ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

SCHOOL OF INFORMATION STUDIES FOR AFRICA

ONLINE TUTORIAL FOR MICRO CDS/ISIS SOFTWARE

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN INFORMATION SCIENCE.

BY

SISAY FISSAHA

MAY, 1995

ADDIS ABABA UNIVERSITY

School of Graduate Studies

Online Tutorial for Micro CDS/ISIS Software

by

Sisay Fisseha Adafre

School of Information Studies for Africa (SISA)

Approved by Board of Examiners

	Signature
Ato Getachew Birru, Chairman, Examining Board	
Ato Nega Alemayehu, Advisor	
Dr. G.G. Chowdhury, Advisor	
Dr. R. Gibson, External Examiner	
Ato Tesfaye Birru, Internal Examiner	

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my supervisor, Dr. G. G. Chowdhury without whom this thesis would not have been a reality. I am also grateful to Ato Nega Alemayehu for his guidance and assistance in every circumstances from the beginning to the end.

I am indebted to AAU for sponsoring my study. My special thanks goes to Ato Getachew Biru, Dean of SISA, for facilitating my study. I would like to express my sincere appreciation to Ato Tesfaye Biru for his valuable comments and advices; Ato Dawit Birhanu for providing me necessary materials for this work, Ato Worku Alemu and W/O Woinshet Abdela for their continuous encouragement and help.

DEDICATION

To my mother W/O Bekelech Yigezu.

ABSTRACT

User assistance through online help or tutorial facilities are among the major considerations in designing a user interface which in turn is the major factor for successful utilization of a software.

Micro CDS/ISIS is an information retrieval software package developed by UNESCO and distributed free of cost to non-profit making organization. In spite of its free availability and large number of users, use of the software has been severely limited by a number of factors, chief among them is lack of adequate user assistance and instruction through online help or tutorial facilities.

This thesis is an attempt to design and develop an online tutorial facility for Micro CDS/ISIS software which is believed to contribute greatly to ease of use and learning the software.

In accomplishing this task, the software has been analyzed and described in terms of its major functions. Survey of the available developmental approaches has also been conducted and the one appropriate for the current work has been adopted.

The tutorial consists of twelve lessons. It is developed using Turbo Vision which is an object oriented application framework for windowing programs. Although all the lessons have been designed, due to time constraints only the first three lessons have been programmed. However, the major design features proposed for the tutorial have been incorporated in these three lessons.

Among the features that the tutorial provides is use of menus to provide smooth access to the tutorial lessons, and provision of control button that enables the learner to control the pace of the tutorial, linking of the concepts thereby enabling the learner to get more information on related concepts, use of animated windows and highlights in drawing attention and motivation of learner etc.

TABLE OF CONTENTS Page

CHAPTER 1

INTRODUCTION

CHAPTER 2

MICRO CDS/ISIS SOFTWARE

CHAPTER 3

APPROACH TO TUTORIAL DEVELOPMENT

CHAPTER 4

DESIGNING THE TUTORIAL

LIST OF FIGURES

LIST OF ABBREVIATIONS

CAI	Computer Assisted Instruction
SISA	School of Information Studies for Africa
IDRC	International Development Research Centre
ISO	International Standard Organization
PADIS	Pan African Development Information Systems
ILCA	International Live Stock Centre for Africa
ILRI	International Live Stock Research Institute
NASTIDC	National Scientific and Technological Information and Documentation Centre
ESTC	Ethiopian Science and Technology Commission
IFLA	International Federation of Library Associations
ECA	Economic Commission for Africa

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND AND JUSTIFICATION

Data processing and information handling have been performed down through ages, first by hand, then by machine-assisted manual and now by electronic machine, such as computers. The capacity of computers have been rapidly expanding due to the development in Information Technology (computer technology, communication technology, microelectronics technology, etc.), the hardware and software. It has become an indispensable tool in handling the huge amount of information available in today's society.

The development in microcomputer technology has also made available different DBMS and Text Retrieval software which are used for managing this huge amount of information existing in our society.

Such development has also resulted in emergence of different categories of computer users, ranging from novice users who are unfamiliar with both specific syntax or generalizable knowledge in the use of computers, to experts who develop applications for use by others.

To meet these challenges most software systems, including DBMS and Text Retrieval software, provide support for the effective utilization of the system. Such support provided may vary from general explanation or help to tutorial facilities consisting of various lessons.

Micro CDS/ISIS is an information retrieval software package developed by UNESCO and distributed free of cost to non-profit making organizations. Unlike most of the commercially available software, however, Micro CDS/ISIS software does not provide adequate user assistance and /or user instruction through online help or tutorial facilities which contribute greatly to the ease of use and learning (Perera 1992).

This work, therefore, aims at developing an online tutorial facility for Micro CDS/ISIS software which will enable users to learn the software easily and this will foster optimum use of the software.

1.1.1 **Micro CDS/ISIS User Interface**

One major design factor that facilitate the effective use of such software packages as DBMS and TRS is the software's user interface. Although, the term user interface, generally, refers to such design elements as screens, keyboards, devices, languages, and other means by which the human user and computer system exchange inputs and outputs' (Davis and Olson 1985), its use inhere is restricted to such aspect of an interface as, screen lay out, language used and user assistance (manuals, online help facility, etc.).

As mentioned before, the incorporation of user interface in the design of software is gaining much attention mainly due to the coming of different categories of computer users. Some are less interested about its internal working and are not willing to undergo extensive training for the purpose of utilizing the computer to solve their problems. While others need to be provided with the basic functions which enable them to set up applications to be used

by others.

In addition to the above, the evolution from batch to online mode of processing requires the availability of more interactive system, which in turn calls for a more sophisticated user interface (Everest 1986).

Due to these reasons and others, most of the commercially available software packages include various level of dialogue mode, such as command and menu mode, and provide extensive user assistance through online help and tutorial facilities.

Micro CDS/ISIS, the subject of this study, is an information retrieval software specifically designed to handle structured non numerical databases. It provides most of the information retrieval functions available in a number of commercially available software. It enables to create a database, and also to create, delete, display records in a database. In addition to these facilities, it enables automatic creation of fast access file (inverted file), retrieval of records from a database using simple or complex (including boolean, adjacency and other operators) search expressions, and provides an opportunity to enhance the software's capabilities through programs written in CDS/ISIS Pascal language. Furthermore, it can handle unlimited number of databases with maximum of 16 million records each and with a maximum of 8000 characters per record. It works with variable length fields and this enables users to save more disk space by releasing the space not occupied by the data. As such it can be said that Micro CDS/ISIS fulfils most of the functional requirements of an information retrieval software.

Micro CDS/ISIS has a menu-driven interface, with different worksheets and prompts to assist user in performing the above functions. The menus are full screen and options are clearly indicated and always displayed. This in turn saves users from looking for additional keystrokes for activating the menu, as with the case with pop up and pull down menus. Users can choose an option identifier to perform certain function or to access another submenu. Each menu has an exit option which enables users to go to higher level menus. It also provides function keys which are used for shortcut switching between the different layers of menus. Hence, once the basic functions have been understood accessing them is not difficult.

However, an easy-to-use menu system is not the only required features of a user interface. A user interface should be equipped with adequate user instructions, and error messages and error handling mechanisms. The user instructions should provide the user with adequate information on the purpose and uses of the menu options, and step by step description of how to perform a given function. It should also provide the user with assistance when an error occurs and should enable user to recover previous state of processing (Carroll and Aaronson 1988; Kieras and Bovier 1984).

In this respect, Micro CDS/ISIS is not well suited for beginners. It does not have an online help or tutorial facility. But such facilities are very important while performing some of the functions. For example, Micro CDS/ISIS provides users with a set of formatting language commands which are useful for specifying formatting requirements for online display or printing. However, writing a display /print format is not a simple task as observed from the experience of most users who need to spend a lot of time in order to come up with desired

results. Furthermore, while writing the display format, the system provides a blank screen with brief message on it which is of little use to the user. A similar situation also exists in performing other functions such as, search formulation, defining field select table, etc.

In addition to the above, even though some commands are available at the users' disposal, nowhere on the screen it is indicated about their availability (Perera 1992). For example, since there is no facility for displaying the available databases, the user may want to exit temporarily to the DOS shell using 'F6' and scan the directory. However, the user may not be aware of the availability of this function key unless he/she consults the CDS/ISIS Read.me file.

Certain level of user instruction may be achieved by defining help messages for data entry worksheet as well as to some of the system worksheets. This, however, may be limited to a specific database and requires prior experience with the system. ' The naked standard version of the CDS/ISIS software as offered by UNESCO can hardly be used without a manual '(Nieuwenhuysen 1991).

The error messages are full of incomprehensible codes which have little instructional value (Perera 1992). After a careful evaluation of the Micro CDS/ISIS search interface under various criterion, such as user friendliness, user instruction, output control, and documentation, Perera (1992) has come to the following conclusions:

Micro CDS/ISIS

- is user friendly to experts but hostile to novices,

- does not provide adequate user instruction, and controlling output is not an easy task for novice users,
- the documentation which is available with the standard package does not provide much help for the novice but they are useful for experts.

Although some modifications have been made to improve these situations (since the release of the Micro CDS/ISIS version 2.3), some of the arguments still hold true, specially those on user instructions. The manual, which is that of version 2.3, has been graded as being partially comprehensible by software evaluation group (Sieverts et al. 1991).

According to the forgoing discussions, it can be generalized that the user interface of Micro CDS/ISIS software is not well suited for beginners.

1.1.2 **Need for an Online Tutorial**

Micro CDS/ISIS software is increasingly being used by different institutions. Since the release of the first version of the software in December 1985, some twenty thousand users are reported to be using it in different parts of the world (International Classification 1993).

As the number of users increases, the number of novice users who are rather impatient and require to get their job done with a minimum of prior effort, increases proportionally. To meet this challenge Micro CDS/ISIS software needs to be equipped with adequate user instruction. 'Only when the system functions fit actual work and the system is easy to learn and use will the system be adapted by users' (Gelack and Kuo 1990).

Different approaches are available in order to provide users with adequate instruction such as providing short training manuals, personal instruction, and Computer Assisted Instruction (CAI). The manual, as indicated earlier, is not well suited for novice user and is less comprehensible (Perera 1992 and E.G Sieverts et al. 1991). A less refined training manual may assist novice users in learning CDS/ISIS software. However, manuals alone may not be sufficient for describing the developing and dynamic system which requires practical exercise in addition to learning it through reading.

Non-availability of adequate number of experts in Information Technology (specially on CDS/ISIS software) in Africa contributes to the inadequate training of the CDS/ISIS software. Unlike, commercially available software, UNESCO does not provide adequate support (Nieuwenhuysen 1991). Even though, regional and national distribution centres provide some support, it is not adequate. In general, personal instruction costs higher, and it may not be available any time when the user requires it.

Provision of online tutorial facilities for users may be one possible way to improve or alleviate this situation. Among the advantages cited in using tutorial systems are, the system allow users to control the learning process, and work at their own pace, graphics capability of computers are not limited to static pictures which is useful to illustrate some abstract concepts easily, and also to motivate users (Bork 1981). Furthermore, tutorial software has a number of other advantages such as ease of modification, provision of realistic experience with the hardware mechanics, reliability and ease of access, widespread availability with respect to time, location, and size of audience, etc, (Eisenberg et. al 1989).

Tutorial application of computers which utilizes the presentation and interactive capability of computers to present the information and provide hands on exercise on the use of the software can be used to provide a detailed information on the meaning and use of a command, a menu or a function within the system. This in turn reduces the difficulties which arise in learning and using the CDS/ISIS software, and enables to save the time and money required for training the user.

1.2 OBJECTIVES OF THE STUDY

1.2.1 General Objective

The general objective of the study is to develop an online tutorial facility for Micro CDS/ISIS using Turbo Pascal which will enable users to learn the software facilities easily and to perform the major operations effectively. Once developed the system can also be used as a quick reference in fully utilizing the potential of the software.

1.2.2 Specific Objectives

In order to achieve the general objective, this work aims to develop an online tutorial package for Micro CDS/ISIS that would:

1) introduce users to the basic database concepts, database files, records, fields, etc;
2) provide an overview of the CDS/ISIS software and its development;
3) provide a detailed explanation of the different menus and worksheets;

4) provide instructions to guide users in performing the major functions, i.e.

a) designing databases;

b) formulation of search expressions;

c) modifying menus and worksheets;

d) import and export records to/from CDS/ISIS database;

e) print and sort operations;

f) writing display format;

5) write a program using Turbo pascal to perform the above operations.

1.3 SCOPE AND LIMITATIONS OF THE STUDY

Due, mainly, to the limitation on time, the tutorial may not cover all aspects of the software package. However, most of the functions which may be required by the novice users are included. Furthermore, the description of the purpose and use of some of the advanced features are also included. By its very nature, the tutorial is tailored more towards novice users than experienced ones.

Although all the tutorial lessons have been designed taking the above points in to considerations, again due to shortage of time, only the first three lessons are programmed.

1.4 REVIEW OF LITERATURE

In fact, since the release of version 1 of Micro CDS/ISIS in 1985, a number of efforts have been made to improving its user-friendliness. Most of the efforts, however, were directed

towards improving the user interface. For example, in version 2 of Micro CDS/ISIS, the six programs which were functioning separately in version 1, were integrated and a main menu was provided to access the different functions. Molla Hunegnaw (1993) has developed an interface called System Interface Search Assistance (SISA) which was intended to improve the search facility of Micro CDS/ISIS. A similar attempt has given rise to Heurisko, which is an interface used to perform search and retrieval operations on CDS/ISIS database (Pozzana 1993). In the area of data entry, a program has been developed to ensure the quality of input data entered in to Micro CDS/ISIS databases (Lugongo 1994). In addition to the above, several CDS/ISIS Pascal programs are available, again to assist in the design and development of databases, data entry, global editing of records, generation of reports, etc. These are : NEWDB, GDB, GMOD, GLB, VOCON, QUICK, etc.

A training manual has been created with examples of database structures for monographs, serials and various types of the addresses (Janssens and Jesse 1991). A tutorial manual was also developed for Micro CDS/ISIS version 2.3 (Otto 1990).

However, little attempt is made to develop an online tutorial facility to Micro CDS/ISIS software.

1.5 ORGANIZATION OF THE THESIS

The thesis is organized into 6 chapters.

The first chapter deals with background information and justification of the present study.

Review of the major functions of CDS/ISIS software, and their application in different areas is discussed in Chapter Two.

The approach adopted in developing the tutorial and the design aspect of the tutorial package, i.e, the structure of the lesson and their logical organization, are discussed in the third and fourth chapters respectively.

Chapter Five deals with the description of the program structure and guidelines on how to use the tutorial.

The last chapter includes some concluding remarks and recommendations for future work.

CHAPTER 2

MICRO CDS/ISIS SOFTWARE

Micro CDS/ISIS is an information retrieval software package designed to handle structured non numerical databases. Its historical development is described by Janssens and Jesse (1989).

ISIS was developed by the international labour office in 1964 to run on main frame computer (IBM 360). In late seventies, it was re-written by UNESCO, and was named CDS/ISIS.

By 1978, the International Development Research Centre (IDRC) had designed MINISIS, an ISIS version that can operate on Minicomputers (HP3000).

By 1986, UNESCO had issued an ISIS version for use on Micro-computers, IBM PC or compatibles with 512 k memory and a hard disk. There is also a version for the WANG PC and one for the VAX/VMS series. Since then different releases of the Micro version have been introduced.

Micro CDS/ISIS is suitable for handling databases of structured textual content, and has incorporated some of the major features of Text Retrieval Software.

According to Kimberley (1990), Text retrieval software is generally characterized by:

- variable-length fields
- access to records through an inverted file of index keys or text terms which are drawn from the records on the database.
- a range of retrieval facilities which support retrieval based on words in records, where there is limited control over the form of the search key in the record.
- emphasis on the management of one or more distinct databases, where the ability to draw data from a number of related databases is not critical.
- fixed applications which require relatively limited programming or systems.

Micro CDS/ISIS works with variable length fields and this enables users to save more disk space by releasing the space not occupied by the data. It also enables retrieval of records through an inverted file index, and provides a wide range of retrieval facilities such as, boolean searches, proximity searches, right truncated search, etc. Furthermore, Micro CDS/ISIS stores all the information concerning a given application in a single database, and works with one database at a time. A given database, however, may consist of different sets of records, and Micro CDS/ISIS provides a mechanism for linking these records. This facility in turn allows to retrieve a wide range of information with a single query. A number of bibliographic formats have evolved to facilitate the design of integrated databases using Micro CDS/ISIS. Examples of such formats include ABNCD+ (Abebe et. al 1992), MIBIS (Lauro 1990), IDIN (Lauro 1988), etc.

The rest of this chapter provides a detail description of each of the major modules of the Micro CDS/ISIS.

2.1 MAJOR MODULES

Micro CDS/ISIS consists of eight services which are broadly classified as user services and system services (UNESCO 1989). User services include functions like data entry and retrieval, sorting and printing, and inverted file update which are performed on an already established database. On the other hand, system services include facilities for setting up and/or maintenance of database, and also developing applications for use by others.

2.1.1 Working with New Databases

Database definition is the first step in setting up a database system. It specifies the content of the database and the rules that the different modules of the Database Management System may follow in manipulating the data. In other words, it is the blueprint governing the storage and retrieval of the data (Everest 1986).

CDS/ISIS software allows users to define new databases using database definition services. Database definition involves the following four steps:

- Creation of the field definition table;
- Creation of the data entry worksheet;
- Creation of the display format; and
- Creation of the field select table.

2.1.1.1 *Field Definition Table*

Micro CDS/ISIS requires that the information which will be stored in the database be structured into fields, and fields into records. This means that the structure of the database has to be designed before users are able to store and retrieve information. This is an inherent feature of most Database Management Systems. Micro CDS/ISIS enables to define the structure of a database using Field Definition Table.

The field definition table contains the fields to be included in the database, and their characteristics. The characteristics of the fields are expressed in terms of the following six parameters: Tag, Name, Type, Length, Repeatability, and Subfields/Patterns. The system uses the field tag while performing any function on the given field. The field name, on the other hand, is descriptive of the content of the field and used in communication with users. Specifically, it is used for labelling fields in the worksheet.

The Field Type defines the type of the field values. Fields may be of Numeric, Alphabetic, Alphanumeric, or Pattern type. The field length is the expected length of field values. It can be altered when defining the data entry worksheet.

Repeatability indicates whether a given field can occur more than once in a given record or not. Depending on the type of the field specified, users may define the subfield identifiers if the field is to contain subfields, or the pattern for pattern type field in the last column of the field definition table.

Subfields are identified by the field tag attached with it a 2 - character subfield delimiter, i.e ^X where ^ denotes that what follows is a subfield, and 'X' denotes a specific subfield delimiter, e.g. A, B, C... or a,b,c etc. However, when defining subfield identifiers in the field definition table, the caret sign (^) should not be specified e.g the required entries in the given column may be abc, ABC, fhlq, FHLQ etc.

Pattern is a character by character description of the content of a field. While defining the pattern, the designer specifies the type of each character position in a field. Each character position may be of one of the following type:

X - the position may contain any alphanumeric character

A - the position must contain an alphabetic character

9 - the position must contain a numeric character

other - the position must contain the indicated character

e.g. Pattern

99-999/AA	35-674/XE	this is a valid pattern entry
	35-j56/XE	this is not a valid entry because 'j' is not numeric character.

These are the last characteristics of the fields that will be defined in the Field Definition Table.

Other modules of the CDS/ISIS software which perform operations on the fields of the database are governed by this definition. Any operation on the fields which is not in conformity with their definition on the Field Definition Table will be rejected.

2.1.1.2 *Data Entry Worksheet*

Data entry worksheet is an on screen form used to create and/or update database records. It contains one or more of the fields defined in the Field Definition Table. A database can have more than one data entry worksheet containing subsets of the fields defined in the Field Definition Table. This is specially important when users have an integrated database containing distinct set of fields. Instead of having a single long worksheet consisting of all the fields, users can create separate worksheets containing each distinct set of fields. This in turn enables to have smaller worksheets which are simpler to work with.

2.1.1.3 *Display Formats*

The display format is a set of instructions, which forms part of the Micro CDS/ISIS formatting language, used for specifying how the data in the database is to be displayed and/or printed. The formats used for displaying records are referred as Display Formats where as those used for printing are called Print Formats. Formatting language commands are also used in Field Select Table to select the data elements to which a particular indexing technique is to be applied. These are referred to as Data Extraction Format. A database can have two or more separate display formats each displaying the subset of the fields defined in the Field Definition Table. Using the IF format command, users can also integrate different set of formatting language commands into a single display format and execute each based on the condition specified for them. It is also possible to link records using the REF() function. This in turn enables to display different records as if they come from the same records.

2.1.1.4 *Field Select Table*

The Field Select Table is used to extract data from the database. It is mostly used in operations which require data extraction such as, building the inverted file, specification of the sort key in case of sorting and printing, and for reformatting the database records during import and export operations. The field select table that users create during database definition is used for extracting the terms which will constitute the dictionary of searchable terms. While searching the database, users can display these terms and select some of them for building their query. Specification of the Field Select Table is the last step in database definition.

2.1.2 Working With an Existing Database

2.1.2.1 *Modifying Database Definition*

In addition to defining a new database, the database definition services enable also to modify definition of an already existing database. Some of the fields may be deleted from the field definition table, or additional fields may be added to it. The field definition table, however, can neither be deleted nor is there an option for making a copy of it. Whenever a change is made to the Field Definition Table, necessary modification has to be made to the worksheet, display format, and field select table. Otherwise, inconsistencies among the database file may exist which in turn may result in the corruption of the database files.

Additional worksheets, display formats, and field select tables may be created by making copies of the existing worksheets, display formats, field select tables, and subsequently modifying them, or defining each of them from scratch. Modification to the existing worksheets, display formats, and field select tables can be made, and those which are no longer needed can also be deleted. However, the default worksheet, display format and field select table created during database definition cannot be deleted. Note that any change made to one component may call for the revision of the rest. Hence, attention must be given to all the components of the database during database modification.

2.1.2.2 *Data Entry and Modification*

After defining a database and before any retrieval can take place, data must be entered into the database. Data Entry Services option of the Micro CDS/ISIS main menu enables creation and/or update of the database records. Records may be created through direct keyboarding of the data using data entry worksheet, or importing or downloading from another database. Records may also be modified directly using data entry services or using user-written Pascal program that allows specialized kind of record modification.

2.1.2.3 *Inverted File Generation and Update*

After data has been entered into the database, Inverted files should be generated so that users can take advantage of the powerful search facility. Inverted file is created using the inverted file services. Inverted file is an index to the database containing terms extracted from the database and the Master File Number (MFN) of the records from which the terms

are extracted. Inverted file services provide facility for inverting the whole database, which may take longer period of time for relatively large databases. Once an inverted file is created users can use the 'Update inverted file' facility to invert only the newly created, or modified records.

Full inverted file generation consists of three distinct operations which are performed consecutively. These are creation of the link file, sorting the link file and loading the sorted link file into the Inverted file. Inverted file provides options to perform these operations one after another separately. Once created, users will be able to search through the inverted file which is much faster than free text search.

2.1.2.4 *Information Retrieval*

Retrieval of the records from a database is accomplished through the Information Retrieval Services Menu. Micro CDS/ISIS provides sophisticated retrieval facilities based on boolean algebra. The retrieved records may also be displayed and/or saved for later processing. Micro CDS/ISIS permits two types of searches:

i. Searching through the Inverted file; and

ii. Free text searches.

Searching through the inverted file requires that an inverted file be created first. It may be noted that Micro CDS/ISIS does not create the inverted file automatically. Free text search enables to search on those fields which are not indexed. It is a sequential process and usually takes longer period of time.

2.1.2.5 *Sorting and Printing*

Generation of outputs either in the form of printed output or to a file, in a user defined format, is among the key features of an Information retrieval system. Micro CDS/ISIS has incorporated such facilities under its sorting and printing module. It enables to obtain printed outputs which are important for generating notices, reports, bibliographic indexes, etc. Printout of previously saved search results may also be obtained using this module. Users may also sort the records to be printed depending on their requirements. Since sorting and printing requires a number of parameters to be defined, Micro CDS/ISIS uses a system worksheet to collect these parameters from the user. Unlike data entry worksheets, system worksheets are supplied by Micro CDS/ISIS. However, users may also define their own print and/or sort worksheets containing the most frequently used parameters.

2.1.2.6 *Data Security and Exchange*

Other important features of an information retrieval system include, the ability to maintain data integrity, and data exchange with other systems. Micro CDS/ISIS provides back up and restore facility to protect from accidental loss of data, and import and export facilities for interchanging data with other systems that support ISO 2709 standard. Like sorting and printing, Micro CDS/ISIS uses system worksheets for collecting the parameters required for import and export operations. These facilities are accessed through the Master file services module.

2.1.2.7 *Customization of System Menus and Worksheets*

Customization of the system menus and worksheets may be accomplished using the system utility services. Micro CDS/ISIS allows to create and/or edit menus and system worksheets. System worksheets are used in import and export operation as well as sort and print operations to collect the required parameters. Print out of the system worksheets, menus, and system messages can also be obtained using this module. This in turn enables users to get the hard copy equivalent of the worksheets which may be used for data preparation, and also of the messages which may be used for translation of the messages in designing a new language version of the software.

2.1.2.8 *Programming Facilities*

The modules discussed so far enable users to perform most of the basic information storage and retrieval tasks. However, users' need change from time to time and they may need to perform specialized tasks which may not be accomplished using the existing functional modules. For this purpose, CDS/ISIS provides users with a Pascal programming interface which enables them develop applications meeting their specific needs. The Pascal interface is a library of procedures and functions which enables users to manipulate the database records and perform most of the Micro CDS/ISIS functions using the Pascal library.

2.1.2.9 *Multilingual Dialogue*

One last, but important, feature of CDS/ISIS software is its capability for multilingual dialogue. The standard Micro CDS/ISIS software comes in three language versions and users may change the dialogue language using the 'Change dialogue language' option. This is important for the purpose of internationalization.

In summary, Micro CDS/ISIS software has incorporated most of the major features of an information retrieval system.

2.2 RELATIONSHIP AMONG THE MAJOR MODULES

The first version of Micro CDS/ISIS software consisted of six programs functioning independently of one another. In later version of the software, the six programs were integrated and a Main Menu was provided. The Main Menu allows a smooth access to the different functions. Still, however, there is less integration among the different modules of the software (Nieuwenhuysen 1991).

Some of the CDS/ISIS functions may not be performed automatically and they require user involvement. The modules of Micro CDS/ISIS software represent homogenous functions which may be performed one after another. For example, inverted files are not updated automatically whenever records are created or modified, although users will be reminded to update inverted file in some cases. Automatic back up facility is not available. Hence, users need to take backup of the database periodically to protect their data from accidental

loss. There is also less integration between data entry and retrieval (Nieuwenhuysen 1991). That is, it may not be possible to correct errors identified while browsing the records of the database using the information retrieval module. Instead, the user needs to note down the MFN of each of the records, and use the data entry module to edit the records through their respective MFNs. It would have been very helpful to the users if it were also possible to print records while browsing records in the information retrieval services.

Although, the major CDS/ISIS modules exhibit some sort of independence, there are other features of the software that make it look very much interrelated. Its menu-based interface, for example, together with its short cut keys, enable the user to move from one module to another easily. Hence, the user may not notice the problems associated with the relatively independent modules. Furthermore, global application of some of the techniques also indicates some sort of relationship among the different modules. For example, the display format created during database definition services is used for displaying and printing records in information retrieval services, and in sorting and printing services respectively.

In addition to the above, creating a data entry worksheet is not significantly different from that of system worksheet since the same worksheet editor is used to create both the worksheets. Likewise, specification of the parameters for Field Select Table, while defining a database, is also almost the same as specifying the parameters for selecting the sort key, and also reformatting Field Select Table for import and export operations. In general, the relationship among the different modules may be summarized using a block diagram shown in Figure 2.1.

2.3 USE OF THE SOFTWARE

Due to such functional capabilities and its availability of free of cost, Micro CDS/ISIS is increasingly being used for information retrieval activities in the developing countries. Its capability for handling structured text, such as bibliographic description, has made it popular in such institutions as library and information centres. Surveys by the Pan-African Development Information System (PADIS) indicates a significant increase in the use of the software in Africa (PADIS 1989, 1991).

Pan-American Health Organization uses the Micro CDS/ISIS to develop bibliographic databases and to distribute these via CD-ROM (Nieuwenhuysen 1991). Micro CDS/ISIS is increasingly being used in Arab countries due to its suitability for the Arabic language. In Jordan, for example, over 60 institutions have established bibliographic and non bibliographic databases in Arabic, English, and French (UNESCO 1992, Vol. 20). In Latin America, there are over 7000 users of the CDS/ISIS software (UNESCO 1993, Vol. 21).

Bibliographic records from the World Health Organization's (WHO) office of Health Literature and Information Services, the Malawi Ministry of Health Library and Documentation Centre, and the University of Nairobi Medical Library, were successfully merged into one database using CDS/ISIS software; and WHO developed WHOBIS format which is intended to be used as the medium for exchange of computerized database records (UNESCO 1991, Vol. 19).

PADIS and ILCA (International Livestock Centre for Africa, presently, ILRI, International Livestock Research Institute) are among the institutions which make extensive use of the software and also promote its use by providing training and technical assistance. NASTIDC (National Scientific and Technological Information and Documentation Centre) of ESTC (Ethiopian Science and Technology Commission), which is the major distributor of the Micro CDS/ISIS software in the country, uses MINISIS and Micro CDS/ISIS software for building bibliographic databases. The Survey made to establish National CDS/ISIS software users' group indicates that over 30 institutions are using CDS/ISIS software in Ethiopia (Birru 1994).

Since Micro CDS/ISIS provides a Pascal interface, it is also being used as a framework for developing several applications. An example to such development is that of SANJAY developed by DESIDOC under a NISSAT project (Chowhdury and Chowdhury 1994, vol.4). In addition to allowing the usual information retrieval operations, the software also provides the facility for performing library house keeping operations like Acquisition, Circulation,and Serials control.

The QUICK.PAS program has been developed by Khalid Basher Mohammed (1987) using CDS/ISIS Pascal to assist at data entry stage in Micro CDS/ISIS (version 1). In addition, Khalid Basher Mohammed (1987) developed MTHES.PAS, a modification of the THES.PAS program provided by Unesco along with the standard Micro CDS/ISIS, that enables selection of terms from a thesaurus and add it to a specified field in a Micro CDS/ISIS database record.

A similar attempt to the above is that of the VOCON.PAS which is a Pascal interface program used for online selection of term(s) and/or code(s) from a vocabulary control tool to specified field(s) of one or more records of a Micro CDS/ISIS database (Chowdhury, Neelameghan, Chowdhury 1994). There are still a number of applications developed using CDS/ISIS Pascal such as, NEWDB, GDE, GMOD, GLB etc, which assist the user in the design and development of databases, data entry, global editing of records, generation of reports, etc.

Micro CDS/ISIS has not been advertized and publicised in large scale like most commercial software which in turn has some impact on its use. For the first time in the world, the 1st international CDS/ISIS conference is going to take place in Columbia, Latin America during 22-26 May 1995. Another significant development is the publication of a new journal on CDS/ISIS. Till now news columns appear in several regular publications such as the Unisist Newsletter, PADIS Newsletter, ASTINFO Newsletter, IFLA Newsletter, Information Development, etc. However, for the first time a journal totally devoted to CDS/ISIS has started to appear from Argentina. The journal is published quarterly and is entitled INFOISIS. Hopefully, this will contribute to its use.

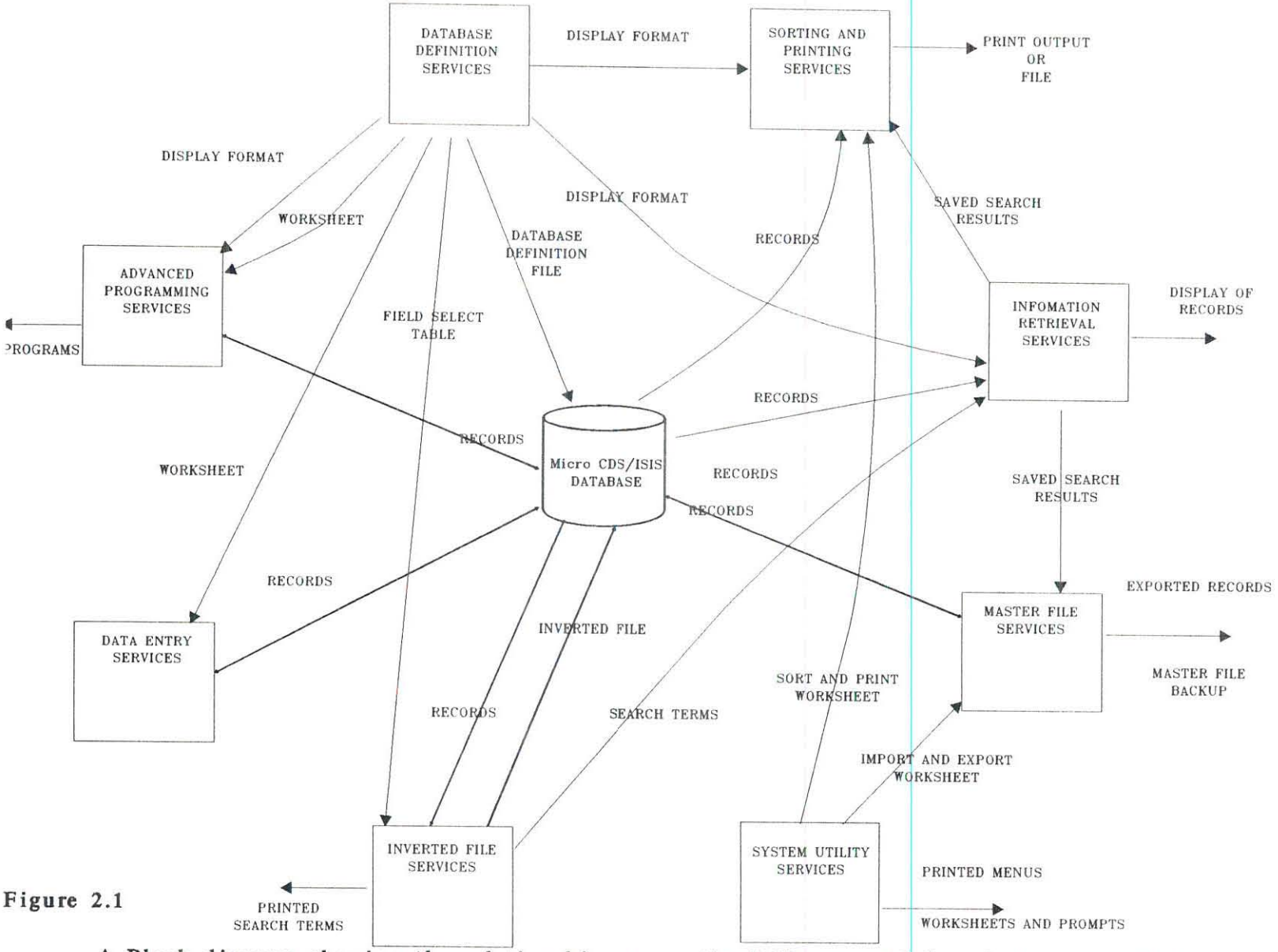


Figure 2.1

A Block diagram showing the relationship among the different modules of Micro CDS/ISIS software

CHAPTER 3

APPROACH TO TUTORIAL DEVELOPMENT

Developing a Computer Assisted Instruction (CAI) requires the availability of different expertise from various fields of knowledge (Burke 1981). A CAI author must acquire or seek assistance from people in several fields of knowledge to come out with a good lesson. According to Burke (1982), the different fields of knowledge with which the CAI author must either become familiar or seek assistance, in order to produce effective CAI lessons, are the subject matter that make up the lesson, learning theory, instructional system design methodology, and computer science.

In developing MEDLEARN, a computer assisted instruction program which provides online training for MEDLINE, a team composed of experts from different fields such as programming, CAI methodology, educational philosophy, and subject content, was established (Eisenberg et al. 1978). This shows that the body of knowledge mentioned above are widely recognized as useful knowledge prerequisite for developing CAI lesson. But it is difficult for an individual to have adequate expertise on the above knowledge prerequisite. Assistance should be sought from experts in the respective fields. Development of tutorials, as part of CAI, require these prerequisite knowledge. This in turn calls for effective communication among the different experts so that a Tutorial which is fully mature in all respect can be developed.

In this undertaking due, mainly, to such constraints as time, availability of required expertise and other reasons beyond those mentioned in the Scope and Limitation of the

study, the overall development process assumes Prototyping approach. Prototype is a trial model or a preliminary version of a product whereas prototyping is the process of producing a trial version of an application before developing a final system (Smith, 1991). This approach basically consists of four steps. The first step involves identification of the basic user requirements. Based on these requirements, an initial prototype system will be developed in step two. The prototype system will be used to refine the users requirements. Users will have hands on experience with the prototype system which provides them an opportunity to improve upon their requirement and come up with new ideas, suggestions, etc. This constitutes the third step. In the fourth step, the prototype system will be revised and enhanced based on additional requirements. The last two steps are repeated until the user is satisfied with the system.

When applied to the current problem, first the basic requirements for the tutorial are identified and major design decisions are made. Second, the result is used to develop the initial prototype. This prototype system will be presented for discussion to students and advisors in the third step. Finally, based on the outcome of the discussion, improvement will be made on the prototype system. This process will be repeated until a system meeting the basic requirements is achieved. The major advantage of this approach is that it can facilitate communication between developers and users by experimentation with working prototypes. Sometimes users may best express their requirement when they actually have experience with the prototype system. Furthermore, it enables to get a functional system with reduced developmental time and with relatively less cost (Takashi et al. 1993).

The remaining part of this chapter enumerates the basic requirements for the tutorial, and also discusses some of the major design decisions.

3.1 **PREPARATION**

For development of a tutorial, undertaking inital preparation which mainly includes identification of some of the basic user requirements, and also the different development techniques, is essential.

To this end, for background information and preparation, discussion were made with the second year students who have some experience of using the software in their coursework, faculty memebers of SISA and the Departement of Library Science, and people from the Science and Technology Commission of Ethiopia who are experts in the software. The later category of people are also engaged in providing training in Micro CDS/ISIS.

Materials on CAI and other related topics have been reviewed to build background knowledge on the available techniques, and also to identify the important points which needs to be considered in the design and development of the Tutorial. The materials required for the development of the tutorial content have been collected and carefully analyzed.

Tutorial of other similar software packages has been looked at to identify some of the most common design features.

3.2 REQUIREMENT SPECIFICATION

This tutorial is being developed in recognition of the need to provide adequate assistance to users of Micro CDS/ISIS software. In particular it should provide for the following functional and non-functional requirement.

The tutorial should be designed such that after going through the tutorial lessons, the learner will be able to perform the major functions with less difficulty. Specifically, after going through the tutorial, the learner should be able to:

- define a Micro CDS/ISIS database and modify it,
- enter data into the database and modify it,
- build and maintain inverted files,
- conduct searches on Micro CDS/ISIS database,
- produce various printed outputs
- perform Import/Export operation on CDS/ISIS databases, and
- take back up of the database and restore it, whenever needed.

In addition to the above, the tutorial should incorporate the following important features.

- The tutorial should be modular, thereby enabling the learner to interact with the appropriate segment.
- The objectives of each of the tutorial modules should be fully and clearly defined.

- Prerequisite skills need to be defined and the tutorial content should match objective.
- The tutorial should enable active participation of the learner, and provide adequate feedback.
- The tutorial should provide the learner adequate control. That is, it should allow users to exit the tutorial at any point in time, enable them jump from one topic to another with relative ease. The learner should not get lost in the middle of the tutorial. Instructions on what to do next should be clearly indicated and should be unambiguous.
- A help facility need to be available at any point in the tutorial session which should provide a brief description of the control keys.
- The tutorial should minimize necessary typing, and be able to handle various types of responses of the learner.
- New materials presented should be related to the previous one, and summaries and reviews need to be provided at the end of each module, and important concepts should be restated.

3.3 **INSTRUCTIONAL METHODOLOGY**

One of the major decisions on designing a CAI lesson, is determination of the instructional functions that the lesson serves. CAI is used to enforce learning which was accomplished using other means such as text books, lecture etc, or may be used as a primary medium for delivery of instruction (Burke 1982). Some of the instructional applications of computers are Drill and Practice, Tutorials, Games and Simulations.

Each type of CAI is composed of different sets of steps, which support or enhance learning, called Events of Instructions (Gagne et al. 1981). According to Gagne et al. (1981), there are nine Events of instructions which must be taken into consideration and applied appropriately so that any act of learning will be complete. These are:

(i) Gaining attention,

(ii) Informing learner of lesson objective,

(iii) Stimulating recall of prior learning,

(iv) Presenting stimuli with distinctive features,

(v) Guiding learning,

(vi) Eliciting performance,

(vii) Providing informative feedback,

(viii) Assessing performance, and

(ix) Enhancing retention and learning transfer.

Drill and Practice is a common application which enables one to practice an instruction until certain level of mastery has been reached. It is mostly used in question and answer type of learning; and hence usually consists of two events of instructions, i.e Eliciting response and Providing feedback (Gagne et al. 1981). The actual presentation of the information is usually accomplished by other instructional means such as through lecture.

Tutorials are more comprehensive and assume the role of a human tutor. The tutorial design works best for the initial presentation of new material, and is also suitable for highly verbal material which lends itself to narrative description (Bruke 1982). In order for a tutorial to function as a fully contained instructional strategy, it should include the nine events of

instructions (Merrill 1986). However, all events of instruction need not always be present in every tutorial lesson.

Simulation, another type of CAI, refers to computer programs which model reality or real system. They are specially useful in situations where actual experimentation or real experience is impossible, dangerous or expensive. Furthermore, these can also be used for clarifying some concepts which are difficult to explain through lecture or any other means. Games are like simulation except that games involve some sort of competition with an opponent, which may be time, score, etc, (Kearsley 1983). They have got a high potential for motivation and are good for increasing effective user involvement which in turn increases likelihood of learning and retention (Burke 1982).

In this thesis, a tutorial which incorporates some aspect of drill and practice, and simulation, will be developed. The tutorial is to be used along with the Mini-Micro CDS/ISIS reference manual version 2.3.

The main reason for adopting a tutorial strategy is the need to provide an alterative training facility which is self-sufficient in most cases, and can be used as a primary means of providing instructions on the software.

3.4 DEVELOPMENTAL TOOLS

Selection of software for developing the CAI program is another major decision point which must be given due attention. One option available for developing a CAI is an Authoring

System. It is a software package which guides the CAI author through the programming process and eliminates the need to know how to program the computer or to know a programming language of any kind (Burke 1982). It saves more time since most of the common functions involved in developing the tutorial are handled using an authoring software. This in turn enables the developer to concentrate on the content of the tutorial rather than other aspects such as programming.

Another alternative may be that of Authoring language. Authoring language is a high level programming language which provides a set of generalized commands that enables to perform most of the authoring functions such as display formatting, graphics creation, test scoring, answer matching, student data collection, etc, with relative ease and can be mastered with little effort. It doesn't build the CAI material automatically as in the case of Authoring system. However, it reduces programming effort to a greater extent (Burke 1982).

Neither Authoring system nor Authoring language is currently available at SISA for this work. In such circumstances, the option left for use is the use of the available high level languages. This option requires greater development time and resource. In particular, the high level programming language selected is Pascal. Two options are available for consideration in this regard: Micro CDS/ISIS Pascal and Turbo Pascal.

System. It is a software package which guides the CAI author through the programming process and eliminates the need to know how to program the computer or to know a programming language of any kind (Burke 1982). It saves more time since most of the common functions involved in developing the tutorial are handled using an authoring software. This in turn enables the developer to concentrate on the content of the tutorial rather than other aspects such as programming.

Another alternative may be that of Authoring language. Authoring language is a high level programming language which provides a set of generalized commands that enables to perform most of the authoring functions such as display formatting, graphics creation, test scoring, answer matching, student data collection, etc, with relative ease and can be mastered with little effort. It doesn't build the CAI material automatically as in the case of Authoring system. However, it reduces programming effort to a greater extent (Burke 1982).

Neither Authoring system nor Authoring language is currently available at SISA for this work. In such circumstances, the option left for use is the use of the available high level languages. This option requires greater development time and resource. In particular, the high level programming language selected is Pascal. Two options are available for consideration in this regard: Micro CDS/ISIS Pascal and Turbo Pascal.

3.4.1 CDS/ISIS Pascal and Turbo Pascal

Micro CDS/ISIS provides a facility to enhance the software's capabilities through programs written in Pascal language (referred to as CDS/ISIS Pascal). CDS/ISIS Pascal language consists of a compiler, an interpreter and a library (UNESCO 1989).

The CDS/ISIS Pascal library consists of procedures and functions which are designed to manipulate the data within CDS/ISIS database and to perform other system functions specific to the software. The procedures and functions enable to perform most of the CDS/ISIS functions from within the program just like the standard package. In the course of developing a tutorial system, particularly this enables to call upon most of the functions easily for the purpose of explaining their features and also provide hands on exercise. For example, a simple call to SEARCH function activates the CDS/ISIS search with all its full features. However, the flexibility of use may be limited. Sometimes it may be impossible to interrupt these functions to perform some action such as displaying message, instructions etc.

Programs written using Micro CDS/ISIS Pascal are converted into pseudocode using the compiler, then only they can be executed by the interpreter. Because the executable code is machine-independent, it is possible to run programs written in one computer system on another as long as Micro CDS/ISIS supports both systems. The programs cannot run without the interpreters, i.e the Micro CDS/ISIS software.

Micro CDS/ISIS Pascal supports only four types of variable declarations, i.e Real, Array[1..n] of Real, Array[1..n] of string, and String. Micro CDS/ISIS Pascal does not allow other data types such as Record, enumerated types, Sets, Objects, etc. The programs are restricted to a maximum of 10000 instructions without Expandable Memory Support, and 16363 intructions if Expandable Memory Manager is installed. Some of the error messages by the compiler do not exactly indicate source of the error and are of little use. Worse is that Micro CDS/ISIS does not provide an editor for editing the source code. Each time an error occurs users need to exit Micro CDS/ISIS and use other text editors to make the correction. To compile the source code they have to run the Micro CDS/ISIS software again. The process therefore becomes laborious particularly while writing large programs. Furthermore, Micro CDS/ISIS Pascal interface doesn't support graphics. Graphic images are seen as an alternative means of conveying meaning and are also an important means of stimulating the learner.

On the other hand, Turbo Pascal is fully a compiler which is designed for all types of users who want to develop applications for the DOS operating system (Borland 1992). It has an easy-to-learn and easy-to-use integrated development environment. The editor compiler, linker, and debuger to create, debug and run Pascal programs are built into the Turbo Pascal, and can be accessed from the integrated development environment.

It supports various data types enabling to represent data in various forms. The ability to break programs into separate units allows to build larger applications with far more number of instructions than that of Micro CDS/ISIS Pascal. The Turbo Pascal help system provides detailed information on the Turbo Pascal language, Integrated development environment,

the runtime library, compiler directives, and so on. And in most cases, users can solve their problems using the Turbo Pascal help system. Turbo Pascal provides a library of procedures and functions which users may use to create different graphics image to enhance their applications.

In addition to the above, Turbo Pascal provides support for object oriented programming and has now incorporated a new data type called Object. 'Object oriented programming is a method of programming that closely mimics the way we get things done' (Borland 1992). That is, it provides better concepts and tools to model and represent the real world as closely as possible (Parsaye, et al. 1989).

Object type is structurally similar to that of Record type. However, an object type has a number of features which differentiate it from other data types. It consists of components where each component is either a field containing data, or a method (function or procedure) which performs operation on the object. As a rule, object oriented programming requires that objects should be as much as possible self contained. That is, manipulation of the fields of the object should be accomplished using the methods provided by the object itself. For example, if external program needs to access the fields of the object, it should be done through methods provided by the object. The welding of data and code together into Objects is referred to as Encapsulation (Borland 1992).

An object type may be descendant of another object type inheriting all the methods and fields of its ancestor and incorporating additional methods and fields of its own. This in turn enables to extend the capabilities of an object and build a hierarchy of objects with differing

capabilities but having some common properties. The process by which one object can acquire the properties of another object is referred to as Inheritance (Borland 1992).

Polymorphism is another characteristic feature of an Object Oriented Programming. It means giving an action one name that is shared up and down an object hierarchy with each object in the hierarchy implementing the action in a way appropriate to itself (Borland 1992). These characteristic features of an object oriented programming, i.e. Encapsulation, Inheritance, and Polymorphism, have been claimed to providing modularity, reusability, maintainability etc., of the software products. However, the main feature of Turbo Pascal that makes it candidate for the development of the Tutorial is its support for an object-oriented application framework called **Turbo Vision** (Borland 1992).

3.4.1.1 *Turbo vision*

Turbo Vision is an object-oriented application framework that enables to build menus, windows, dialogue boxes and other screen features which are common in most applications with relative ease and less time. Since it enables to build the user interface completely without actually developing application, it is very useful for prototyping.

All the views such as, Menus, Windows, Buttons, Dialogue boxes, etc. provided by the Turbo vision have got built in mouse support and the capability to handle standard keystroke. They can be moved around on the desktop and can also be resized. This in turn enables to build an interactive system easily and to create some interesting screen effects.

In general, Turbo Vision facilitates the design of user interfaces and enables one to concentrate on other aspects of the application which perform the actual job. Hence, due to this and the benefits mentioned in the previous section, the familiarity of the student researcher with the language and its availability, Turbo Pascal has been chosen as the programming language for developing the Tutorial.

CHAPTER 4

DESIGNING THE TUTORIAL

Before attempting to develop a tutorial program one has to make sure that the content of the tutorial is complete, covering all the important concepts, and structured in a form suitable for presentation. Unless careful consideration is given to the preparation of the tutorial content, it is likely to have severe impact on further development of the tutorial package (Christopher and Quentin 1983).

Preparation of the tutorial content is not an end to the development process. The tutorial should be programmed. The tutorial program needs to be designed in such a way as to make maximum learner interaction or involvement possible. 'Allowing users to actively participate in their learning enhances the learning process' (Joan et al. 1987).

In general, the importance of design in the development of tutorial package has been emphasized by different authors. Bruke (1983) stated: 'If you do not start out with a solid appropriate design, the effectiveness of the lesson will be minimal at best, and revision will be difficult if not impossible'. In the next sections, a detailed design of the tutorial will be presented.

4.1 STRUCTURE OF THE TUTORIAL

It is a common practice to break large tutorials into chapters, chapters into sections, and sections into further subdivisions. Modular structuring enables a training designer to take

account of differences in learner experience and work responsibility (Christopher and Quentin 1983). Having recognized the importance of modularization, this Tutorial is organized into lessons, and each lesson into topics. The topics are again divided into a set of paragraphs.

One advantage of having such a hierarchical organization is that the learner can start the tutorial session from any topic. This allows the learner:

i) to sequence the instruction in a manner suitable to his or her needs and capabilities, and

ii) to interact with the tutorial segment relevant to her/him.

Another benefit derived from having such modular design is that it allows decomposition of the development process into modules that can be prototyped efficiently. This in turn allows a step-by-step implementation of new modules when developed. Furthermore, revision and modification of the tutorial modules can be accomplished with relative ease since modularization makes the tutorial program clear and more understandable (Christopher and Quentin 1983).

The target user groups for this tutorial range from beginners, who are new to the Micro CDS/ISIS and require extensive training so that they can make effective use of it, to experts who have some experience of using the software and need ad hoc assistance. Therefore, this modularization enables to incorporate the needs of such a wide variety of users with different capabilities into the tutorial.

Having such a hierarchical organization by itself does not guarantee smooth access to the tutorial components. Therefore, it will be necessary to specify a mechanism by which a user will get access to the different components of the tutorial. There are a number of models available which specify different kinds of branching rules, such as, Mastery, Adaptive, Learner control etc. In the Mastery and Adaptive models, the branching decision is controlled by the tutorial program based on the results of pre and post tests that the learner will be subjected to attend, or evaluation of the previous performance of the learner. On the other hand, in the learner controlled model, the selection and sequencing of the tutorial materials are under full control of the learner (Kearsely 1983).

Since the aim is to have maximum learner involvement and control, the third approach is adapted for our purpose. To achieve this, the screen needs to be designed in such a way that the learner will be allowed to actively participate in the learning process. According to Bork (1981): 'The most essential capability, beyond those of programming languages is the screen design capability (in developing CAI Software), the ability to construct information interactively on the screen'.

Therefore, a menu is provided consisting of 12 lessons and each option in the menu opens up submenus consisting of a number of topics included within the lesson. The learner can start the tutorial session by selecting any of the topics listed.

Furthermore, the user should also be provided with a mechanism that allows him/her to get more information on related concepts while learning certain concepts. To enable such linking possible, the screen is designed to hold control keys which, upon selection, may

provide the user with additional information on some of the related concepts. A diagram showing all the possible links among the different lessons are provided in Figure 4.1.

In addition to the above, one has to consider also how the learner will be able to control the progress of the tutorial lessons. The tutorial should provide a smooth way of moving around the lessons. Therefore, in addition to those used for branching, control keys are provided to the learner which enables to continue and also to exit the tutorial with a minimum of keystrokes. Since they are the means by which the learner will be able to control the lessons, they should always be made available on the screen, clearly indicated and standard. A help key, which upon selection, provides information on the control keys, should also be available always. This in turn minimizes the chances of being lost in the middle of the tutorial.

Another major consideration, in addition to providing the user with full control over the tutorial sequence and pace, is how the tutorial is going to be presented to the learner. Structuring the tutorial into small paragraphs greatly facilitates the presentation of the tutorial. Users don't normally like to read large amount of text on the screen unless they have got strong motivation for it (Joan et al. 1987). Attempt has been made to reduce the amount of information, commonly referred to as *Frame*, that is presented on the screen at a given time. Each Frame or screen display consists of one or more of the windows which may contain the unit of information such as a sentence, paragraph etc. Turbo Vision windows can be moved around the screen and can be resized thereby allowing complete control over the display screen.

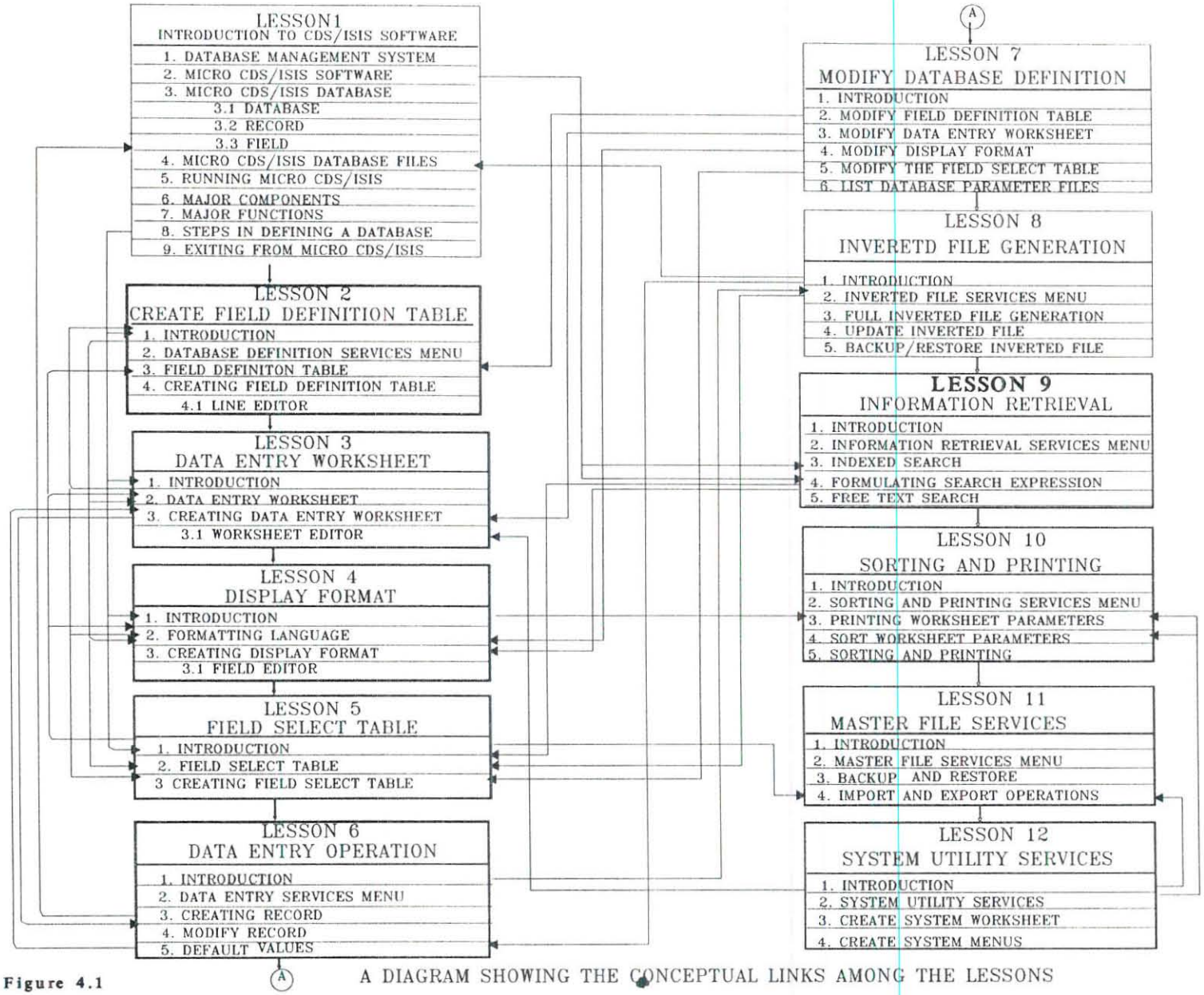


Figure 4.1 A DIAGRAM SHOWING THE CONCEPTUAL LINKS AMONG THE LESSONS

Colour is another important feature of screen displays (Christopher and Quentin 1983). The text within the windows are displayed in black on white background. This in turn enables to obtain a clear screen display over a wide range of display monitors. Different colour attributes have been used in some of the screen displays to emphasize some of the concepts being discussed.

Text displays are not the only means of presenting information to learner. The possibility of using graphics to provide information, as support to the textual information, are also considered. Animation of the text and graphics presented are used to attract user attention. Sound is used to amplify the beginning and ending of each topic or a lesson. It is also used to attract user attention as an alternative to highlighting or animation.

So far we have been discussing how the tutorial is structured into different modules and also other aspects of the tutorial, such as branching mechanisms, presentation of the tutorial, and screen features etc. Next we will attempt to describe logical organization of the tutorial.

4.2 LOGICAL ORGANIZATION OF THE TUTORIAL

Logical organization describes how the different sections of the tutorial content are sequenced in order for the tutorial to achieve its objective. The tutorial is divided into 12 lessons based largely on the functional decomposition of the Micro CDS/ISIS. Micro CDS/ISIS consists of eight services each dealing with a specific function that can be learned independently. Arranging the tutorial based on the eight services, however, results in having long lessons which may be difficult to develop, and also creates problems in implementing

some of the design features discussed in the previous section.

Due to this reason, Database Definition is dealt in four separate lessons, each discussing one of the four steps involved in defining a new database. Database modification is treated in a separate lesson since there are a number of operations involved in it.

Using Micro CDS/ISIS requires some background knowledge of the concept of database, records, fields, etc. Therefore, an introductory lesson is provided to incorporate such prerequisite knowledge in the tutorial. The rest of the tutorial deals with the six Micro CDS/ISIS services, leaving out the Advanced Programming Services which will not be covered by this tutorial. Each of the six services deals with the specific function of the software and are treated in separate lessons. This in turn enables to build relatively independent lessons each dealing with a specific topic.

Once the lessons are identified, the next step may be to define the order of presentation. The tutorial lessons are arranged following the steps that a user may follow in setting up and using a CDS/ISIS database. 'Probably the simplest and most common order of instruction is the order in which the job is performed' (Christopher and Quentin 1983).

However, arranging the lessons in this manner may results in having a sequence which start from the difficult part. Although, in normal situations, it is preferable to have a lesson which proceeds from elementary to complex task. Nevertheless, since the sequence of the tutorial is completely under the control of the learner, he/she can interact with the appropriate section of the tutorial.

Each lesson is organized into topics which enable further segmentation of the tutorial lesson into smaller units. Identification and sequencing of the lessons' topics are based on the stages of instruction (events of instruction) suggested by Gagne et al. (1981) although they may not be followed strictly. As mentioned in chapter three, there are nine events of instruction which support or enhance learning at each stage of the learning process. Since the tutorial is intended as a primary means of instruction, all the nine events of instructions need to be considered as these are important for a tutorial to function as fully contained instructional strategy (Merrill 1986).

Therefore, the first step involves specification of the tutorial content either in the form of topic list or objective. This is essential as it enables to build learner's expectation of the outcome of a particular lesson. Therefore, they need to be stated clearly and in a measurable way. For this, terms describing performance such as locate, select, describe etc., need to be used in specifying objectives as these will facilitate specification of criterion in the form of a test for measuring the achievement of the objectives (Christopher and Quentin 1983).

Next to presenting the learning outcome, the actual presentation of the lesson follows. Short description of the concepts having some relationship with the current topic will be provided. This in turn enables the learner to recall some of the prior learning and to relate it with the present discussion. Then the current topic will be discussed and be elaborated at length which will be followed by different examples which supplement the discussion.

After the discussion, the learner will be made to work on some of the concepts presented previously which require practical exercise. For example, if the discussion were on creation of a field definition table, after the discussion on the FDT and the parameters, the learner will be asked to define a field definition table under the program control.

After presentation and demonstration of the concepts, it is important to assess whether the information presented is actually communicated to the learner and the objective stated for a given lesson has been actually met. This is achieved through the quiz that are provided at the end of each lesson. Responses for each of the questions are kept as simple as possible in order not to delay the learner. Such complex responses as typing long sentences usually delays the learner's progress and may not be convenient for all learners. Feedback is provided in the form of correct answers in case the user fails to provide the correct answer, or references to further reading.

Based on the result of the quiz, the learner will either be requested to repeat the lesson or be presented with summary of the discussion which will basically consist of the restatement of the concepts discussed so far. Such repetition of concepts are useful for reinforcing and also for enhancing retention (Joan et al. 1987).

Examples from real life situation are also presented as a support to the formal discussion to illustrate some of the concepts, e.g. address book is used (due to its familiarity to most users) while discussing databases structure.

So far we have been discussing the design considerations in the context of the whole tutorial. The details of each of the tutorial lesson are not presented here as they form part of the tutorial program which can be run from the .EXE file provided in the accompanying floppy. However, brief descriptions of each of the lessons are provided below.

4.2.1 Lesson 1: Introduction to Micro CDS/ISIS

This is the first lesson of the tutorial. In this section an attempt has been made to build the knowledge which is considered basic to the understanding of subsequent lessons. It consists of ten topics.

i) **Introduction**

The objectives of the lesson are presented in the following manner.

Upon completion of this lesson, you will be able to

1. describe Database Management Systems and Text Retrieval Systems,
2. enumerate the characteristic features of Micro CDS/SIS Software,
3. decribe the concepts of database, records and field (subfields and repeatable fields), and of Micro CDS/ISIS database.
4. run Micro CDS/ISIS and exit from it,
5. identify the major components of Micro CDS/ISIS software,
6. enumerate the steps involved in defining a database.

ii) **Database Management System**

The user is presented with the concepts of Database Management System and Text Retrieval Systems, their difference and similarities in a very simplified form. The concept of database is also discussed by citing examples of address book and library card catalogue.

iii) **Micro CDS/ISIS Software**

In light of the above discussion, the features of the Micro CDS/ISIS software in most general terms have been discussed in this section. It is intended to provide a general idea of the category to which the Micro CDS/ISIS software belongs.

iv) **Micro CDS/ISIS Database**

An attempt is made to provide detailed description of the concept of Database, Records, and Fields in this section since they are frequently encountered by the learner in subsequent discussion.

v) **Micro CDS/ISIS Database Files**

Micro CDS/ISIS database consists of a number of files which may be confusing for beginners. This section provides a brief description of the different files that constitute a Micro CDS/ISIS database.

vi) **Running Micro CDS/ISIS Software**

Describes the steps needed to run the Micro CDS/ISIS.

vii) **Major Components**

Description of the major components such as Menus, Tools, and Techniques of the software is provided in this section.

viii) **Major Functions**

Description of the Micro CDS/ISIS main menu and of the major functions that one can perform using the software is provided in this section.

ix) **Steps in Defining a Database**

This section enumerates the steps which are to be followed in defining a database. This in turn provides a link with the subsequent lessons.

x) **Exiting from Micro CDS/ISIS**

It provides the steps required to exit from the Micro CDS/ISIS Software, and also indicates the end of the first lesson.

4.2.2 Lesson 2: Creation of Field Definition Table (FDT)

This lesson attempts to provide the learner with the necessary knowledge which would enable him/her to define a Field Definition Table. It consists of four topics,i.e

i) **Introduction**

This section provides the objectives of the lesson as follows.

Upon completion of this lesson, you will be able to

1. describe the Database Definition Services Menu.
2. describe the Field Definition Table parameters.
3. create entries in the field definition table using the Line Editor.
4. modify the entries in the field definition table.
5. save the Field Definition Table and Exit from the Line Editor.

This section also enumerates the steps involved in defining a new database.

ii) **Database Definition Services Menu**

A description of the database definition menu is provided which the user will encounter while defining a database.

iii) **Field Definition Table Parameters**

In this section, the learner will be presented with the detailed description of the parameters which will be defined in the Field Definition Table. This in turn lays the ground for the next topic.

iv) **Creating Field Definition Table**

This section enables the learner to have hands-on exercise in creating Field Definition Table. The learner is guided through the steps in creating a Field Definition Table. Creation of the FDT requires the knowledge of line editor commands; hence, line editor commands are described before the demonstration.

4.2.3 Lesson 3: **Data Entry Worksheet**

Data Entry Worksheet is an on-screen form used to create and/or update database records. This lesson introduces the learner to the Data Entry Worksheet, and shows how to create a new Data Entry Worksheet. It consists of three topics.

i) Introduction

This introductory topic presents the objective of the lesson as shown below.

Upon completion of this lesson, you will be able,

1. describe a data entry worksheet.
2. enumerate the steps involved in defining a field in a worksheet.
3. describe the worksheet editor commands.
4. create a data entry worksheet.

The steps required in defining a database are also enumerated in this section thereby creating a link with previous and subsequent lessons.

ii) **Data Entry Worksheet**

Under this topic, a description of the Data Entry Worksheet is provided using a sample data entry worksheet. Description of the system worksheet, and its similarity and difference with data entry worksheet is also provided in this section.

i) Introduction

This introductory topic presents the objective of the lesson as shown below.

Upon completion of this lesson, you will be able,

1. describe a data entry worksheet.
2. enumerate the steps involved in defining a field in a worksheet.
3. describe the worksheet editor commands.
4. create a data entry worksheet.

The steps required in defining a database are also enumerated in this section thereby creating a link with previous and subsequent lessons.

ii) **Data Entry Worksheet**

Under this topic, a description of the Data Entry Worksheet is provided using a sample data entry worksheet. Description of the system worksheet, and its similarity and difference with data entry worksheet is also provided in this section.

iii) **Creating the Data Entry Worksheet**

Data entry worksheets are created using worksheet editor. Hence, the worksheet editor is first discussed in detail. Then the steps involved in creating a worksheet along with their description are presented while describing the worksheet editor. Next, the learner is guided through the different steps involved in creating a Data Entry Worksheet.

4.2.4 Lesson 4: Display Format

In this lesson, the learner will be introduced to the formatting language commands, and to the technique of creating a display format which is used for online display of records or for printing on paper. It consists of three topics.

i) **Introduction**

This introductory topic presents the learner with the objective of the lesson as follows.

Upon completion of this lesson, you will be able to

1. describe the formatting language commands,
2. create display format,
3. describe field editor.

The steps involved in defining a new database, followed by the description of the different kinds of formats, are also presented in this section.

ii) **Formatting Language**

This topic explains each of the formatting language commands. Examples are also provided to illustrate the use of most of the commands.

iii) Creating Display Format

Using the formatting language commands, discussed in the previous sections, the learner is allowed to create a display format under the program control. Here the learner is presented with the required display output and will be guided through the steps involved to achieve the required display.

Creation of the display formats involves the use of the field editor. Therefore, a brief description of the field editor is also provided in this section. While creating the display format, the learner will be made to practice some of the features of the field editor such as cut and paste.

4.2.5 Lesson 5: Field Select Table

This lesson introduces the learner to a Field Select Table, and explains the techniques of defining it. It consists of three topics.

i) **Introduction**

This introductory topic presents the learner with the objective of the lesson as shown below.

Upon completion of this lesson, you will able to

1. describe the Field Select Table Parameters.
2. create entries in the Field Select Table using the Line Editor.
3. modify the entries in the Field Select table.
4. be able to Save the Field Select Table and Exit Line Editor.

The steps involved in defining a new database is also presented in this section.

ii) **Field Select Table Parameters**

In this section, the learner will be presented with the detailed description of the parameters which will be defined in the Field Select Table.

iii) Creating Field Select Table

This section explains how to create a Field Select Table. The learner is guided through the steps in creating a Field Select Table. Creation of the Field Select Table requires the knowledge of Line Editor commands. But the same line editor commands are used to create Field Definition Table and Field Select Table. Hence,

instead of repeating the detailed description of the Line Editor commands, an option will be made available to the learner which, upon selection, provides detailed description of the Line Editor.

4.2.6 **Lesson 6: Modify Database Definition**

Once the user has defined a database, he/she is mostly involved in modifying the database definition. This section provides instruction on how to modify an already existing database. It consists of six topics.

i) Introduction

The introductory part presents the objective of the lesson as shown below.

Upon completion of this lesson, you will be able to

1. describe option U of the Database Definition Menu,
2. modify the field definition table, worksheet, display formats and field select table of an existing database,
3. create additional worksheet, display formats and field select table,
4. make a copy of the worksheets, display formats and field select table,
5. delete worksheets, display formats and field select table which are no longer needed,
6. list the database parameters files.

v) **Modify the Field Select Table**

This section explains how the learner will be able to

- create additional Field Select Table;
- update an already existing Field Select Table;
- make a copy of an already existing Field Select Table; and
- delete Field Select Tables which are no longer needed.

vi) **List Database Parameter Files**

This section provides detailed description of option K which enables to list the worksheets, display formats, field select tables defined for the selected database.

4.2.7 Lesson 7: Data Entry Operation

After defining a database and before retrieval can take place, data must be entered into the database. This section explains how to create and/or modify database records. It consists of five topics.

i) **Introduction**

The learner is presented with the objective of the lesson as shown below.

Upon completion of this lesson, you will be able to

1. describe Data Entry Services Menu
2. create new records
3. modify existing records
4. define default values

ii) **Data Entry Services Menu**

Brief description of the different options of Data Entry Services Menu will be provided in this section.

iii) **Creating Record(s)**

This section explains how to create a new record, and guides the learner through the different steps of record creation by taking an example. During the discussion, some of the points, which need consideration, during data entry are also discussed.

iv) **Modify Record(s)**

This topic explains how to edit or delete an existing record and also how to restore a deleted record, and illustrates this using records created in the previous section (ii).

v) **Define Default Values**

This section explains how to define a default value.

4.2.8 Lesson 8: Inverted File Generation

This lesson provides instruction on how to create Inverted File. It consists of five topics.

i) **Introduction**

The introductory topic provides the learner with the objective of the lesson and provides general description of an inverted file. Here the back of a book index has been used to illustrate the concept of an inverted file as supplement to the discussion. The objective of the lesson is presented as follows.

Upon completion of this lesson, you will be able to

1. describe inverted file service menu
2. explain the inverted file
3. describe the steps involved in full inverted file generation
4. update inverted file
5. perform backup and restore operation on inverted file

ii) **Inverted File Services Menu**

The Inverted File Services menu will be described briefly in this section.

iii) **Full Inverted File Generation**

This section explains the process of Full Inverted File Generation and the three steps involved in it. The discussion is supplemented with an illustration of the Full Inverted File Generation using sample database records.

iv) **Update Inverted File**

Describes Update inverted file option and illustrates it on a sample record.

v) **Backup and Restore Inverted File**

Describes inverted file Backup and Restore operations.

4.2.9 **Lesson 9: Information Retrieval**

This lesson provides a detail description of the Micro CDS/ISIS Information Retrieval Facilities, and also teaches the learner the skills required in formulating search expressions. It consists of five topics.

i) **Introduction**

The learner is presented with the objective of the lesson as shown below.

Upon completion of this lesson, you will be able to

1) describe the information retrieval services menu

2) describe indexed search

3) formulate search expressions

4) perform free text searches

ii) **Information Retrieval Services Menu.**

Provides description of the different options of Information Retrieval Menu.

iii) **Indexed Search**

Description of search terms and operators are provided in this section. The learner will be asked to perform simple searches under the program control.

iv) **Formulating Search Expressions**

Continuing from the previous section the learner will be guided to formulate complex search expressions.

v) **Free Text Search**

Explains how to perform free text searches and illustrates the discussion using an example.

4.2.10 **Lesson 10: Sorting and Printing**

Sorting and Printing services of the Micro CDS/ISIS software enables to obtain printed output of the database records. This section explains how to sort and print database records. It consists of five topics.

i) **Introduction**

The introductory topic provides the learner with the objective of the lesson.

Upon completion of the lesson, you will be able to

1. describe Sorting and Printing Services Menu
2. describe print worksheet parameters
3. describe sorting worksheet parameters
4. perform sorting and printing

ii) **Sorting and Printing Services Menu**

Brief description of the different option of Sorting and Printing Services will be provided in this section.

iii) **Print Worksheet Parameters**

This section provides detailed description of the Print worksheet and its parameters.

iv) **Sorting Worksheet Parameters**

This section provides detailed description of the Sort worksheet and its parameters.

v) **Sorting and Printing**

The learner is presented with the required print output and will be guided through the steps involved to achieve the required print.

4.2.11 Lesson 11: **Master File Services**

This section provides brief description of the Master File Services of Micro CDS/ISIS Software. It consists of five topics.

i). Introduction

This section presents the objective of the lesson as follows.

Upon completion of this lesson, you will be able to,

1. describe Master File Services Menu
2. describe Master File Backup and Restore operations
3. describe the Import and Export worksheets parameters
4. describe the Import and Export operations

ii) **Master File Services Menu**

The Master File Services Menu will be described briefly in this section.

iii) **Backup and Restore Operations**

In this section, Micro CDS/ISIS Master file Backup and Restore operation will be discussed in detail.

iv) **Import and Export operation**

Brief description of the Import and Export worksheets will be presents, and the corresponding parameters will be provided in this section. This is followed by illustration of the Import and Export operations using sample records.

4.2.12 Lesson 12: System Utility Services

System menus and worksheets may be created and/or modified using System Utility Services. This lesson provides detailed description of System Utility Services. It consists of four topics.

i) **Introduction**

The introductory topic provides the learner with the objective of the lesson and provides general description of System Menus and Worksheets. The objective is presented as shown below.

Upon completion of the lesson, you will be able to

1. describe System Utility Services Menu
2. describe System Worksheets Editing options
3. describe System Menus Editing options
4. describe the steps involved in creating System worksheet and Menus
5. print system worksheets, menus and system messages
6. describe Menu Editor commands

ii) System Utility Services Menu

The System Utility Services Menu will be described briefly in this section.

iii) **Create System Worksheet**

This section provides detailed description of the System Worksheets Editing options and also enumerates the steps involved in creating a System worksheet. Creation of the System worksheets requires the knowledge of Worksheet Editor commands. The same Worksheet Editor commands are used to create Data Entry Worksheets as well as System Worksheets. Hence, instead of providing the detailed explanation of the worksheet editor commands, an option will be made available to the learner which, upon selection, provides detailed description of the Worksheet Editor.

iv) **Create System Menu**

Under this topic, detailed description of the System Menus Editing options is provided. Then, brief description of the Menu editor commands will be provided since creation of the System Menus requires the knowledge of Menu Editor commands.

Upon completion of each of the above lesson, the learner will be presented with a quiz consisting of a set of questions which enables to evaluate the learner's understanding of the lesson. Then the learner will be prompted to repeat the lesson or to go through the summary of the lesson.

In general, the tutorial lessons are prepared as described above. The tutorial may not cover all the aspects of the Micro CDS/ISIS Software. Where appropriate the learner will be referred to the appropriate section in the Mini-Micro CDS/ISIS reference manual version 2.3.

CHAPTER 5

IMPLEMENTATION AND DEMONSTRATION

5.1 IMPLEMENTATION

The tutorial is developed using Turbo Vision (version 2.0) which is an application frame work for windowing programs. The tutorial has been developed under MSDOS operating system. It is tested on a 640 kb memory IBM compatible Tandon PC and found to run successfully.

The tutorial program consists of one Main program and four resource files which store different object and data required by the main program.

The tutorial program can be run from floppy or hard disk. Implementation of the tutorial may be achieved by copying the four files in the required drive and directory using DOS copy Command. If one wants to install the tutorial in the directory where Micro CDS/ISIS is installed, the following commands are to be issued at the DOS prompt.

Assuming that Micro CDS/ISIS is installed in C:\ISIS07

Type

A:\copy CDSTUTOR.EXE C:\ISIS07

A:\copy *.TVR C:\ISIS07

To start the Tutorial, user has to change to the directory where the CDSTUTOR file is located and then, the following command is to be issued.

CDSTUTOR followed by <CR>.

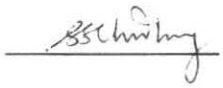
DECLARATION

The thesis is my original work and has not been presented for a degree in any other university.

Sisay Fissaha

May 24, 1995

The thesis has been submitted for examination with our approval as university advisors.



Dr. G. G. Chowdhury

Advisor

May 24, 1995

Ato Nega Alemayehu

Advisor

May 24, 1995

5.2 DEMONSTRATION

As mentioned in chapter one, this tutorial is tailored more towards novice users than experienced ones. Hence, ease of access to the tutorial lessons has been given much attention in developing the tutorial program and attempt has been made to provide adequate instructions to the user.

When one starts the tutorial by typing at the DOS prompt CDSTUTOR followed by <CR>, the welcoming window will be animated at the centre of the screen, where it will stay for some time and then will go off.

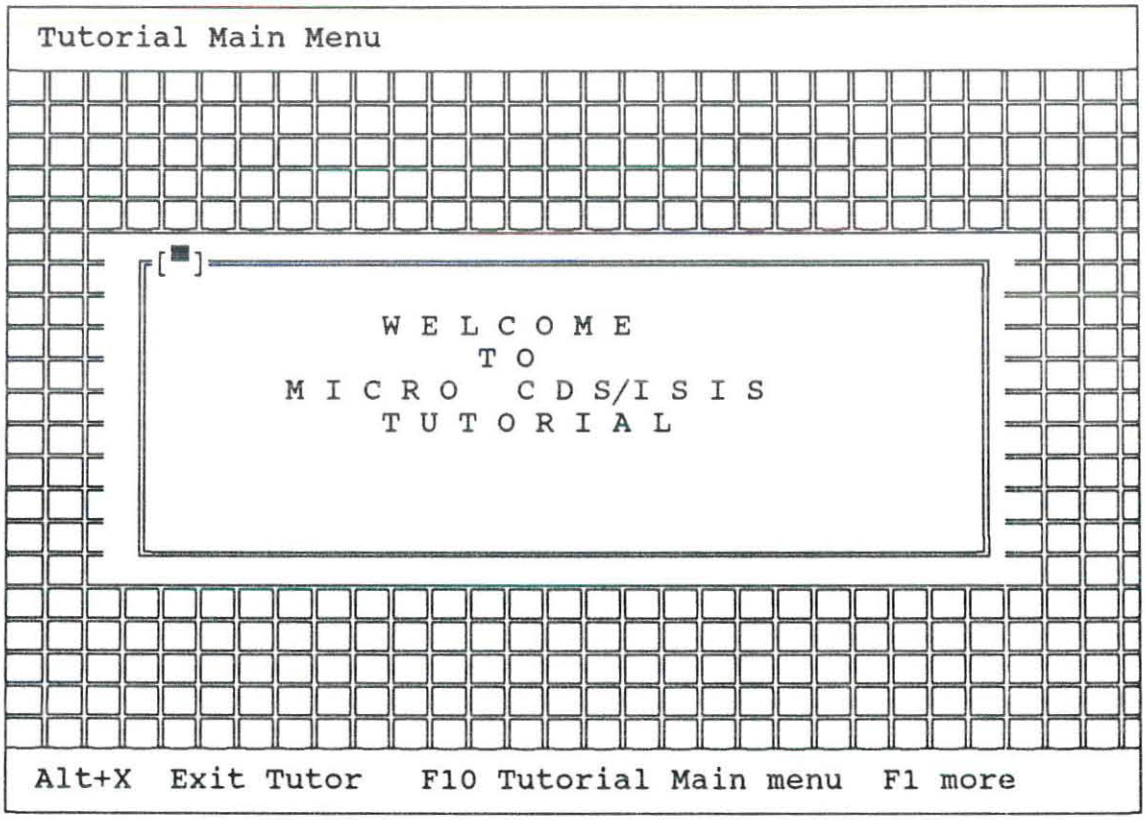


Figure 5.1 WelComing Screen.

After the welcoming screen, another window comes displaying the following message for new users.

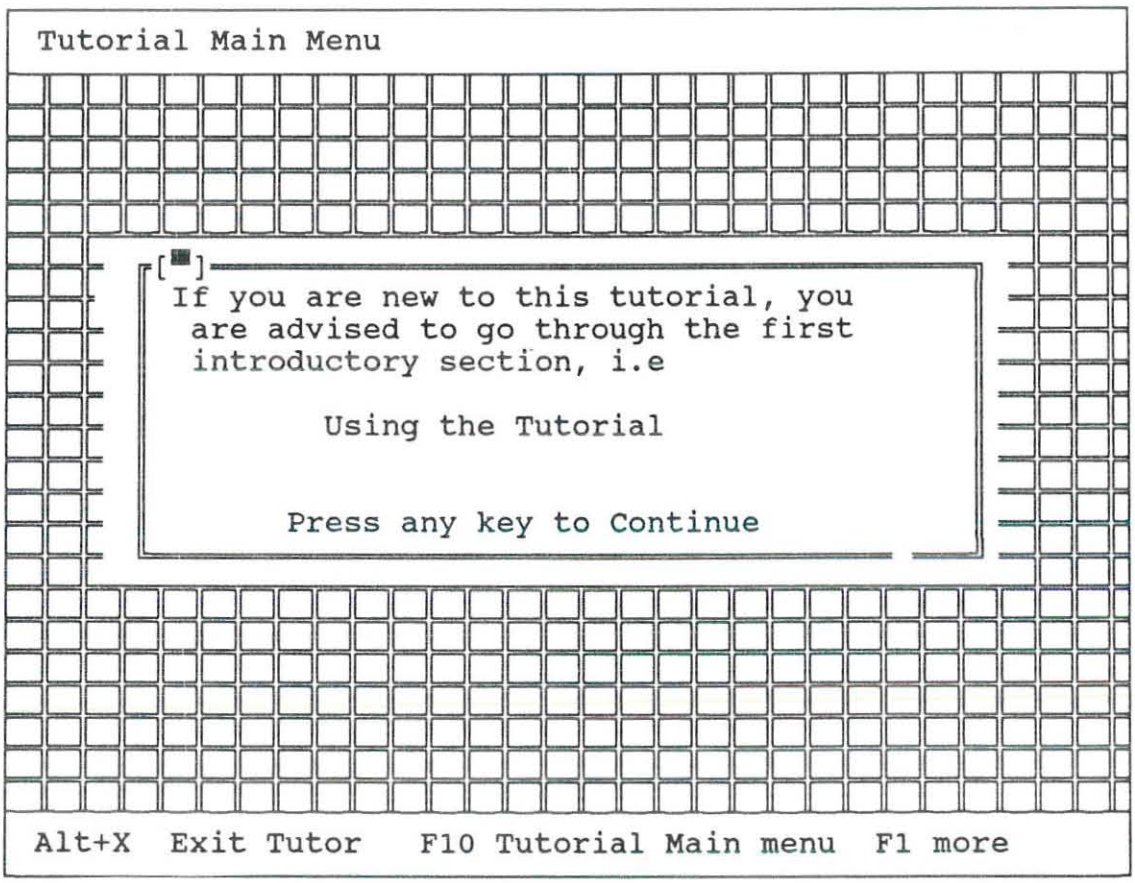


Figure 5.2 Message for Beginning User

USING THE TUTORIAL Topic is useful specially if the user is new to the tutorial. This provides guidance on how to deal with the buttons available throughout the tutorial. The learner can close this screen by pressing any key.

Then, the tutorial displays the main menu and waits for the learner's input.

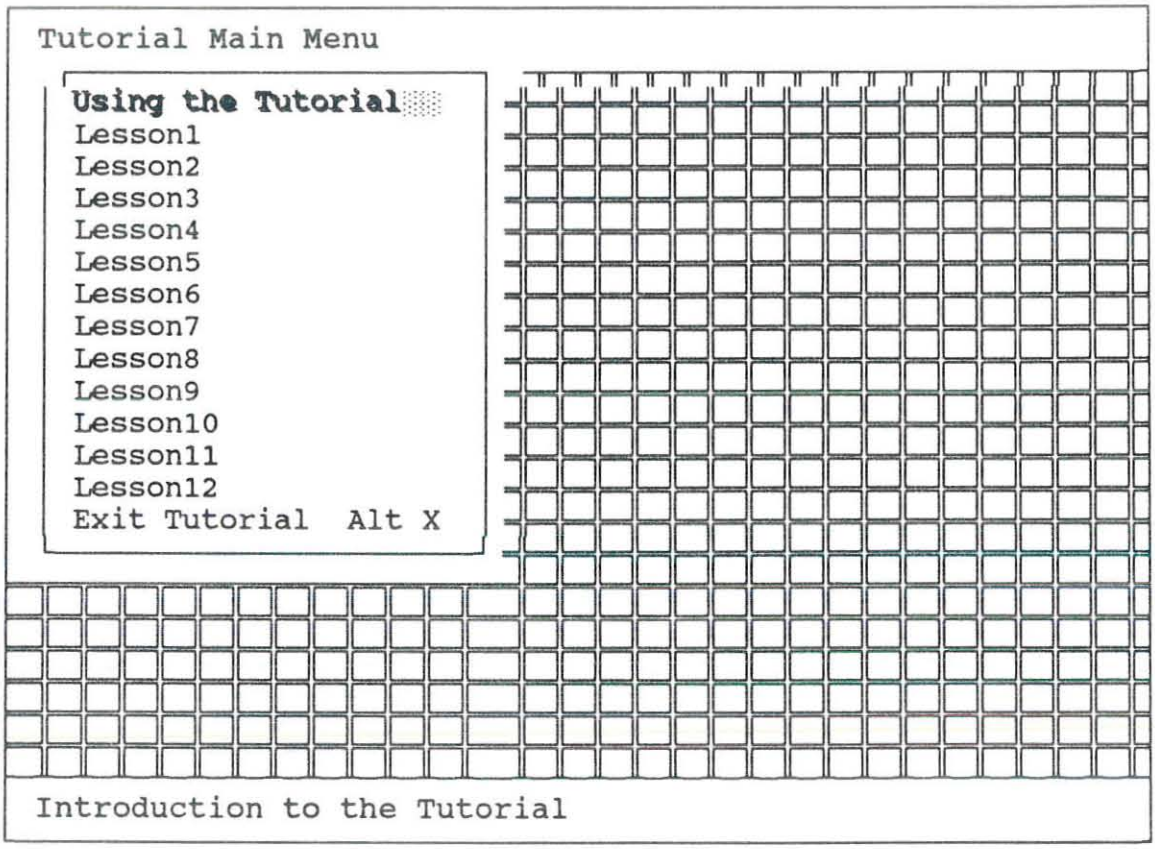


Figure 5.3 Tutorial Main Menu

This is the background screen of the tutorial. It is divided into three major parts MENU BAR, DESKTOP, AND STATUS LINE. The MENU BAR contains the phrase 'Tutorial Main Menu' and is located on the top left of the screen.

The learner can choose an option by highlighting the option and pressing <ENTER> or selecting the highlighted character of the menu option. Each of the lessons in the main menu opens up a submenu listing the available topics under each lesson. The learner can start the tutorial lessons by choosing any of the topics.

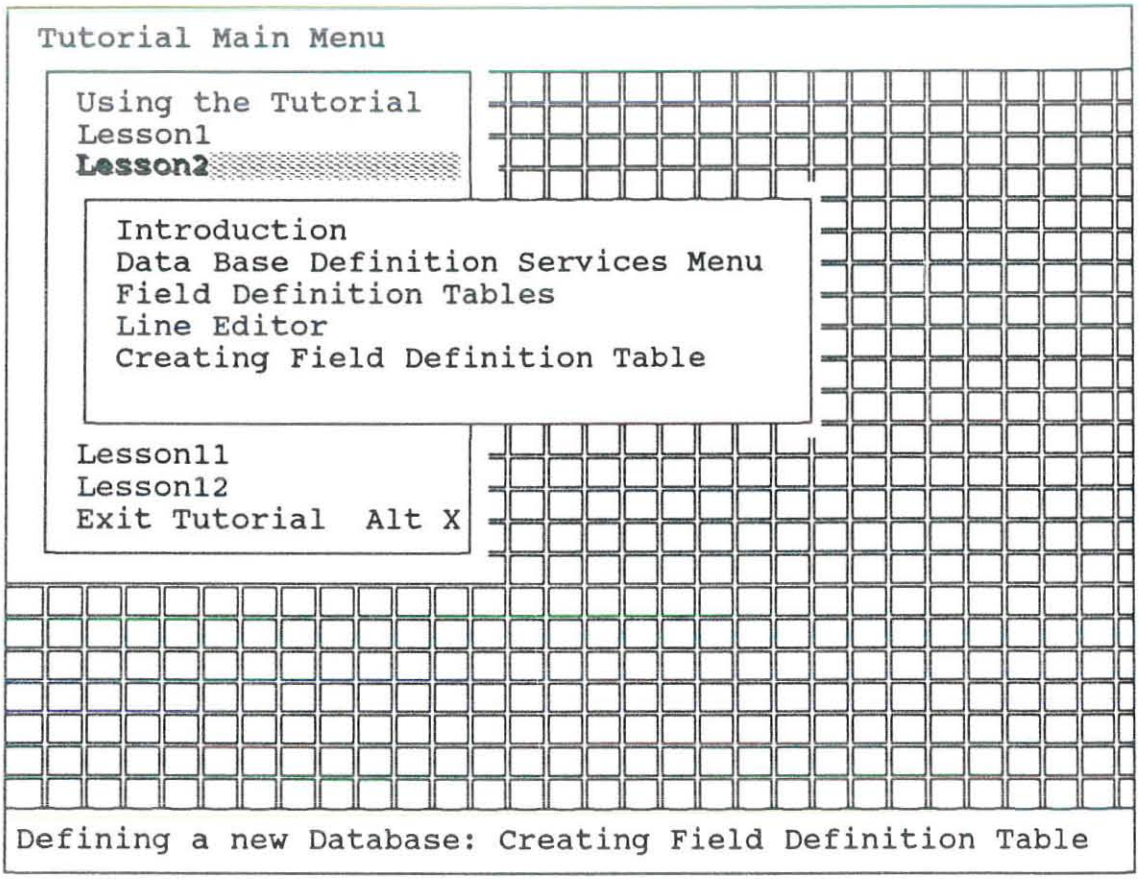


Figure 5.4 Lesson Topics

The STATUS LINE is displayed at the bottom of the screen and is used to show available hot keys such as, Alt + X for quitting the tutorial, F10 to go to the Tutorial main menu (equivalent to the cancel button on the dialog box), and F1 to display additional information (equivalent to the MORE button in the dialog box) and other helpful messages. The STATUS LINE also displays the title of the currently highlighted lesson option on the tutorial menu, and continuously changes its status as the user navigates through the menu options.

Another screen element is that of the DESKTOP which fills the screen area not occupied by the menu bar and the status line. It has blue color on a color monitor. It is on the desktop that all the teaching views such as, WINDOWS, DIALOG BOXES, MESSAGE BOXES, etc are displayed and animated.

The Turbo Vision DIALOG BOXES, MESSAGE BOXES, WINDOWS are the views which are used for the actual delivery of the tutorial lesson. In the majority of the tutorial session dialog boxes are used for delivery of the tutorial lesson due to their suitability. The dialog box normally contains the actual information to be delivered and one or more of the following buttons, CONTINUE, CANCEL, or MORE.

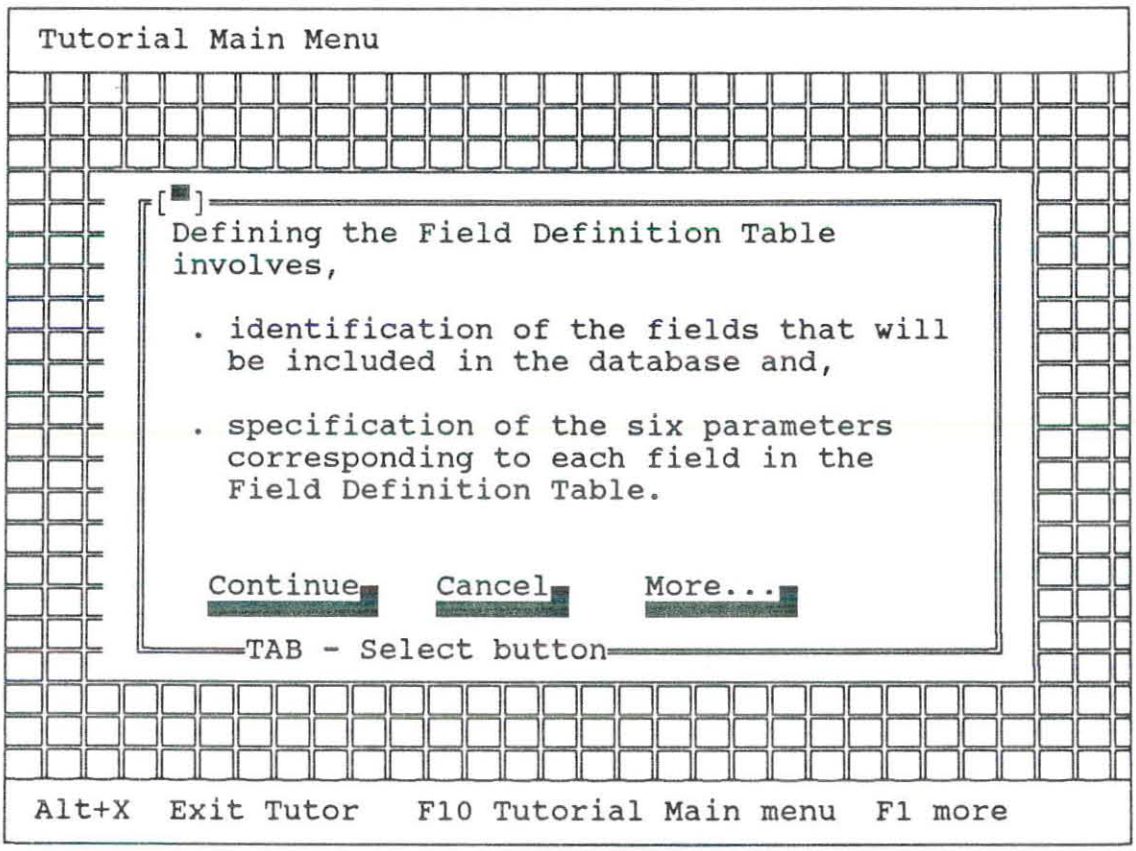


Figure 5.5 Control Buttons

The CONTINUE button is the default button and is always highlighted. It is used to proceed to the next display.

The CANCEL button terminates the lesson and returns the learner back to the desktop. Then, the learner can select another lesson or exit the tutorial. This allows the learner to close topics if he/she wishes to discontinue. This in turn enables the learner to sequence the order of presentation of the tutorial lesson in his/her own needs and capability.

The MORE button enables the learner to get additional information on the current topic under discussion. When the user selects this button a window will be displayed on the top of the current display containing the information. The window may contain an elaboration on the current discussion or information on the related concept. The keywords on the related concepts, if there are any, are highlighted and if the user chooses them, he/she can get more information on those topics.

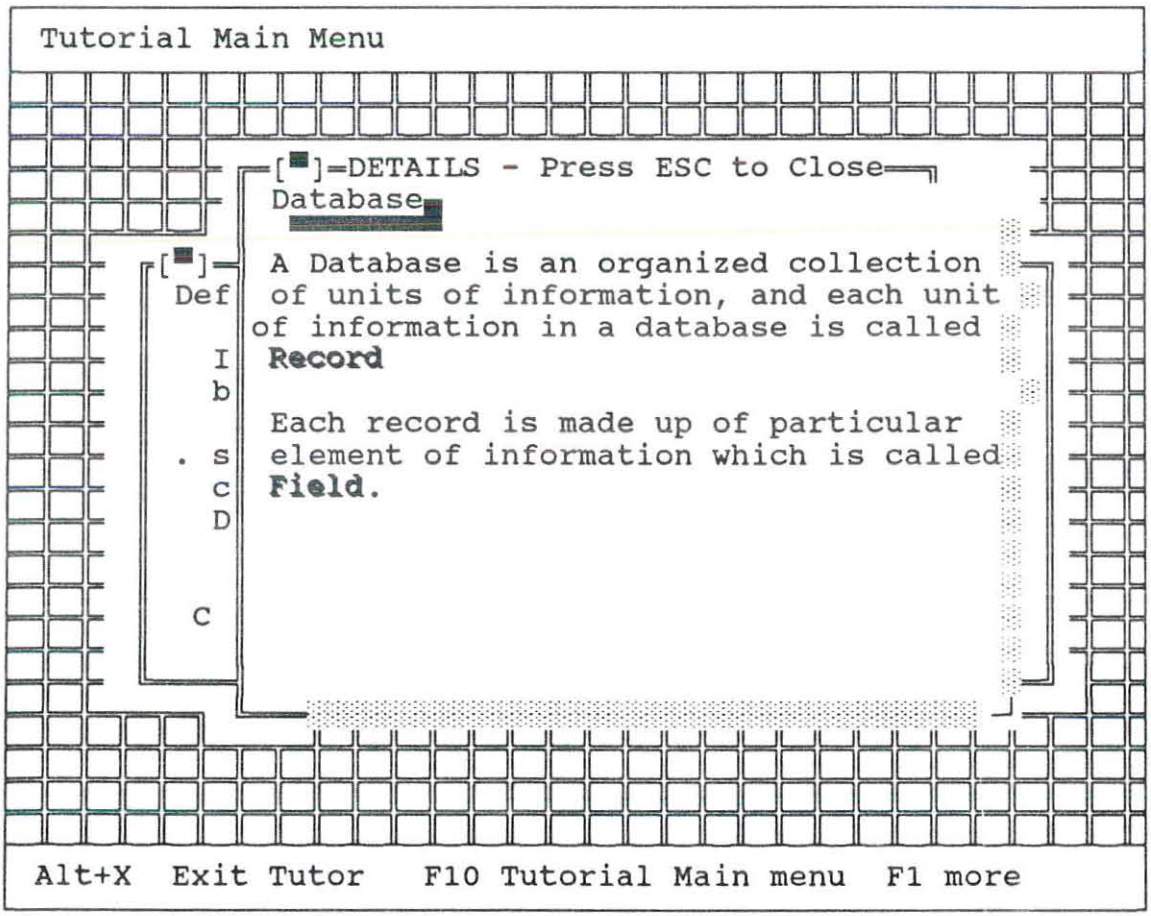


Figure 5.6 More Window

Each of the dialog boxes display the different sections of the tutorial content. Their order of presentation is based on the organization of the tutorial content.

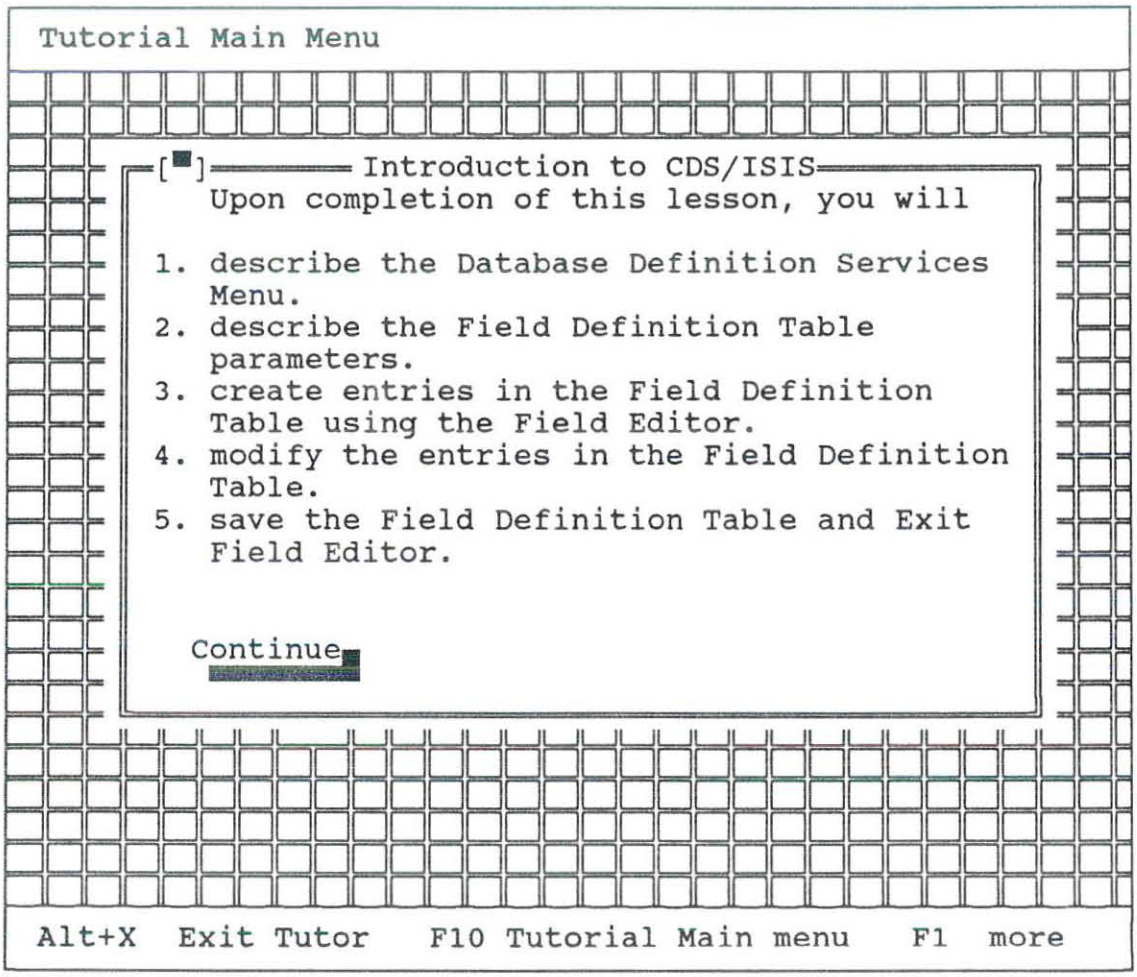


Figure 5.8 Objective Window

After the objective dialog box, there comes a series of screen displays which are used to delivering the actual content of the lessons. During presentation of the lesson, different techniques had been adopted to convey the information. The first consideration was limiting the amount of information that will be displayed at any time. This is achieved through the availability of the <More> button which enables to display the detailed information only if the user requires it. This in turn enables to display only short description of the concepts being discussed. In addition, other techniques such as highlighting and animation of the text and dialog boxes are used to attract attention. Presentation of the information is accompanied by demonstration of the concepts being discussed.

The following sample screen is among the series of screen displays that demonstrate how to create FDT.

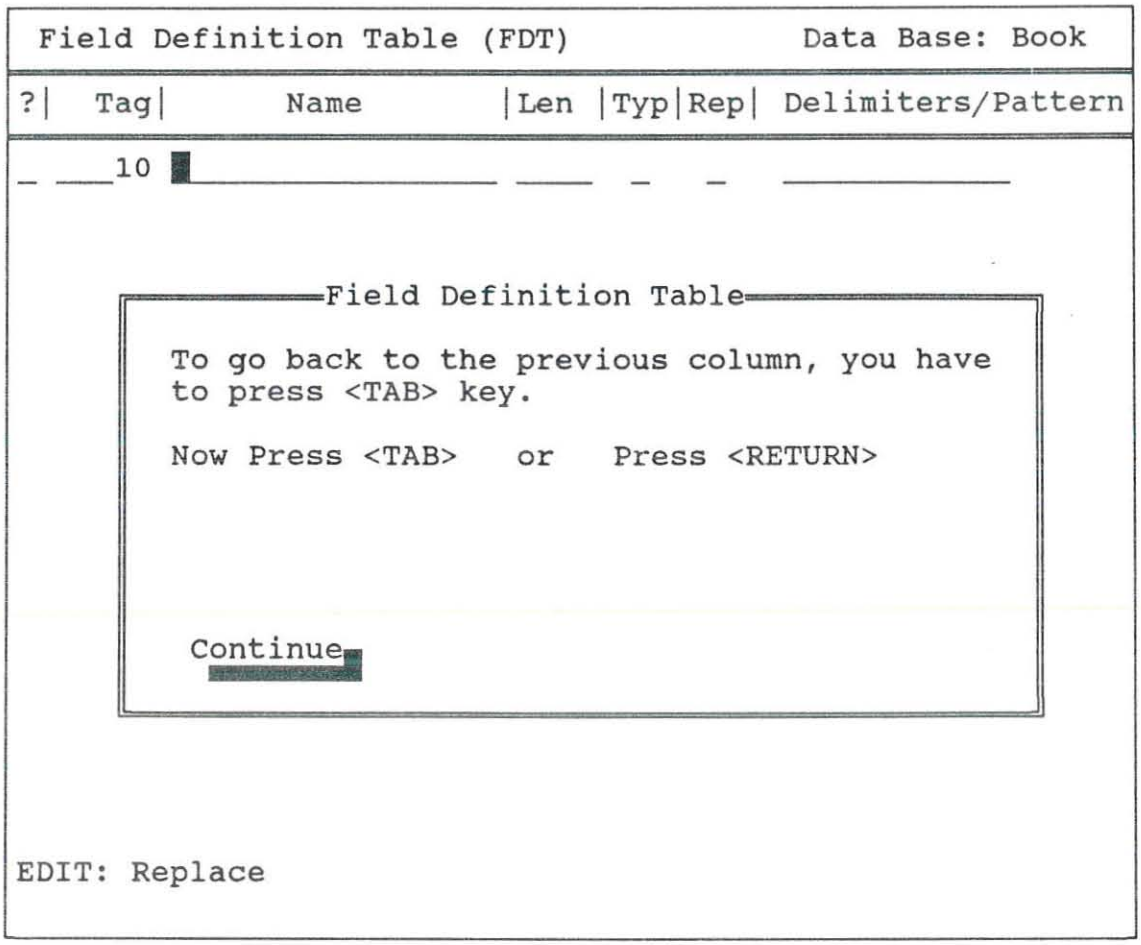


Figure 5.9 Sample Demonstration Screen for the FDT.

In demonstrating the concepts, an attempt has been made to simulate the software as much as possible so that the learner will not have any difficulty of demonstrating what he has learned in using the CDS/ISIS.

The demonstration is followed by the quiz which enables to test whether the information presented is actually communicated to the learner.

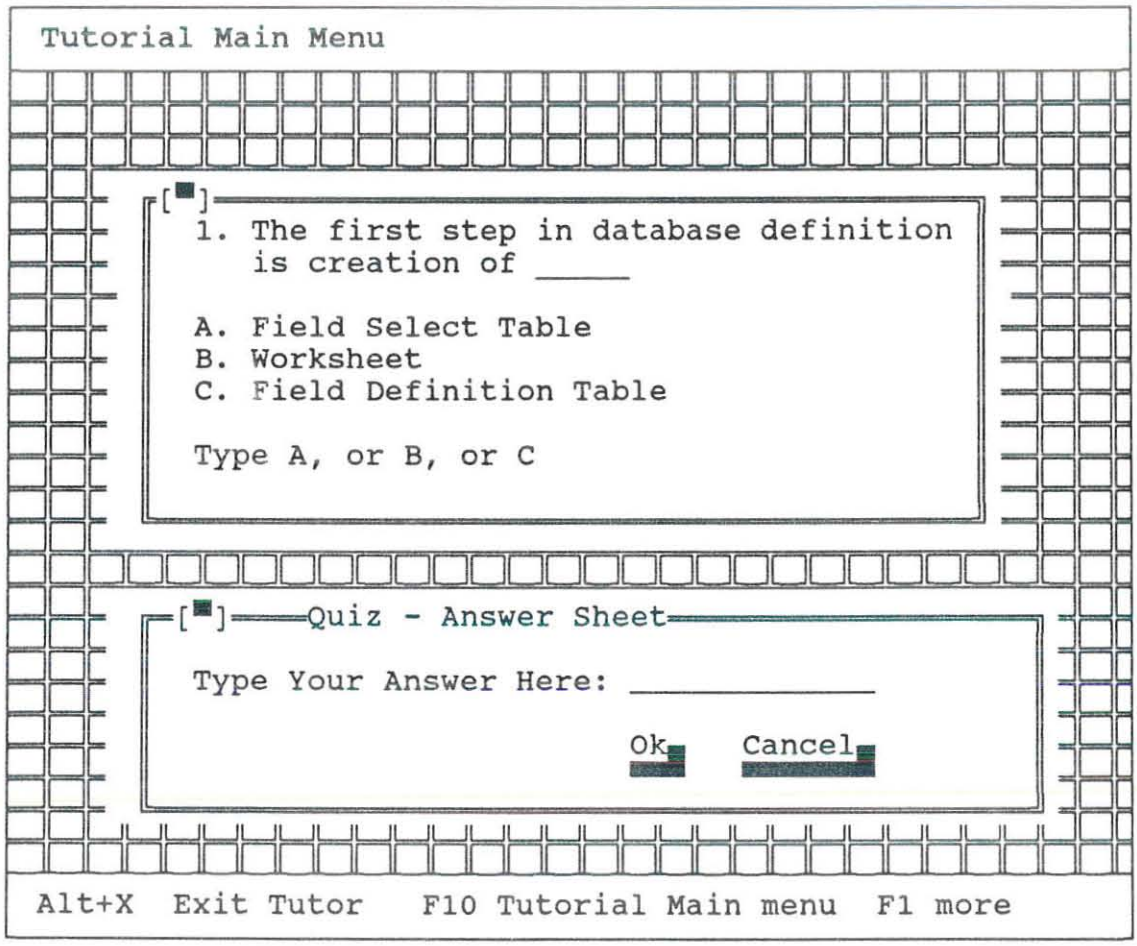


Figure 10. Sample Quiz

When the learner terminates the lesson, he/she will be prompted to view the summary.

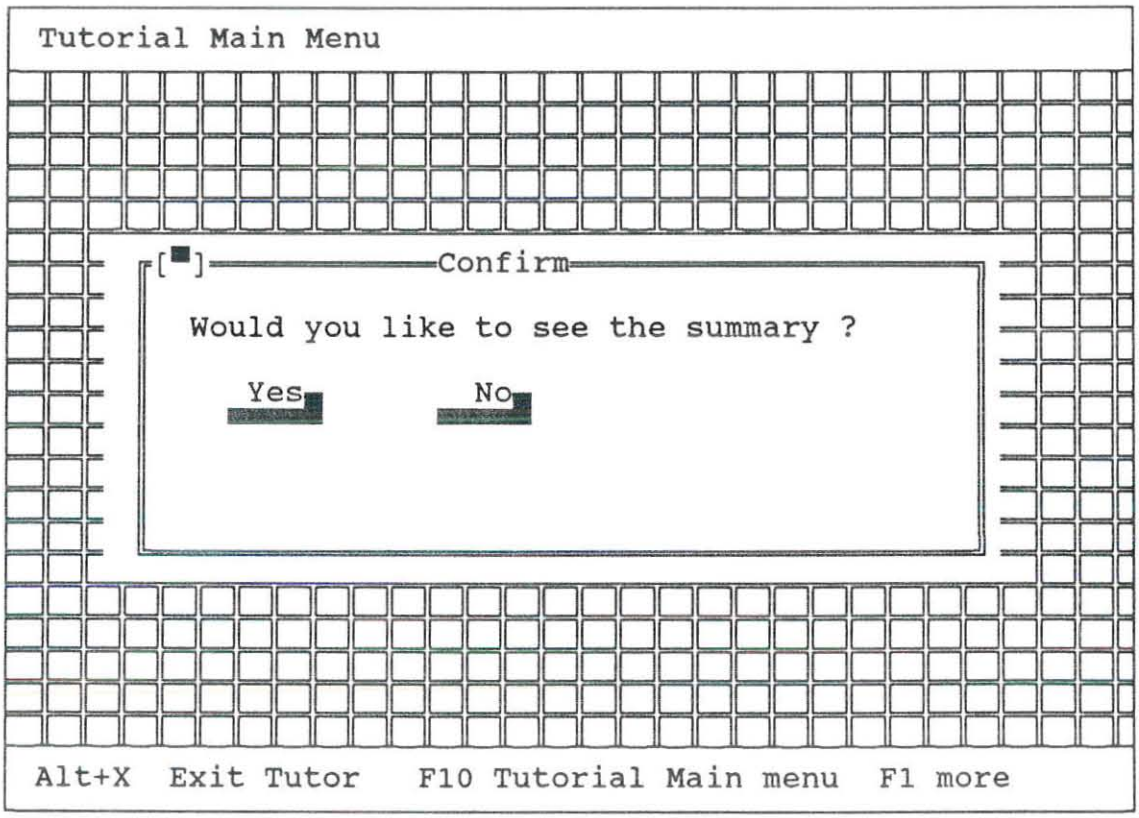


Figure 11 Request for display of a Summary

If the learner replies yes, a short summary of the lesson will be provided.

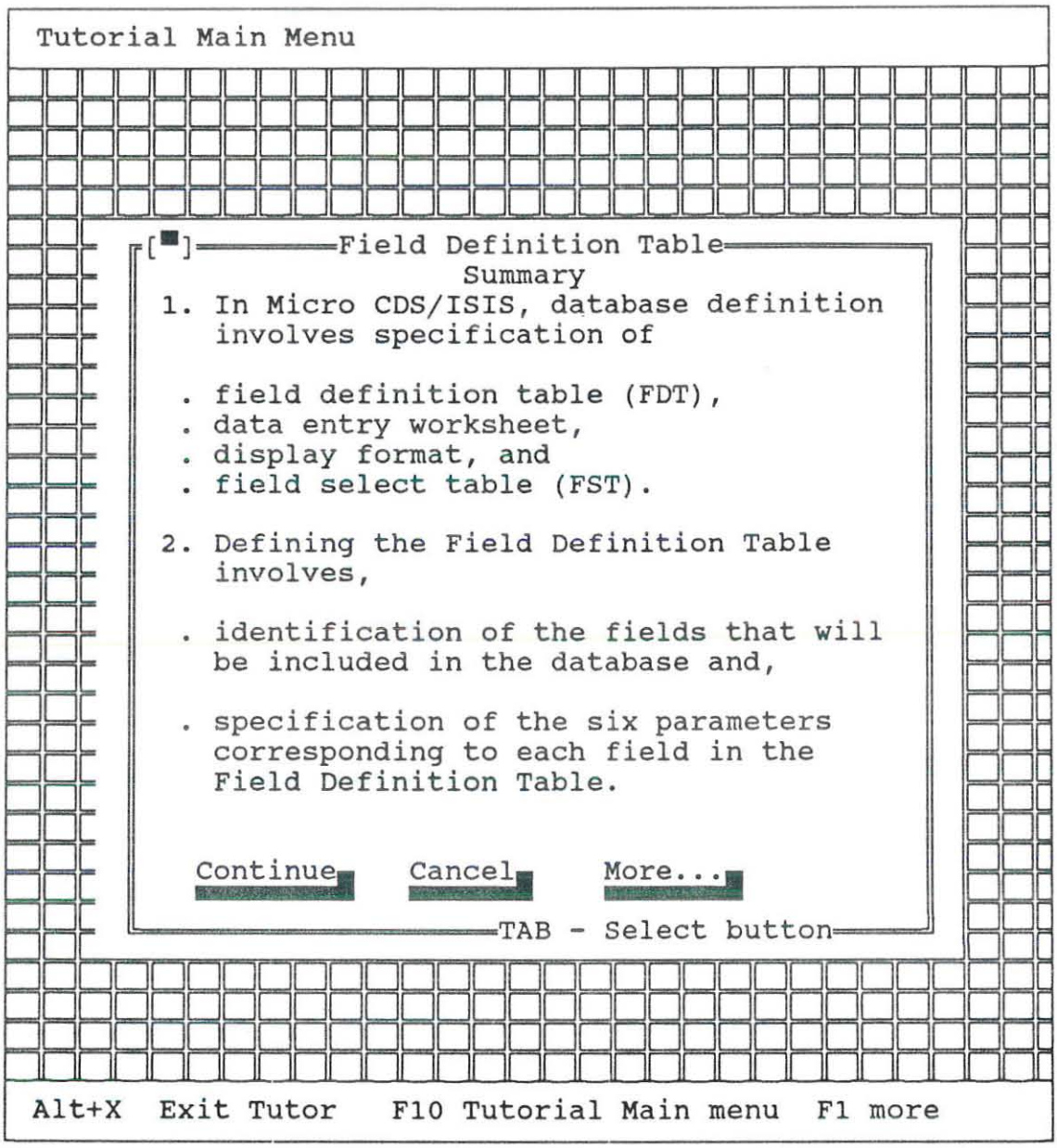


Figure 5.12 Summary

After the summary, the learner will be given the choice to repeat the lesson. The same sequence of instructions can be repeated as much as the learner requires it.

Upon completion of the lesson, the learner can terminate the tutorial session by pressing Alt+X key.

5.3 PROGRAM DOCUMENTATION

Turbo Vision provides a hierarchy of objects that one can use to develop applications. Among the different objects in hierarchy, the following are used to develop the application.

TAPPLICATION is one among the hierarchy of objects of Turbo Vision which is extended and used for developing the tutorial program. It provides the skeleton for developing application; hence, it has been taken as the starting point in developing the tutorial.

```
PCDSISIS = ^TCDSISIS;
TCDSISIS = object(TAPPLICATION)
 constructor init;
 procedure InitStatusLine; virtual;
 procedure Initmenubar; virtual;
 procedure ReInitStatusLine(k:byte); virtual;
 procedure ReInitmenubar(l:byte); virtual;
 procedure HandleEvent(var Event: TEvent); virtual;
 procedure InitDesktop; virtual;
 Procedure Lesson1(topic: word);
 Procedure Lesson2(topic: word);
 Procedure Introduction;
 procedure Outofmemory; virtual;
 destructor done; virtual;
 procedure GetEvent(var Event: TEvent); virtual;
 function  GetPalette: PPalette; virtual;
 Procedure display1(s: string; k,m: word);
 Procedure display2(s: string; k,m,l: word);
 Procedure display3(s: string; m: word);
 procedure display4(s: string; k,m,l: word);
 Procedure Activmenu;
 Procedure rmv;
 Procedure add;
 Procedure GetMnu(Mnuname:string);
 Procedure Frondor;
end;
```

As a starting point, the TAPPLICATION object provides a MENU BAR, a shaded DESKTOP and a blank STATUS LINE at the bottom that indicates the availability of the Alt+X key to exit the program. It provides the methods, InitStatusLine, InitMenuBar, and InitDeskTop for

creating and inserting the three objects, i.e, TMENUBAR, TDESKTOP AND TSTATUSLINE. Using these methods it is extended to have the current look. Furthermore, the TAPPLICATION methods, Init (Constructor), HandleEvent, Done, GetEvent, and GetPalette are modified to provide for proper, initialization, handling of learner input, closure of the tutorial application, handling special keystroks and screen colors respectively.

In addition to the above, various methods has been added to it such as, Lesson1, Lesson2,... corresponding to Lesson 1, Lesson 2, ... of the tutorial, display1..display4, ... etc which are relevant to the tutorial.

The TDESKTOP and TBACKGROUND object has been modified to provide for the current background display.

```
PCDSBACK = ^TCDSBACK;
 TCDSBACK = object(TBACKGROUND)
  Text: TTitleStr;
  constructor Init(var Bounds: TRect; AText: TTitleStr);
  procedure Draw; virtual;
  function Getpalette: Ppalette; virtual;
 end;

 PcdsDesktop = ^TcdsDesktop;
 tcdsdesktop = object(TDesktop)
  procedure InitBackground; virtual;
 end;
```

TDIALOG, and TWINDOW are other group of objects, like TAPPLICATION object which has been extended to control the tutorial dialog. The tutorial communicates with the learner through the different windows or dialog boxes, which appear and disappear on the desktop with respect to the commands issued by the learner. The TDIALOG object has been extended by modifying its methods for, proper initialization of the dialog box, handling learner input, storing and loading the dialog box from resource file, and by introducing additional method

which controls the display of information on dialog box and also insertion of control buttons.

```
Cdswin = ^TCdswin;
TCdswin = object(TDialog)
  lins:byte;
  numbut:byte;
  buttrec: tstr;
  constructor Init(var Bounds: TRect; ATitle: TTitleStr; atextstr:ttextstr; j:byte; but:tstr;
  i:byte);
  Procedure HandleEvent(var event: tevent);virtual;
  Procedure addbut(but: tstr);
  procedure store(var s: Tstream);
  constructor load(var s: Tstream);
end;

KCdswin = ^TKCdswin;
TKCdswin = Object(TCdswin)
 windt : string;
 Constructor Init(var Bounds: TRect; ATitle:TTitleStr;
  atextstr:ttextstr;j:byte;but:tstr;i:byte;tit: string);
 Procedure HandleEvent(var event: tevent);virtual;
 procedure store(var s: Tstream);
 constructor load(var s: Tstream);
 function DP(stn: PD): Pd;
end;
```

The TWINDOW object is basically used to simulate CDS/ISIS menus and other screens such as Field Definition Table, Worksheets, Prompts etc, and methods have been introduced for drawing them. The message box and input line box function are also used in interacting with the learner. Unlike dialog box and windows, message box and input line are not objects. They are functions which are basically used to display messages on the screen.

```
PD = ^TD;
TD = object(TWindow)
 wq:Pdtext;
 x,y: byte;
 WM: PDTEXT;
 constructor   Init(var Bounds: TRect; ATitle: TTitleStr; ANumber:Integer; textdis:PDtext);
 Procedure draw; Virtual;
 Procedure initframe; virtual;
 Procedure DrawMsg;
```

```
 Procedure Getdisp(Btext: Pdtext); virtual;
 Procedure drawdbms(k,c:byte);
 Procedure Drawcrs(stn:string;l,c,k,d:byte);
 Procedure mcrs(x1,y1,c,l,k:byte;ch:chst);
 Procedure FDTExm;
 Procedure FDTMSG(rectxt: txt;i:byte);
 Procedure FDTMSG1(i:byte);
 Procedure FDTMSG2(i:byte);
 Procedure dellin(y1,n,i: byte);
end;


PQ = ^TQ;
TQ = object(Twindow)
  wq : PQuiz;
  Constructor  Init(var Bounds: TRect; ATitle: TTitleStr; ANumber: Integer; textdis:PQuiz);
  Procedure draw; Virtual;
  Procedure initframe; virtual;
  Procedure Getdisp(Btext: PQuiz); virtual;
END;


Wincds = ^TWincds;
TWincds = object(Twindow)
     rw,clr: byte;
     winstr: tstr;
     constructor Init(var Bounds: TRect; AtitleTtitleStr;ANumber:
     Integerfwinstr:tstr;frw,fclr:byte);
     procedure Writdraw(k:byte);
     procedure initframe; virtual;
   end;

PinpDialog = ^TinpDialog;
 TinpDialog = object(TDialog)
   constructor Init;
  end;

Pinpt = ^Tinpt;
Tinpt = object(TInputline)
    Function getpalette: Ppalette; Virtual;
end;

 PRepl = ^TRepl;
 TRepl = object(TPXPictureValidator)
    Procedure Error; virtual;
 end;
```

TResourcefile is another Turbo Vision object that enables to store and retrieve objects by name. In the tutorial program, it is used to store all the dialog box objects of the tutorial and other data required by the program. Furthermore, the Menu bar, and Status line objects are also stored in Resource file. Since TResourcefile object stores and retrieves object which are descendants of the TOBJECT (which is the ancestor of all the Turbo Vision objects), some of the data structures such as records containing the CDS/ISIS screen can not be stored or retrieved directly from Resource File. Therefore, descendants of TObject are created which contains as one of its fields the records to be stored and retrieved on the streams.

```
PQuiz = ^TQuiz;
TQuiz = record
  n: byte;
  Ans: string;
  Postv: string;
  Negtv:string;
  R: Trect;
  Lim:byte;
  Dt: array[1..25] of Txt;
end;


PDtext = ^TDtext;
TDtext = record
  n: byte;
  Dt: array[1..25] of Txt;
end;


PDtextObj = ^TDtextObj;
TDtextObj = object(TObject)
  T: TDtext;
  Constructor init(atext: Tdtext);
  constructor Load(var S: TStream);
  procedure Store(var S: TStream);
end;
```

```
PquizObj = ^TQuizObj;
TQuizObj = object(TObject)
  T: TQuiz;
  Constructor init(atext: TQuiz);
  constructor Load(var S: TStream);
  procedure Store(var S: TStream);
end;
```

In general, these are some of the Turbo Vision objects that are incorporated in the tutorial program. Next an attempt is made to document the tutorial program using structured chart (Program flow chart). Fig 5.13 provides an overview of the tutorial, where as, the second flow chart (Figure 5.14) shows the sequence of steps for the lessons.

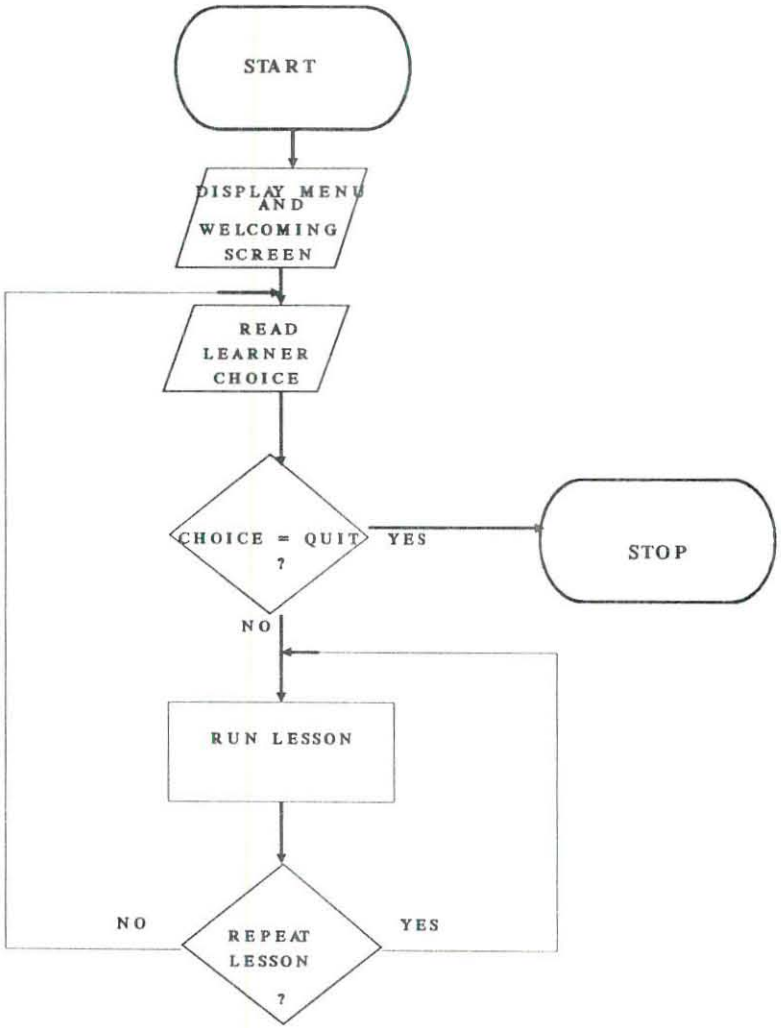


Figure 5.13 An overview diagram for the Tutorial Program

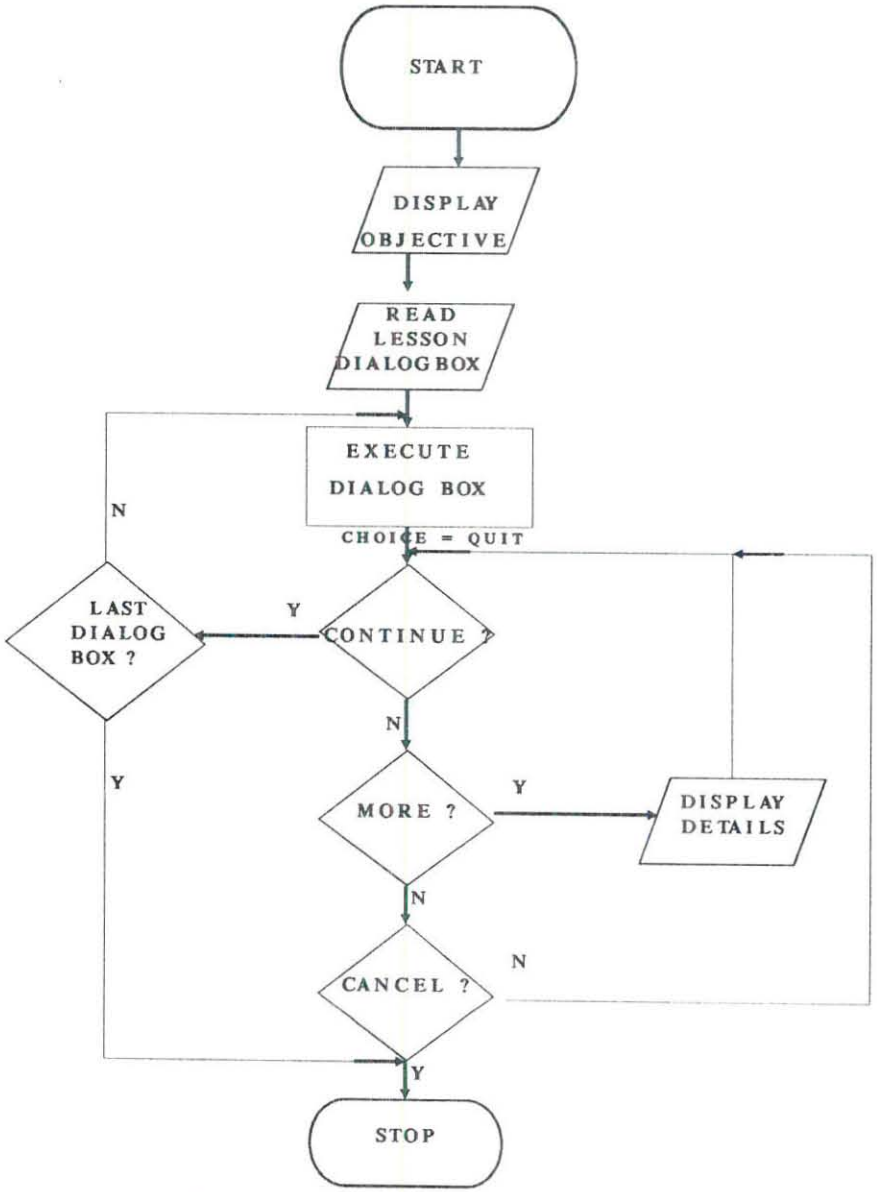


Figure 5.14 A flow chart showing the sequence of steps with in a Lesson

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

Micro CDS/ISIS is available free of charge in non-profit making organizations in developing countries, and it meets most of the functional requirements of an information retrieval system. This in turn indicates that there is little possibility for high cost and/ or poor performance to be considered as the major factors that hinder its wider usage. Instead lack of adequate user assistance and instruction has been felt by many users, and this has been reported in many professional publications.

The documentation currently available does not provide adequate assistance specially to those of the novice users who need all possible guidance and instruction for successful utilization of the software.

Online tutorial facilities are being used to provide a detailed information on the meaning and use of a command, a menu or a function within a software with less time and money. Therefore, development of an online tutorial facility has been taken as one of the solutions for providing adequate user assistance and instruction thereby allowing optimum utilization of the software.

In addition to the above, in spite of the unavailability of authoring software, which is specifically designed for the purpose of developing tutorial programs, the attempt here gives

an indication of the possibility of developing a tutorial using Turbo Vision which meets some of the basic requirements of the development of tutorials in general.

As experience shows, the tutorial can be run under MSDOS operating system, and does not require any specific hardware or software. User can run this program by typing CDSTUTOR at the DOS prompt or from the directory where the program is stored.

The program can solve the problems faced by novice users in learning the software and at the same time might be of assistance to expert users when they get stuck and need more information on a particular topic.

6.2 RECOMMENDATIONS

One can not claim that a tutorial developed once is complete and is the final output. This is due mainly to the fact that developing Tutorial program is not a one time job. It has to pass through different development processes such as testing, revision, etc. This is a continuous process, and major revisions may be required at times particularly with the new version of the software. The current work attempts to show the need, design features and to demonstrate the possibilities of an online tutorial of Micro CDS/ISIS.

The tutorial has twelve lessons. Although all the tutorial lessons have been designed, due mainly to time constraints, only the first three lessons have been programmed. In order for the tutorial to achieve its objectives all the tutorial lessons needs to be programmed based on their design. This task can be accomplished by the same person responsible for this thesis if time and resource is available.

The possibility of incorporating other features of the software not currently covered by the tutorial should also be considered in the future.

Although the tutorial may provide novice users with necessary information which enables them to get adequate knowledge for using the software, it may not always be the case that they will have time to run the tutorial whenever they encounter problems. Therefore, the possibility of integrating tutorial program in the form of online help, which provides brief description of the menus, commands and other aspect of the software and that can be obtained while working with the software, should also be considered.

It is further recommended that a similar tutorial be developed for other versions of CDS/ISIS and also for the utility programs that are developed using CDS/ISIS pascal. This in turn is expected to provide extended view of the software capabilities and possibilities.

The Tutorial needs to be tested among a wide variety of users and necessary adjustments and/or improvements are to be made based on the feedback from the users. As when new version of Micro CDS/ISIS comes out, necessary modification and/or addition are to be made to incorporate the new/modified features of the software into the tutorial.

BIBLIOGRAPHY

1. Abebe Rorissa, et al. 1992. ABNCD+ : a prototype for an integrated information storage and retrieval system. Microcomputers for Information Management. 9(3) 1992.

2. Arno, Takashi et al. 1993. An object oriented prototyping approach to system development. IEEE service centre, Pisactaway, New Jersey: 20-19.

3. Alfred Bork. 1981. Learning with Computers. Digital Equipment corporation. USA : 239-245.

4. Barker, Philp., and Manji,Karim. 1992. Computer based training : an institutional approach. Education and Computing 8(3) :229-237.

5. Besemer, Hugo. 1993. User Friendly Interfaces: IAALD Quarterly Bulletin XXXVIII,2-3. 162-163.

6. Birru Dori. 1994. A Survey to Establish National Micro CDS/ISIS user groups (Unpublished).

7. Borland. 1992. Turbo Pascal (Version 7.0): User's Guide.Ireland: Borland International.

8. Borland. 1992. Turbo Visison (Version 2.0): Programming Guide. Ireland: Borland International.

9. Boyad-Barreft, Oliver. 1990. Computers and learning. Great Britain: Addison Wesley Pub.

10. Burke, R. L. 1982. CAI Source Book: Background and Procedures for Computer Assisted Instruction in Education and Industrial Training. New Jersey. Prentice-Hall, Inc.

11. Capretz, L. F. and Lee, P. A. 1993. Object-oriented design: guidelines and techniques. Information and Software Technology. 35(4): 195-204.

12. Carroll, J.M and Aaronson, A. P. 1988. Learning by Doing with Simulated Intelligent Help. Communications of the ACM. 31(9): 1064 - 1079.

13. Cherry, J. M., Turner, J. and Clinton, M. 1989. Online Public Access Catalogue (OPACs): Design of Instructional Software for User Training. University of Toronto. Toronto, Ontario, Canada. 143-150.

14. Chowdhury, G. G. and Chowdhury, S. 1994. Text retrieval and library management software in india. Program, 28(3): 253-261.

15. Chowdhury, G. G. et al. 1994. Vocabulary Control Online in MicroIsis Databases: A Pascal Interface. Program 9(3): 11-14.

16. Davis, G. B. and Olson, M. H. 1985. Management Information Systems: Conceptual Foundations, Structure, and Development. 2nd ed. Singapore: McGraw Hill Book Co. 529-559.

17. Dean, Christopher and Whitlock, Quentine. 1983. A Handbook of computer based training. London: Kogan : 28-37, 173-196.0

18. ECA, PADIS. 1988. The Use of Microcomputers in Documentation and Information Centres in Africa. Fifth Session of the Joint Conference of African Planners, Statisticians and Demographers held at Addis Ababa, 15-20 March.

19. ECA, PADIS. 1990. The Use of Microcomputers in Documentation and Information Centres in Africa. Sixth Session of the Joint Conference of African Planners, Statisticians and Demographers held at Addis Ababa, 21-28 March.

20. Eisenberg, L. J., et al. A Computer-Assisted Instruction (CAI) Program for MEDLARS. Training and Education for Online. Editor Jackson, A. H. London: Taylor Graham. 4: 66-73.

21. Everest, Gordon C. 1982. Database Management: Objectives,System, Functions and Administration. USA: McGraw-Hill.

22. Gagne, R. M., Walter, W. and Alicia, R. 1981. Planning and authoring computer assisted instruction. Educational Technology. : 17-26.

23. Gerlack, J. H. and Kuo, Feng-Yang. 1991. Understanding Human-Computer Interaction for Information System Design. MIS Quarterly: 15(3): 527-543.

24. Janet, R. 1985. CBT Library: Interactive Video. Module 4. NCC The National Computing Center Limited.

25. Janssens, D. and Jesse, A. 1989. Micro-ISIS training course: data processing principles and applications (database for bibliographic records and serials, training material and training institution, addresses, and registration of mail). Geneva: ILO: 15-100.

26. Kearsley, G. 1983. Computer Based Training. Great Britain: Addison-Wesley Publishing : 1-41, 103-122.

27. Kieras, D. E. and Bovier, S. 1984. The Role of Mental Knowledge in learning to operate a device . Cognitive Science (8): 191-219.

28. Kimberley, R. and Rowley, J. 1990. Text Retrieval: a directory of software. England: Gower Publishing company Limited: 1-15.

29. Lauro, A. P. 1990. Manual for Preparing Records in Microcomputer-based Bibliographic Information systems, Ottawa: IDRC.

30. Mandell, Steven L. 1985. Computers and data processing: concepts and applications. 3rd ed. USA: West Publishing : 419-447, 474-496.

31. Meera, B. M., and Rahel Bekele. 1994. Computer Assisted Instruction for Classification (CAIC). Paper presented at a DRTC annual seminar-28 on Teaching and research in classification and Indexing languages- Banglore.

32. Merrill, Paul F. et.al. 1986. Computers in Education. New Jersey:Prentice-Hall: 1-52.

33. Molla Hunegnaw. 1993. Enhancement of User-Friedliness of Micro CDS/ISIS for Search and Retrieval Phase. MSc. thesis. Addis Ababa University, School of Information Studies for Africa. Addis Ababa.

34. Nieuwenhuysen, Paul. 1991. Computerized storage and retrieval of structured text information: CDS/ISIS Version 2.3. Program. 25(1): 1-18.

35. NSTDIC. 1991. Proceedings of the national policy seminar on information systems and services. 27-29 November. Addis Ababa.

36. O'Neil, Harold F. 1981. Computer Based Instruction: a state of the art assessment. UK: Acadamic Press, :1-64.

37. Parsaye, Kamran et al. 1989. Intellegent Databases Object-Oriented, Deductive Hypermedia Technologies. USA: John Wiley and Sons. 97-167.

38. Perera, P. 1992. Micro CDS/ISIS: a critical appraisal of its search interface. Program 26(4): 373-386.

39. Rahel Bekele. 1994. Computer Assisted Instruction for Bibiliometrics (CAIB). paper presented at a seminar in DRTC, Indian Statistical Institute, Banglore.

40. Scholtz Jean et al. 1993. Object oriented programming: the promise and the reality. North-Holland: Elsevier Science Publishers B.V: 199-204.

41. Smith, M. F. Software Prototyping: Adoption, Practice, and Management. England. McGraw-Hill Company (UK) Limited: 20-80.

42. Sieverts, E.G. et al. 1991. Software for information storage and retrieval tested,evaluated and compared: part III - End-user software. The Electronic Library 10(1): 5-19.

43. Szentjobi, O. 1990. Mini-Micro CDS/ISIS Tutorial (Version 2.3). Paris. Unesco: 1-16.

44. Unesco. 1989. Mini-Micro CDS/ISIS (Reference Manual Version 2.3), Paris. Unesco

45. Lohner, W. et al. 1991. Unisist Newsletter. France. Unesco. 19(4): 72-74.

46. Lohner, W. et al. 1992. Unisist Newsletter. France. Unesco. 20(4): 51-53.

47. Lohner, W. et al. 1991. Unisist Newsletter. France. Unesco. 21(2): 25-26.

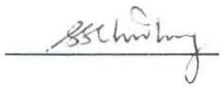
DECLARATION

The thesis is my original work and has not been presented for a degree in any other university.

Sisay Fissaha

May 24, 1995

The thesis has been submitted for examination with our approval as university advisors.



Dr. G. G. Chowdhury

Advisor

May 24, 1995

Ato Nega Alemayehu

Advisor

May 24, 1995