interface of the CMC system used by MTS. By selecting the ADMIN option the user could communicate directly via CMC with the MTS administration department. The "Blue Chip Cafe" option was chosen by a user if the user wanted to send a message to a social conference created to allow students to merely chat to each other.

A similar interface using visual metaphors is used by the CoSy CMC system described by Mason [MASO89]. The interface to CoSy developed by the OU is illustrated in **Figure 11.2**. Based on these examples, an investigation needs to be conducted in order to determine feasiblity of employing the use of visual metaphors as part of the TELETUTOR interface in a such manner that the criteria outlined in **Chapter 10** are still met.

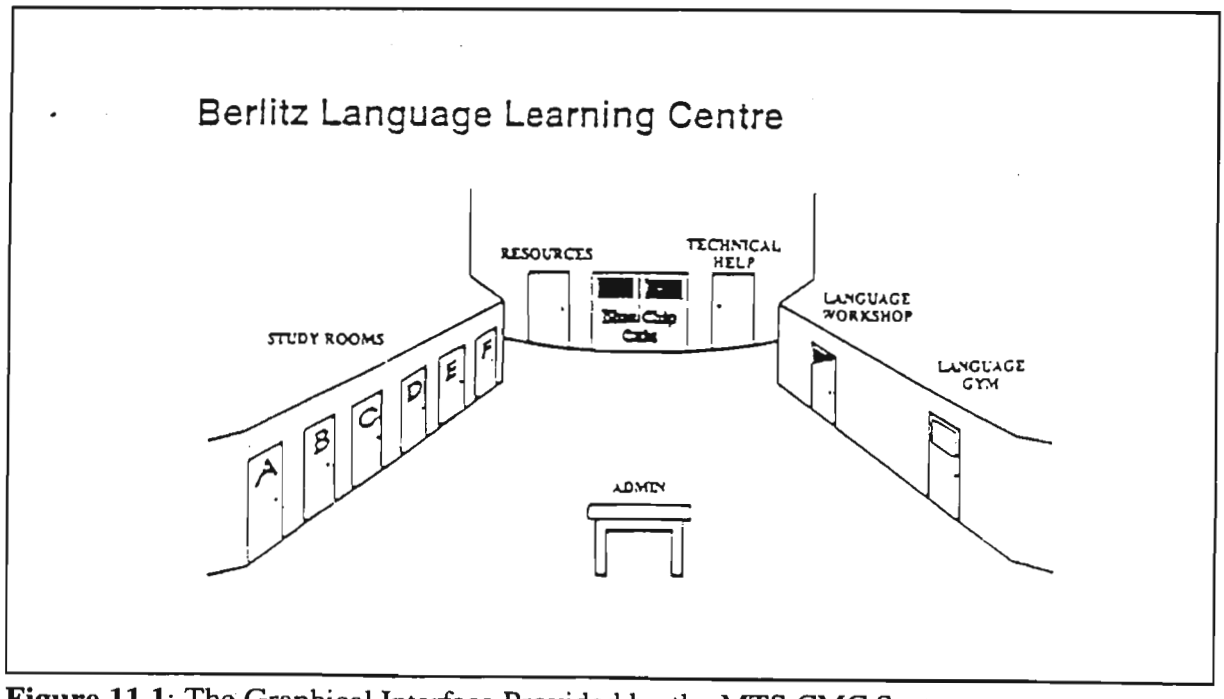

Figure 11.1: The Graphical Interface Provided by the MTS CMC System

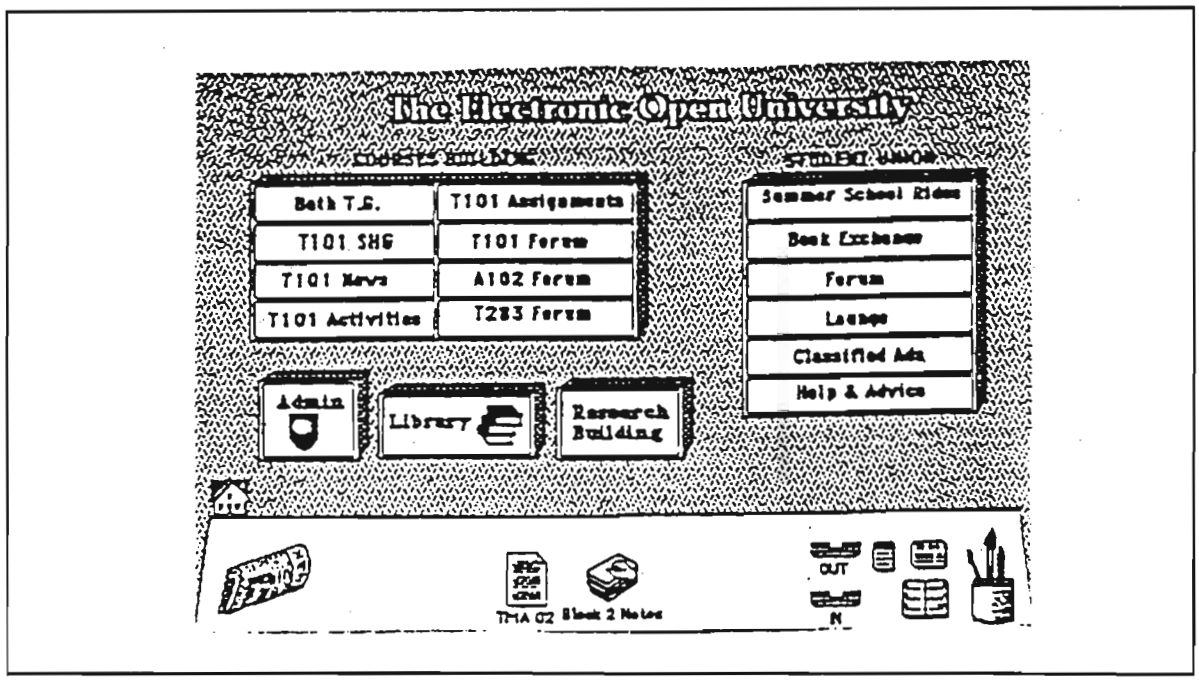

Figure 11.2: Graphical Interface to the CoSy System

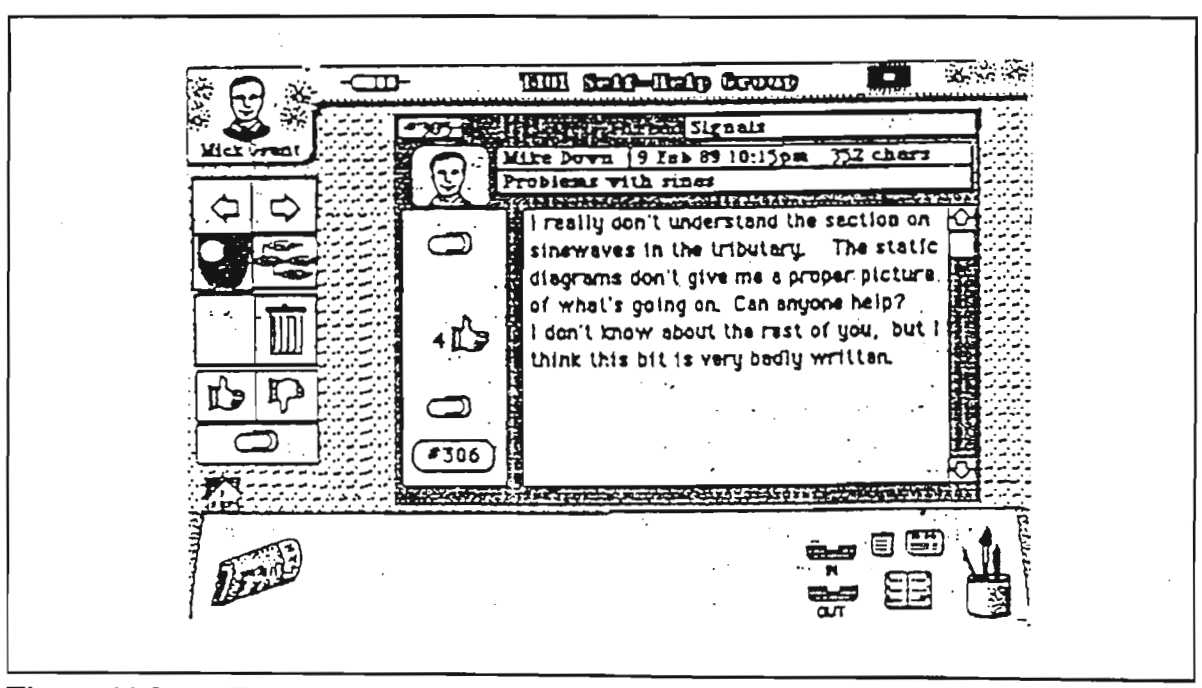

Figure 11.3: An Example of an Interface to Promote Collaborative Learning

Gary Alexander [JONE92] of the OU in the UK has conducted much research on the development of CMC system interfaces to promote collaborative learning. An example of such an interface is depicted in **Figure 11.3**.

Interfaces similar to this could possibly be incorporated into TELETUTOR for reading E-mail messages. When reading a message, a monogram of the sender as well as his or her name, address and telephone number will appear on the screen. However, to prevent any form of discrimination, the user can be given the option as to whether he or she would like his or her monogram to be displayed on the recipient's screen together with the message or not.

A database of scanned photographs of students as well as their names, addresses and telephone numbers can be stored on the hard drive of each client. When the user wishes to read a message TELETUTOR can determine whether the monogram should be displayed or not. Consideration needs to be given to the following:

- Disk space that will be required to store such a database.
- The screen resolution that will be required to view the monogram.
- The possibility of the database being stored on the mail server.

11.3 MECHANISMS THAT WILL FACILITATE CERTAIN ORGANIZATIONAL STRUCTURES

11.3.1 A Multi-user System

In the present study each student had access to their own computer system. However, a number of distance education institutions, e.g. the Open University in the UK have what they call regional centres established in cities or towns where their students reside. It is usually at these centres that students have access to computers. One possible extension of the study presented in this thesis would be to extend TELETUTOR to a multi-user system which would facilitate the use of CMC in a regional centre environment.

The following changes would have to be made to TELETUTOR for this purpose:

- A mechanism for adding users to the system would have to be developed. This would involve:
  1. A [userid].RC file would have to be created for each user.
  2. Each user would have to be defined in the *passwd* file. The tutor or system administrator for each regional centre would be specified as a super user and hence be assigned rights to add users to the system and remove users accordingly.

- A mechanism for removing users from the system:
  1. The relevant [userid].RC file would be deleted.
  2. The corresponding entry would be deleted from the *passwd* file.

- Procedures for logging users on and off the system. This would involve changing the values of the environment variable ***uupcusrrc***.

- Protection procedures - two possible means of preventing unauthorised access of mail would be to encrypt all files an to require that each user enters a password whenever they login into the system.

11.3.2 Integrating the Use of CMC with Other Media

Mason [MASO89] defines the modes of communication between students and lecturers in distance education to include:

- Radio transmission
- The Postal service
- Satellite Broadcasts

An investigation needs to be conducted in order to determine how CMC can be used in conjunction with other means of communication in distance education.

During the past two years much research has been conducted on the integrated use of CMC and satellite broadcasting in distance education.

According to Jennings [JENN94] the Multimedia Teleschool (MTS) at CECOMM integrates satellite transmission and CMC in the instruction of their business language courses. Students at study centres watch broadcasts and interact with lecturers and tutors via CMC. Jennings refers to this as interactive Teleteaching.

The Africa Growth Network launched by ABSA bank in October 1994 involved broadcasting distance education courses via satellite transmission. Students at "electronic study centres" throughout the country watched broadcast lessons and communicated with tutors at the broadcasting centre via E-mail.

11.3.3 The Availability of Non-academic Facilities

11.3.3.1 Administration Facilities

TELETUTOR should be adapted to provide an ADMIN function. On choosing this option the user would be taken into an editor to load a file or to compile a message. This message or file would automatically be transferred to the administration department of the institution involved. In this way the user could attend to any administrative matters that they need to without physically travelling to the institution.

The EKKO CMC system used by the NKI College of Computer Science in Norway provided students with such a facility for registering for courses. According to Paulsen [MASO89] students apply for enrolment to courses by sending an E-mail message stating the courses they wish to register for to a program Sysop. The program Sysop then "registers" the students for the courses specified.

In order to enter for examinations students E-mail a letter indicating that they intend writing the exam via the EKKO system to the college student secretary who registers the student. Similarly, the system presented here could be extended in order to provide a specific administration facility that allows for registration forms to be E-mailed to the student, these can be completed and returned to the administration. The returned forms could then be imported into a database system. This would reduce the work involved in the processing of registration forms.

11.3.3.2 Library Facilities

An online library :

An online "library" could be developed. A database consisting of information related to the course being taught via CMC could be created. Via E-mail students could then request a list of articles available on a particular topic. These articles can then be E-mailed to the students. A program to deal with student requests can be created.

Access to off-line library facilities:

Access to the library at the particular institution could also be provided via E-mail. The EKKO CMC system was used by the NKI College of Computer Science in Norway. According to Paulsen [MASO89] students sent an E-mail message to the student counsellor via the EKKO system to order books. The books were dispatched via the postal service to the students. Similarly a student could send an E-mail message to the librarian via TELETUTOR listing the books he or she would like to use. These can be posted to the student via the postal service. A program could be developed to keep track of when library books are due and automatically send the user an E-mail reminder.

11.3.3.3 Student Counselling

TELETUTOR can be extended to provide users with a "student counselling" option. Any mail compiled using this option would be E-mailed directly to the student counsellor. In this way students will be able to discuss any problems they may be experiencing with a student counsellor.

11.3.4 System to Manage the Submission of Assignments

Students were required to submit the LOGO component of their assignments via TELETUTOR to lecturers. In spite of the fact that the CMC system kept track of which student an assignment was received from and when it was received, lecturers still felt overwhelmed by the task of keeping an account of which assignments had been submitted and a record of the marks obtained by students. With further use of the system by lecturers this problem will possibly no longer exist. However, a way to deal with this initial problem would be to develop a system that manages the submission of assignments. Such a system should provide the following:

- The system should maintain subdirectories on the client accessed by each lecturer or tutor for each student in which the assignments for each particular student should be stored.
- At any stage the lecturer should be able to obtain a list of assignments that have been submitted by a particular student. The lecturer or tutor should be able to delete or access these assignments at any time.
- A mechanism that differentiates between late assignments and those that arrived on time.
- The system can also include a mechanism to maintain a list of the marks obtained by each student for each assignment.

11.4 MECHANISMS THAT WILL SUPPORT POSSIBLE EDUCATIONAL STRUCTURES

11.4.1 Using CMC in Conjunction with CAI and CAL

One of the first CMC systems developed was the MERLIN system which was developed by the Open University in the UK. Jones et al. [JONE87] describe this CMC system as providing a CAI option in the form of tutorials. An account of the OU's experience with MERLIN was given in **Chapter 4**.

According to Guihot [MASO89] in 1980 a project was initiated by the National Institute for Pedagogical Research (INPR) in Paris to determine the feasibility of using a CMC system in the instruction of courses in secondary schools. A system known as Teletel was developed for this purpose. In conjunction with providing the basic CMC instructions Teletel provided access to a number of CAL (Computer Assisted Learning) programs in Science, English, Physics and Mathematics.

Based on these examples and additional literature surveyed TELETUTOR can be extended to provide both CAI and CAL options to students.

Such a system could possibly operate as follows. The CAI component of TELETUTOR can provide students with exercises on each section. The exercises for a particular section will consist of questions at three levels of difficulty, low, medium, and high. Once the student has completed the exercises at a particular level he or she can choose the menu option to assess the exercise. The program will provide students with a report indicating their weak and strong areas. The tutorial program will continue to give the student exercises in weak areas before moving to a new level within a section.

For assessment purposes each section would be followed by a set of questions which, when completed, would be automatically mailed to the tutor or lecturer in charge of the course.

11.4.2 Use of the Internet to Facilitate CMC

Chapter 2 outlines the facilities provided by the Internet to facilitate distance education via CMC. Further research is needed to determine how these facilities can be utilized in order to use CMC in the instruction of distance education courses. In particular, attention should be given to Freenets which provide access to the Internet.

Ellsworth [ELLS94] describes a Freenet as a network providing access to the Internet in urban areas. Examples of Freenets presented by Schuler [SCHU94] include the Cleveland Freenet and the Blue Sky Telegraph. The concept of Freenets was developed in Canada. Schuler in his paper "Community Networks: Building a New Participatory Medium" lists the characteristics of Freenets as defined by Tom Grunder, the originator of the Cleveland Freenet to include:

- Freenets are unrestricted, anyone can use a Freenet.
- They are inexpensive - These systems are free of charge or have a very low charge.

A further investigation into the use of Freenets for CMC purposes within a South African context needs to be conducted.

11.4.3 Conferencing Systems

The revised version of TELETUTOR provides a conference option. However, at present users can only contribute to a single conference. Other conferences need to be set up. From the literature surveyed it is evident that a common conference which promotes communication between students facilitated by a CMC system is a "cafe" conference. A cafe conference is an informal conference that facilitates socializing among students. Another common conference which is useful is one in which students can discuss the technical problems they might be experiencing. The CoSy system described in **Chapter 4** was used to set up the "Gremlins" conference specifically for this purpose.

11.4.4 Computer Marked Assignments

It is essential that the response to practical work in the form of programming submitted by students is fairly rapid. Although the use of CMC facilitates rapid feedback, this is still dependent on the workload of the tutor or lecturer. One possibility would be to develop a system that:

- Automatically marks practical assignments.
- Detects whether assignments are late and deducts marks accordingly.

Benford et al. [ALEX94] in their paper "Ceilidh: A Management System for the Administration and Assessment of Computer Programming Courses" describe the Ceilidh system which has been developed at the University of Nottingham. Ceilidh assesses programs written in Unix and Windows based C and C++. The system is currently being extended to other programming languages including Pascal, Ada and SML.

Based on this, TELETUTOR could be extended to provide tutors and lecturers with a feature which automatically assesses LOGO assignments.

12 CONCLUSION

The aim of the study presented in this thesis was to determine the technical feasibility of implementining a CMC system to help South African distance learners to communicate while studying at a distance. The objectives of this study as outlined in **Chapter 1** were:

- Conduct a study of the use of CMC in other educational institutions
- Based on this study develop a CMC system.
- Examine the use and hence re-define the importance of the CMC system as seen by South African distance learners.
- Identify technical problems associated with the implementation of a CMC system.
- Use the CMC system developed to determine the technical characteristics of a CMC system for novice computer users studying at a distance in South Africa.
- Based on the fourth objective, revise the system to meet the needs of South African distance learners.
- According to Finnie [FINN87] "attitudes towards computers has been shown to play a significant role in the successful implementation and use of computer systems" and hence indirectly effects the feasibility of a system. Hence, the relationship between the attitudes of distance learners towards computers and their use of the system was examined. Furthermore, the effect that the use of the CMC system has on students' attitudes was also be investigated.

An investigation on the use of CMC in distance education institutions throughout the world was conducted. The results of this survey are presented in **Chapter 4**. Based on the experiences of other distance education institutions with CMC, a CMC system was developed and incorporated into the instruction of courses at a South African distance education institution, the Natal College of Education.

From this implementation it is evident that South African distance learners see the most important benefit of the CMC system to be a means of communicating with lecturers and hence obtaining assistance. Secondly, students felt that the CMC system enabled them to communicate more easily then previously with peers.

Those students that lived out of Pietermaritzburg found the CMC system useful for submitting their assignments. These students felt that by mailing the assignments to NCE via the CMC system rather than the postal service the time involved in mailing the assignment was reduced thus increasing the time available to work on the assignment.

Consistent with the literature surveyed certain technical problems were experienced by students. This study has given us much insight into these problems which are described in **Chapter 7**. Solutions to these problems are outlined in **Chapters 9** and **11**.

Based on the literature surveyed and the use of the prototype and the revised CMC system the following set of criteria were derived for the use of a CMC system to be feasible in a South African distance education environment:

- The operational costs involved in using the system must be minimized.
- The CMC system must facilitate off-line editing.
- Mechanisms (similar to those outlined in **Chapter 11**) need to be built into the CMC to minimize technical problems that may be experienced.
- It is essential that a support service is set up to assist users with any problems they may experience in installing and using the system.
- In order to ensure that the system is easy to use, the amount of information entered by users should be minimized.
- The system should be extendable from a user point of view.
- The system should provide an extensive context-sensitive help facility.
- The CMC system should accommodate the method of instruction of the distance education courses taught using CMC.
- The software must be menu-driven.
- The software must be easily extendable.
- Options that would be commonly used by users should be easily accessible.

Attitude surveys were conducted in order to assess the degree of acceptance of the CMC system in the first instance and to computers in general in the second instance. The attitude

survey revealed that the attitudes of South African distance learners towards computers can be represented by eight dimensions which are described in **Chapter 8**. From the discussion in **Chapter 10** it is clear that the eighth factor, namely the ritualistic behaviour of people resulting in them viewing the use of computers negatively, has had much influence on students' use of the CMC system.

A survey was conducted in order to determine whether using the CMC altered the attitudes of students towards computers. Students who completed and submitted the questionnaires were essentially those that had utilized the CMC system. For this sample of students, the majority of which had utilized the CMC system, there appeared to be an increase in the positiveness of students' attitudes towards:

- computers in general,
- the used of computers in education, and
- the use of CMC in distance education.

However, statistical tests conducted indicated that this change in attitude was not valid for the entire population.

In the study primarily presented in this thesis, the feasibility of the CMC system implemented was assessed on a purely technical basis. However, some of the problems, e.g. difficulties experienced in integrating CMC into the LOGO course and getting students to use the system, encountered in this study indicate that sociological, organizational and educational issues need to be considered in the implementation of a CMC system.

In conclusion, this study has served the following purposes:

- It has helped us determine the technical problems that users are likely to experience in using a CMC system within a South African infrastructure. Furthermore, solutions to these problems and precautions that can be taken to avoid such problems have also been defined.

- It has established that South African distance learners have found the CMC system effective as a means of communicating with peers and lecturers as well as a suitable medium for submitting assignments.
- It has led to the derivation of a list of criteria which should ensure the technical feasibility of a CMC system as a solution to the communication problems experienced by South African distance learners.
- Although this study has been restricted to an evaluation of the technical feasibility of a CMC system, it is apparent from this study that organizational, educational and sociological factors need to be considered in the implementation of a CMC system.

13 REFERENCES

The references listed below include those references that have been surveyed in order to gain an understanding of a particular procedure or concept e.g. the statistical technique of factor analysis. Consequently not all the references listed are cited in the thesis.

[ALEX94] - Alexander A.M.: Computer-Assisted Education & Training in Developing Countries, Unisa, 1994.

[ANDE89] - Anderson B., Costales B., Henderson H. : Unix Communications, Howards W. Sams & Company, 1989.

[BATE84] - Bates A. W. : The Role of Technology in Distance Eudcation, Croom Helm, !994.

[BENS95] - Benson A.C. : The Complete Internet Companion for Librarians, Neel Schuman Publishers, 1995.

[BERG96] - Berghel H. : The Client's Side of the World-Wide Web, Communications of the ACM, Vol 39 No 1, January 1996.

[BORL92] - Borland Turbo Pascal Version 7: Turbo Vision Programming Guide, 1992.

[BRUN94] - Brune R., Erasmus D., Gouws H., and Nel A. : The Internet and Good Business Sense - Using Existing TCP/IP Technology and Integrated Diverse Organization, Pages 307 - 321, Proceedings of the Fifth Annual CISNA Conference, 1994.

[CAMB87] - Campbell J. : C Programmers Guide to Serial Communications, Howard Sams & Company, 1987.

[CHRI91] - Christensen L.B., Stoup C.M. : Introduction to Statistics for the Social and Behavioural Sciences, Brookes\Cole Publishing, 1991.

[COOV80] - Coovert M.D. & Goldstein M.: Locus of Control as a Predictor of User's Attitudes Towards Computers, Psychological Reports, Vol 47, 1167 - 1173, 1980.

[DETT89] - Dettmann T. : DOS Programmer's Reference, 2nd Edition, Ques Corporation, 1989.

[DIGB87] - Digby G.N., Galaway N., Lane P : Genstat : An Introduction, Oxford Publications, 1987.

[DIGB89] - Digby G.N., Galaway N., Lane P. : Genstat: A Second Course, Oxford Publications, 1989.

[DUNC88] - Duncan R. : Advanced MSDOS Programming, Penguin Books, 1988.

[EAST95] - Eastmond D. V. : Alone but Together - Adult Distance Studying Through Computer Conferencing, Hampton Press, 1995.

[ELIF90] - Elifson K.W., Runyon R.P., Hader A. : Fundamentals of Social Statistics, 2nd Edition, McGraw Hill, 1990.

[ELLS94] - Ellsworth J.H. : Education on the Internet, Sams, 1994.

[ERLA94] - Erlank S. : Surfing the Internet : Implications for Education in Southern Africa, Proceedings of the Fifth Annual CISNA Conference, Pages 333 - 346, 1994.

[ERTL93] - Ertl F., Machholz R., Golgath A. : A Programmers Guide to Turbo Vision, Addison & Wesley, 1993.

[FINN87] - Finnie G.R. : Novice Attitude Changes During a First Course in Computers: A Case Study, QI Quaetiones Informatice, Vol 5 No 2, Pages 56 - 62, 1987.

[FINN90] - Finnie G.R. : On Learning Style and Novice Computer Use, Quaestiones Informatice, Vol 5, No 1, Pages 1-10,1990.

[GOOD94] - Goodyear P. : Telematics, Flexible and Distance Learning in Postgraduate Education: The MSc in Information Technology and Learning at Lancaster University, The CTISS File, 1994.

[HARA93] - Harasim L.M. : Global Networks - Computers and International Communication, MTS Press, 1993.

[JENN94] - Jennings C. : Delivering Interactive Distance Education Using Advanced Communication Technologies, The CTISS File, Pages 8 - 13, 1994.

[JONE87] - Jone A., Scanlon E., O'Shea T. : The Computer Revolution in Education: New Technologies for Distance Education, The Harvester Press, 1987.

[JONE92] - Jones A., Kirkup G., Kirkwood A., : Personal Computers for Distance Education, Paul Chapman, 1992.

[KELL94] - Kelly M.G. : Teaching Mathematics with Technology, Arithmetic Teacher, January 1994.

[KEND93] - Kendra Electronic Works.: Don't Panic, UUPC/Extended Version 1.12b

Installation and User Reference, October 1993.

[KENN75] - Kennedy T.C.S. : Some Behavioural Factors Affecting the Training of Naive Users of an Interactive Computer System, International Journal of Man-Machine Studies, Vol. 7, Pages 817 - 834, 1975.

[LAFF94] - Lafford A. : NISS: Sources for Courses, The CTISS File, Pages 43 - 45, 1994.

[LAWR94] - Lawrie M. : A Combined SNews/UUPC/PMail System for MSDOS, Version 23, January 1994.

[LEE70] - Lee R.S. : Social Attitudes and the Computer Revolution, Public Opinion Quaterly, Vol 54, Pages 53 - 59, 1970.

[MANL96] - Manly B.F.J. : Multivariate Statistical Methods -Primer, Chapman & Hall, 1986.

[MARR91] - A Study of the Use of Computers in the Teaching of Physical Science in Secondary Schools Controlled by the House of Delegates School, A University of Natal Masters Dissertation, 1990.

[MASO89] - Mason R.D., Kaye A. : Mindweave: Communication, Computers and Distance Education, Pergamon Press, 1989.

[MASO94] - Mason R. : Computer Conferencing at the Open University, The CTISS File, Pages 5 - 7, 1994.

[MORR83] - Morrison P.R. : A Survey of Attitudes Towards Computers, Communications of the ACM, Vol 26, Pages 1051 - 1057, 1982.

[NELS94] - Nelson J. : Introducing Computers to Undergraduate Distance Learning, The CTISS File, Pages 38 - 40, 1994.

[NICH94] - Nicholson A. N. S. : The MSc in Information Technology and Learning at Lancaster University: A Students Perspective, The CTISS File, Pages 20 - 23, 1994.

[NKLI94] - Nkhalambayousi R.M. : Electronic Mail Empowers, Proceedings of the fifth Annual CISNA Conference, Pages 325 - 331, 1994.

[OLIV93] - Oliver R.G. : A Comparison of Secondary School Information Technology, Computer Education Programmes, Computer Education, Vol. 74, Pages 2 - 7, June 1993.

[OPPE66] - Oppenheim A.N. : Questionnaire Design and Attitude Measurement, Heineman, 1966.

[ORCU74] - Orcutt J.D., Anderson R.E. : Human-Computer Relationships : Interactions and Attitudes, Behavioural Research Methods and Instrumentation, Vol 6, No 2, Pages 219 - 222, 1974.

[OREI87] - O' Reilly T. : Managing UUCP and Usenet, O' Reilly and associates, 1987.

[ROBE79] - Robey D. : User Attitude & Management Information System Use, Academy of Management Journal, Vol 2 No 3, Pages 527 0 538, 1979.

[ROET94] - Roets R. : The Effects of Computer Literacy Training on educationally Disadvantaged Pupils, Proceedings of the Fifth Annual CISNA Conference, Pages 349 - 361, 1994.

[SAID94] - Saide, Distance Education, 1994.

[SCHU94] - Schule D. : Community Networks : Building a New Participatory Medium, Communications of the ACM, Vol 37 No 1, January 1994.

[SEWA83] - Sewart D., Keegan D., Holmberg B. : Distance Education - Interantional Perspectives, Croom Helm, 1993.

[SMIT87] - Smith P., Kelly M. : Distance Eudcation and the Mainstream, Croom Helm, 1987.

[STEV86] - Stevens J. : Applied Multivariate Statistics for the Social Science, Hillside, 1986.

[SWIF94] - Swift D. : An Open University First Year Course, SAIDE, 1994.

[TIFF95] - Tiffin J., Rajasignham L. : In Search of the Virtual Class - Education in an Information Society, Routledge, 1995.

[TITT95] - Tittel E., Robbins M. : Internet Access Essentials, Academic Press Limited, 1995.

[TODI91] - Todino G., Dougerty D. : Using UUCP and Usenet, O' Reilly & Associates, 1991.

[YOUN80] - Young L.F. : A Case in MIS Education : Attitude Changes Among MBA's Information and Management, Pages 73 - 80, 1980.

14 APPENDIX A - UUPC WORKING FILES

```
Nodename=ncelogo
Domain=ncelogo.cs.unp.ac.za
postmaster=npillay
mailserv=research
Inmodem=modem
options=nobang multiqueue
options=autoedit dot
dos.editor=c:\uupc\bin\ed.exe %s
```

UUPC.RC

```
Mailbox=npillay
Name=Nelishia Pillay
Home=c:\uupc
Organization=NCETELENET
options=autoedit
options=dot
Dos.editor=c:\uupc\bin\ed.exe %s
```

NPILLAY.RC

```
research:*:::research mailserv
npillay:*:::Super User
```

PASSWD

```
Description=Generic Hayes Smartmodem at 2400 baud, disabling command echo
Answer=CONNECT
Ring="" \pATS0=1 OK-ATS0=1-OK "" RING
AnswerTimeout=30
Connect=CONNECT
NoConnect="NO DIALTONE" "BUSY" "NO CARRIER"
Device=COM4
DialPrefix=\pATDT
DialTimeout=41
Initialize= "" AT&FE1V1X4&C1D2S0=0S2=43 OK--OK
ModemTimeout=2
options=nofixedspeed carrierdetect
InSpeed=2400
```

MODEM.MDM

```
research Any modem 2400 2605968 g ogin:--ogin: Uncelogo word: college
```

SYSTEMS

```
LOGNAME=research SENDFILES=yes REQUEST=yes COMMANDS=rmail:rnews:uupc \
MACHINE=research WRITE=c:/uupc/public \
VALIDATE=research READ=C:/UUPC/PUBLIC
```

PERMISSN

15 APPENDIX B - INSTRUMENTS USED AND RESULTS OBTAINED FOR ATTITUDE SURVEYS CONDUCTED

15.1 ATTITUDE STATEMENTS ADMINISTERED TO STUDENTS

1. There is something fascinating and exciting about computers.
2. Computers are rather strange and frightening.
3. They do such things that stagger your imagination.
4. They give the impression that machines can be smarter than people.
5. They are important to the general economic development of our country.
6. They can be used for evil purposes if they fall into the wrong hands.
7. They will bring about a better way of life for the average man.
8. The use of these machines undermines the capabilities of humans.
9. They can think like a human being thinks.
10. These machines will free people to do more imaginative and interesting work.
11. They are becoming necessary for the efficient operation of large businesses.
12. They can make serious mistakes because they fail to take the human factor into account.
13. Some day in the future these machines will be running our lives for us.
14. They make it possible to speed up scientific progress and achievements.
15. There is no limit to what these machines can do.
16. They work at extremely high speeds.
17. These machines help to create unemployment.
18. They are extremely accurate and exact.
19. These machines are better than people at making important decisions.

20. Too much importance is placed on computers.

21. I would be comfortable using a computer.

22. Learning through the use of computers is important to pupils.

23. I am the kind of person that will need to use a computer.

24. Using computers is likely to take the control away from teachers.

25. Computers should be as important to pupils as text books.

26. Computers are likely to control people.

27. Computers will require pupils to become more active learners.

28. Little use should be made of computers in schools.

29. It is essential for teachers to learn how to use a computer.

30. Teachers should be required to take several courses in computer programming.

31. Computers in everyday life bother me.

32. Using computers increases the teachers work.

33. Computers will improve pupils attitudes towards their work.

34. Computers will prevent pupils from thinking.

35. It disturbs me that my pupils know more about computers than me.

36. It is possible to communicate via a computer with people in any part of the country.

37. It is possible to communicate via a computer with people in any part of the world.

38. Communication via computers should play an important role in distance education.

39. Costs involved in communications via computers is not worth the benefits of such communications.

15.2 FACTOR LOADINGS

15.2.1 A Four-factor Solution for Lee's Model

FACTOR 1:

	STATEMENT	FACTOR LOADING
1.	There is something fascinating and exciting about computers.	0.5178
2.	They do things that stagger your imagination.	0.6609
3.	These machines will free people to do more imaginative and interesting work.	0.7332
4.	They are becoming necessary for the efficient operation of large businesses.	0.6972
5.	They make it possible to speed up scientific progress and achievements.	0.5702
6.	Computers work at extremely high speeds.	0.7519
7.	They are extremely accurate and exact.	0.4911

FACTOR 2:

	STATEMENT	FACTOR LOADING
1.	They can think like a human being can.	0.7266
2.	These machines help to create unemployment.	0.6621
3.	These machines are better than people at making decisions	0.6844
4.	Too much importance is placed on computers.	0.6552

FACTOR 3:

	STATEMENT	FACTOR LOADING
1.	Computers are rather strange and frightening.	0.6111
2.	They will bring about a better way of life for the average man.	0.7193
3.	They can make serious mistakes because they fail to take the human factor into account.	0.6412

FACTOR 4:

	STATEMENT	FACTOR LOADING
1.	They give the impression that computers are smarter than people.	0.6510
2.	They can be used for evil purposes if they fall into the wrong hands.	0.6226
3.	The use of these machines undermines the capabilities of humans.	0.6003
4.	Some day in the future these machines will be running our lives for us.	0.6063

RESIDUAL FACTORS:

1.	They are important to the general economic development of the country.
2.	There is no limit to what these machines can do.
3.	They are extremely accurate and exact.

15.2.2 An Eight-factor Solution of the Responses to the 39 Attitudinal Statements

FACTOR 1:

	STATEMENT	FACTOR LOADING
1.	The use of these machines undermines the capabilities of humans.	-0.6076
2.	Some day in the future these machines will be running our lives for us.	-0.5566
3.	These machines help to create unemployment.	-0.4037
4.	These machines are better than people at making decisions.	0.8122
5.	They can think like a human being thinks.	-0.7763
6.	Computers are likely to control people.	-0.7805
7.	Computers will prevent pupils from thinking.	0.7598

FACTOR 2:

	STATEMENT	FACTOR LOADING
1.	Computers should be as important to pupils as textbooks.	0.4424
2.	Computers will require pupils to become more active learners.	0.6743
3.	It is essential for teachers to know how to use computers.	0.6208
4.	Learning through the use of computers is important to pupils.	0.6389

FACTOR 3:

	STATEMENT	FACTOR LOADING
1.	They give the impression that machines are smarter than people.	0.5139
2.	They are becoming necessary for the efficient operation of large businesses.	0.7358
3.	Computers work at extremely high speeds.	0.7003
4.	They extremely accurate and exact.	0.4923
5.	They make it possible to speed up scientific progress and achievements.	0.4713

FACTOR 4:

	STATEMENT	FACTOR LOADING
1.	Computers will improve pupil's attitudes towards their work.	-0.4726
2.	It is possible to communicate via a computer with people in any part of the country.	-0.8136
3.	It is possible to communicate via a computer with people in any part of the world.	-0.8074
4.	Communication via computers should play an important role in distance education.	-0.4351
5.	I would be comfortable using a computer.	-0.4021

FACTOR 5:

	STATEMENT	FACTOR LOADING
1.	They are very important to the general economic development of our country.	-0.7680
2.	I am the kind of person who will need to use a computer.	0.5463
3.	Teachers should be required to take several courses in computer programming.	0.4302

FACTOR 6:

	STATEMENT	FACTOR LOADING
1.	They will bring about a better way of life for the average man.	0.7695
2.	The can make serious mistakes because they fail to take the human factor into account.	0.4801
3.	Using computers increase the teacher's work.	0.4978
4.	These machines will free people to do more imaginative and interesting work.	0.4178

FACTOR 7:

	STATEMENT	FACTOR LOADING
1.	They can be used for evil purposes if they fall into the wrong hands.	0.7531
2.	Too much importance is placed on computers.	-0.4475
3.	Using computers is likely to take the control away from teachers.	0.5146

FACTOR 8:

	STATEMENT	FACTOR LOADING
1.	Computers are rather strange and frightening.	0.6804
2.	It disturbs me that my pupils will know more about computers than me.	0.6426
3.	Costs involved in communications via computers is not worth the benefits of such communications.	0.6283
4.	They do things that stagger your imagination.	-0.4884
5.	Computers in everyday life bother me.	-0.6421

RESIDUAL STATEMENTS:

1.	There is something exciting and fascinating about computers.
2.	There is no limit to what these machiness can do.

15.3 RESULTS OF THE WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST

A Wilcoxon matched-pairs signed-ranks test was conducted in order to test the significance of the changes in the responses to each attitudinal statement in Study 2 compared with those obtained in Study 1. In each case a *rho* value of 0.1 was used.

	STATEMENT	T-VALUE	DEGREES OF FREEDOM
1.	There is something fascinating and exciting about computers.	174	32
2.	Computers are rather strange and frightening.	279	33
3.	They do things that stagger your imagination.	278.5	37
4.	They give the impression that machines can be smarter than people.	413	41
5.	They are very important for the general economic development of our country.	173.5	28
6.	They can be used for evil purposes if they fall into the wrong hands.	227.5	32
7.	They will bring about a better way of life for the average man.	243	32
8.	The use of these machines undermines the capabilities of humans.	308	36
9.	They can think like a human being thinks.	263.5	32
10.	These machines will free people to do more imaginative and interesting work.	167	29
11.	They are becoming necessary for the efficient operation of a large businesses.	182	28
12.	They can make serious mistakes because they fail to take the human factor into account.	385.5	43

	STATEMENT	T-VALUE	DEGREES OF FREEDOM
13.	Some day in the future these machines will be running our lives for use.	303.5	38
14.	They make it possible to speed up scientific progress and achievements.	185.5	28
15.	There is no limit to what these machines can do.	367.5	40
16.	Computers work at extremely high speeds.	125	23
17.	These machines help to create unemployment.	420	41
18.	They are extremely accurate and exact.	299	36
19.	These machines are better than people at making important decisions.	286.5	39
20.	Too much importance is placed on computers.	386.5	39
21.	I would be comfortable using a computer.	189.5	33
22.	Learning through the use of computers is important to pupils..	199	29
23.	I am the kind of person who will need to use a computer.	345.5	39
24.	Using computers is likely to take the control away from teachers.	322	32
25.	Computers should be as important to pupils as text books.	275	34

	STATEMENT	T-VALUE	DEGREES OF FREEDOM
26.	Computers are likely to control people.	219	32
27.	Computers will require students to become more active learners.	320	39
28.	Little use should be made of computers in schools.	284.5	34
29.	It is essential for teachers to learn how to use a computer.	260	32
30.	Teachers should be required to take several courses in programming.	412	41
31.	Computers in everyday life bother me.	223	30
32.	Using computers increases the teachers work.	251.5	36
33.	Computers will improve pupil's attitudes towards their work.	240.5	35
34.	Computers will prevent pupils from thinking.	201.5	28
35.	It disturbs me that my pupils will know more about computers than me.	334	39
36.	It is possible to communicate via a computer with people in any part of the country.	136.5	26
37.	It is possible to communicate via a computer with people in any part of the world.	168.5	28
38.	Communication via computers should play an important role in distance education.	207	32
39.	Costs involved in communications via computers is not worth the benefits of such communications.	283	36

16 APPENDIX C: EVALUATION QUESTIONNAIRE

UTILIZATION OF THE CBEC SYSTEM

The system that you have used to contact lecturers and fellow students is an example of a CBEC(Computer Based Electronic Communications) system.

1. What difficulties did you experience in using the CBEC system?

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2. In what ways can the system be improved?

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3. What are the advantages of using a CBEC system in distance education?

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4. What are the disadvantages of using a CBEC system in distance education?

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5. Please tick

Has the CBEC system made it possible to communicate with your lecturers and fellow students more often than you have done previously?

YES NO

Through the use of the CBEC system has it been easier to obtain assistance from lecturers?

YES NO