THE DESIGN OF A DATABASE OF RESOURCES FOR RATIONAL THERAPY

by

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I declare that THE DESIGN OF A DATABASE OF RESOURCES FOR RATIONAL THERAPY is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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ACRONYMS AND ABBREVIATIONS

AACR2	Anglo-American cataloguing rules (2nd edition)
ANC	African National Congress
BT	Broader term
CD-ROM	Compact disc read only memory
DBLC	Database lifecycle
DBMS	Database management system
E-R	Entity-Relationship
HP	Health promotion
ISAR	Information storage and retrieval
ISBN	International standard book number
LCSH	Library of Congress subject headings
NEWSTART	Nutrition, Exercise, Water, Sunshine, Temperance, Air, Rest, Trust in God
NHIS	National health information system
NHIS/SA	National health information system/South Africa
NT	Narrower term
PHC	Primary health care
RDP	Reconstruction and development programme
RT	Related term
SABINET	South African bibliographic and information network
SDLC	Systems development lifecycle
UF	Used for
URL	Uniform resource locator
WHO	World Health Organisation

ABSTRACT

The purpose of this study is to design a database of resources for rational therapy. An investigation of the current health situation and reorientation towards primary health care (PHC) in South Africa evidenced the need for a database of resources which would meet the demand for rational therapy information made on the Helderberg College Library by various user groups as well as make a contribution to the national health information infrastructure. Rational therapy is viewed as an approach within PHC that is rational, common-sense, wholistic and credible, focusing on the prevention and maintenance of health. A model of the steps in database design was developed. A user study identified users' requirements for design and the conceptual schema was developed. The entities, attributes, relationships and policies were presented and graphically summarised in an Entity-Relationship (E-R) diagram. The conceptual schema is the blueprint for further design and implementation of the database.

KEY TERMS: information systems; database; database design; primary health care; information science; Entity-Relationship model; conceptual schema; rational therapy; user studies; user requirements; data dictionary

CHAPTER ONE

GENERAL ORIENTATION AND PROBLEM FORMULATION

1.1 INTRODUCTION

As a librarian working at Helderberg College, Somerset West, Cape, where a Health Promotion (HP) course was introduced in 1996, the researcher has become aware of a serious need by both lecturers and students for information on HP and especially information on the rational therapy approach which aims to support primary health care (PHC) in South Africa.

Health care services in South Africa today place emphasis on PHC, self-education and individual rights. From experience in doing literature searches in the field of PHC, the researcher has noted that the main focus is on resources that support the curative or bio-medical model. Resources supporting complementary models of health (eg holistic health, health promotion and prevention of disease, natural remedies, including rational therapy) are often neglected, excluded or not gathered by retrieval systems. Therefore there is an information gap in resources that could support a PHC approach. The design of a database of resources for rational therapy, which is viewed as an approach within PHC, is thought to be a potential solution in narrowing this gap. It is however essential to have a clear idea of the underlying assumptions of the related concepts of PHC, HP and rational therapy as a specific approach, to identify and select necessary information for the potential users of such a database. Such users may include HP lecturers and students, health professionals, librarians and laypersons interested in their own health and wellness. This is important in the current scenario of the restructuring of health practice in South Africa towards a PHC approach with emphasis on HP.

The potential contribution of suitable, credible and relevant information to this reorientation of the health services must be demonstrated. The structuring of a national health information system for South Africa (NHIS/SA) and the role of a database for rational therapy as an approach to PHC in that information system and the database as an element of an information infrastructure must be established. The context of this study must be explained.

1.2 BACKGROUND TO THE PROBLEM

Background factors to the problem to be investigated include the health crisis in South Africa that has necessitated a restructuring of the state health policy towards a PHC approach. This also impacts on development both on an individual and societal level. Another significant factor is the lack of information to facilitate this reorientation process to PHC which reflects an inadequate information system. These factors must be briefly discussed to give the context for the need for a database of information for the rational therapy approach that can also impact on the much needed health information system of South Africa.

1.2.1 Health crisis

Two buzzwords used internationally and especially in South Africa are "health care crisis" and "development". The challenge to medical science is that it is perceived as inadequate by an increasing number of clients. Kolbe (1996:234-235) in *The South African medical journal* identified widespread patient dissatisfaction, doctor disillusionment, spiralling health costs and an outdated concept of disease as significant issues in medicine. There is disenchantment especially with reference to medical science's claim to produce results in regard to chronic diseases (Thurtle 1994:52). In addition the high and rising costs of medical care, inadequate funding, limited and unequal access to medical aid schemes and their collapsing under the strain of high costs of health care, poverty, malpractice, fragmentation of

health systems and unequal access of individuals to health care, are problems involved in this "health care crisis", requiring a reassessment of health care systems.

The consequences of this general dissatisfaction are an accelerating rise of interest in the psycho-socio-environmental factors in health and healing. These include the holistic health and PHC approaches, rational therapy being a specific context for these approaches. More and more medical doctors are combining traditional Western techniques with alternative therapies such as offering alternatives to drugs, making people aware of nutritional influences on health and making recommendations about the use of dietary supplements in their awareness of modern scientific medicine's inherent limitations (Colt 1996:35). The challenge to medical science necessitates a broadening of the health science base to include other systems of health and healing. The relationship between health and lifestyle and the consequent need for information to make informed, responsible choices for prevention of disease and maintenance of health is a significant aspect, as reflected in the rational therapy approach.

Wessels (1997:13) in the daily newspaper *Die Burger* echoes medicine and researchers world-wide pleading for a return to a diet of natural, unrefined plant produce as the most successful 'medicine' to prevent and cure chronic Western diseases thus highlighting the movement away from unnatural to natural medicine. There is a trend in many South African magazines, such as *Cosmopolitan*, *Drum*, *Fair Lady*, *Femina*, *Longevity*, *Pace*, *Reader's Digest*, et cetera to include articles on lifestyle, promotion of health, wellness and so-called 'alternative' approaches. Health-oriented medicine is medicine that is not merely disease-oriented but broadens the base to include many approaches that were marginalised in the over-emphasis on the bio-medical approach.

It is not disputed that modern scientific medicine has made great advances over time, especially in dealing with trauma, acute infections, acute medical emergencies and acute surgical emergencies (Weil 1996b:82). However the triumphs of emergency medicine have clouded the need for preventative measures and the reality of a world-wide lifestyle epidemic in which many illnesses are associated with affluence and technological complexity such as the chronic and degenerative diseases. These are called 'diseases of civilisation' because they are closely related to stressful attitudes, rich diet, substance abuse, alcohol and tobacco use, sedentary living and environmental pollution (Capra 1983:136). Many of these First World diseases are becoming characteristic of Third World communities. Thus lifestyle and informed personal choice are significant factors in a health crisis and are major tenets in the rational therapy approach.

The health care crisis has resulted in the need for individuals to take responsibility for their own health. In the rational therapy approach, health is a personal matter and individual responsibility is advocated. Already in 1973, White (1973:27), in *Scientific American* in its issue on the role of medicine in human life, discussed the need for vastly improved health information on the problems of living as well as the probabilities of death. It was explained: "Insofar as knowledge can help however, we should pursue it vigorously and use it sensibly" (White 1973:33). A warning was issued against separating preventive care from curative and restorative care, or the public's health from the individual's health (White 1973:29).

People are increasingly eager to seek information about their health status and about health care. There is a growing trend toward empowering consumers to take a more active role in their own health care and to provide the necessary information to enhance their decision-making (Jimison 1995:783). The aim is for patients to take some responsibility for their own well-being and, at the same time, to know how and when to seek help. They will become informed 'consumers', taking an active role in decisions about their own care. Newton *et al*

(1998:167) state that this is not a new idea. These ideas are reflected in the tenets of the rational therapy approach (see section 2.5.2). This discussion has highlighted the need for an approach that recognises the individual's responsibility for maintenance of health and prevention of disease. This approach is offered as a significant aspect of PHC.

Therefore the response of the State to many of these issues in South Africa has been to reorient and restructure its health care system and services.

1.2.2 Restructuring of the South African health care system

The Reconstruction and Development Programme (RDP) introduced in 1994 by the African National Congress (ANC) government as policy has outlined objectives to deal with the health care crisis in South Africa. What the RDP policy is striving to achieve is development in the social, political and economic arenas. Both community and individual development is therefore essential and information is a vital component.

The ANC document *A national health plan for South Africa* (1994a:9) states that PHC must form the centre of a successful health care system for the whole population. PHC is considered to be the most effective tool by which community development and development in general can be achieved. In 1990, Hackland (as quoted by Venter [1994:5]) stated that all available sources must be optimally used in pursuit of the goal of making PHC the heart of a successful health care programme for the entire population. The government, health sciences, health institutions and universities must place high priority on this issue.

PHC is a concept which should precipitate a change in the orientation of the health sciences that have long been resistant to change. This will bring about some radical transformations in the health services, in training and research institutions and also in the attitudes of health

providers and individuals demanding health care services (ANC 1994a:21). Price and Van den Heever (1995:iii) state that restructuring South Africa's health system is essential for improving the well-being and ensuring the full and equal participation of all the people in the economy and society. Information will be an essential ingredient in this process, especially in the health care sector, as individuals who have information to make wise life and health choices will be invaluable in making contributions to the economy and society as a whole.

PHC is viewed as a means to individual and social development and is therefore of strategic importance for development in South Africa. As stated by World Health Organisation (WHO) (1988:7), health is a fundamental human right. Each individual in a society has the right to health care and the services provided, including information which assists in making informed choices and acting as a preventive measure. PHC must be available, affordable, accessible, fair and acceptable to the people of South Africa. Rational therapy is a specific approach to PHC, with its own assumptions that are deemed relevant to the WHO (1989:1346) goal of 'health for all' by the year 2000.

According to St Leger (1996:105) South Africa spends more than R30 billion on health care annually but its people are far less healthy than in comparable countries. Limited resources and the need for a healthy population for development, the crisis in health care and the ANC RDP policy are contributing factors to the urgent need for restructuring towards PHC. The psycho-socio-environmental model of health emphasises the following: "the role of people's behaviour, what work they do, and how and where they live their lives is determining their health status" (Gilbert, Selikow & Walker 1996:94). To address the limitations inherent in the bio-medical model and to broaden the base of the health care system, the ANC has initiated this reorientation process to improve the health status of South Africa (Gilbert *et al* 1996:107). This assumes the need for an information system.

"Without the free flow of accurate and comprehensive information, the RDP will lack the mass input necessary for its success" (ANC 1994b:133).

1.2.3 The importance of an information system

The factors discussed above highlight the need for an efficient information system that will assist in the reorientation to PHC in South Africa. There has been a rapid growth in the number of health information services over the last two decades. This is evidenced in magazine coverage and on the Internet too. There is also the health professions' increasing need to locate health education materials to assist in HP (Lunin & Stein 1987:95).

It is important to briefly investigate the present state of the health information system in South Africa. First, reference must be made to the current health crisis, the limitations of the bio-medical model and the broadening of the conceptual models of health care to include both holistic health and PHC. This broadening of the health sciences has developed a need on both a personal and societal level for holistic health, PHC and rational therapy information, hence the need for an efficient information system to make this relevant information available and accessible. A database of resources for rational therapy would contribute to this information system and act as a link between the user and relevant health care resources.

Alemna (1998:70) states that African countries are becoming increasingly aware of the fact that information is an indispensable factor in the development and rational use of their total natural and human resources. Information is one vital resource which plays a significant part in a nation's development process. Changes in socio-economic and political processes, as well as advancement in scientific and technological developments, are induced by the availability of information. With the political and socio-economic changes in South Africa, together with the vast development and reconstruction challenges facing the region, the

availability of accurate and reliable development information for both decision-makers and development practitioners has become of strategic importance (Barnard 1995b:1).

Development information can be defined as:

> intelligence or knowledge that contributes to the social, economic, cultural and political well-being of society, irrespective of the form in which it is encrypted, the social activity that gives rise to it, and the institutions that organise and disseminate it (Barnard 1995b:1).

If people are to play a constructive role in accelerating and sustaining development, they need development information in a language they can understand, which is easily accessible and in a form which they can relate to their own situation (Barnard 1995b:3).

Gann (1986a:1) suggests that:

> Information is the first step to every healthy choice. Improvements in our health depend on us taking control over, and responsibility for, health as an important component of our everyday lives. This active participation requires full and continuing access to information.

Myers, Nkabinde and Blaauw (1995:293) state that the health care systems model in South Africa, which is predominantly urban, hospital-based and curative, is proving hopelessly inadequate to cope with the needs of the majority of South Africans, leaving rural South Africa with little or no access to basic PHC. The lack of a health information system in South Africa is discussed in the *South African health review* (Health Systems Trust 1995:125-126). A health information system is comprised of many components including administrative, financial and data elements, which together support the effective implementation of interventions which promote health. In 1994 a national health information system (NHIS) committee was appointed to develop a national strategy for implementing a NHIS/SA. This involves designing and developing a system that begins at local level, feeding into district,

provincial and national levels in both the public and private sectors (Health Systems Trust 1995:127). Points of relevance to this study include:

- the problems in the health information system in South Africa mirror those in the health service, which has been hampered by its fragmentation and limited by its emphasis on curative care
- analysis of the current information systems showed that while much data was collected, it was mostly not processed or used at an appropriate level and tended to be of an administrative nature, for example statistics
- while many components of the information system were in place, they were generally un-coordinated and under-developed (Health Systems Trust 1995:125-126).

Venter (1994:2) found that there is a need for health information in South Africa and that the need will increase in the future. She investigated community health information for South Africa and found that there was no co-ordinated community health information service in South Africa which would allow individuals access to information about health and medical topics without the intervention of health workers. The concept of the informed consumer rests on the availability of comprehensible, useful health care information (Newton *et al* 1998:173).

Berk (1986:195) suggests that what is generally needed is an information system that will respond to information needs associated with "wellness", which are recognised as distinct and separate from the patient education systems provided as part of the medical system's response to those who are sick. Speaking on health information Cate (1996:229) suggests that information networks offer enormous potential for improving the delivery of health care services, facilitating health-related decision-making and contributing to better health.

This lack of information in the field of HP and PHC in South Africa does not necessarily mean that there is limited information in this field. Rather, the lack of information may be the result of a lack of attention to that which is available because it has neither been identified nor organised and that information technology has not been applied to the field in question.

1.3 RELATED RESEARCH PROJECTS

A review of related research projects done on the *NEXUS* database shows that there are many studies that have researched, and currently are researching HP, PHC and health information systems in South Africa (eg Blignaut [1996], Booysen [1988], Bourne [1994], Coovadia [1992], Gaigher [1993], Kerr-Peterson [1988], Ntutela [1994], Shung [1996], Venter [1994]). However there are none that specifically deal with the design of databases of resources to promote PHC and health education in South Africa, especially with reference to the rational therapy approach.

Most of the afore-mentioned research projects cover the development of systems for specified areas, focusing on the administrative and financial components, with statistical and demographic information of health information systems as the focus. This study is aimed at the design of a bibliographic database which will provide information on rational therapy.

1.4 PROBLEM STATEMENT

Assuming that rational therapy has a role in PHC in South Africa, what should a database comprise in order to organise the existing body of knowledge relevant to a rational therapy approach within PHC? How can these resources best be made available so as to meet the users' information needs in order to thereby contribute to the reorientation towards PHC in South Africa?

The following issues emerge as sub-problems that must also be addressed:

- What is the relevant body of knowledge concerned with PHC and more specifically the information which undergirds the rational therapy approach (ie what is the information infrastructure)?

- What are the information requirements of users and potential users?

- What should a database comprise to answer to the needs of the relevant body of knowledge and the potential users?

- How can a database contribute to the credibility of the rational therapy approach?

1.5 RELEVANCE OF THE STUDY

An interview with Dr Gonda Perez (Perez 1998), the Director of Health Promotion for South Africa, underscored the fact that this study is very timely. The concern of the Ministry of Health with RDP and PHC as its primary focus was evidenced by her visit to Helderberg College, the reason being her interest in the development of the HP course at the College and the rational therapy approach as a specific focus within PHC.

Perez also raised the concern for a health information system to undergird the reorientation towards PHC. Perez (1998) indicated that a working group has been formed to study the NHIS/SA and she acknowledged that what is needed goes beyond statistical information. The relevance of this study lies in the fact that information that supports individual responsibility for health and the relationship between lifestyle, health and disease is needed in this NHIS. This information would reflect the rational therapy approach.

The reorientation towards PHC puts a responsibility on the individual for personal lifestyle choices and for physical well-being. Resources are needed for PHC which focus on mental, social and physical well-being. The database designed in this study will act as a repository for these resources as well as a retrieval mechanism and in doing so would support the RDP and especially health care initiatives in South Africa.

1.6 PURPOSE OF THE STUDY

The purpose of this study is to design a database of resources for rational therapy. The design process will be facilitated by the development of a model which will outline the steps to be followed in this process.

Specific objectives to achieve this purpose are:

- *Analyse the current situation (especially at Helderberg College)*

  The specific problem of the need for rational therapy information identified on the introduction of the HP course at Helderberg College must be investigated.

- *Identify the information infrastructure and types of sources to be used*

  The scope of the database must be delineated and therefore the parameters of rational therapy as an approach to PHC must be defined to delimit it.

- *Identify users and potential users*

  It is critical that a user study is used to determine the tasks and functions of the various user and potential user groups identified.

- *Analysis of users requirements*

  Construct a questionnaire to be used together with a structured interview to collect and analyse users requirements.

- *Design of the conceptual schema*

  Based on the user requirements determined in the user study to design the conceptual schema for a relational database which comprises the data and operations dictionaries and the E-R diagram together with the policies and rules which govern the entities, attributes and relationships among entities.

The conceptual schema, based on the findings of the objectives stated above, would provide the blueprint for a database of resources for rational therapy that should be efficient as well as effective in satisfying user queries. It is believed that the problem of a lack of information experienced by the user groups will be resolved and that the database of resources will give the rational therapy approach credibility and will contribute to the NHIS.

1.7 RESEARCH METHODOLOGY

To be systematic, as objective as possible and thorough in this study, a plan must be detailed and followed. Therefore the following methods will be used:

- *Literature survey*

  The purpose of the literature survey is to clarify the concepts to be used. The literature survey provides a solid basis of theory by which the practical applications can be evaluated. It is important to compare the various models of database proposed by different authors to identify the steps that are relevant to this study and which will be

used in the model for this study. The user must be defined by means of the literature so that the model of the user comprises all the significant elements.

- *User study*

  A user study will be undertaken to determine the user requirements for the design of the database. Various user groups will be identified according to the tasks and functions they fulfil. A questionnaire will be constructed and used in a structured interview situation to collect the data. The nature of the questions included in the questionnaire will necessitate the use of a combination of qualitative and quantitative methods to analyse the data collected.

1.8 DELIMITATION OF THE FIELD OF STUDY

The field of study for this research project must be specified and therefore delimited. The research project will be limited to the design of a database of resources for rational therapy. The implementation of the database will not form part of this study. The conceptual design of the database will therefore be the focus and outcome of this study.

The study will concentrate on the design of the database within the South African situation in the context of the restructuring of the South African health system with its focus on HP and PHC and the development of the NHIS.

The study will revolve around the concept of rational therapy as accepted in the literature surveyed and taught in the HP department at Helderberg College. This will be the specific focus of the concept within PHC and determine the infrastructure for rational therapy and the resources to be included in the database.

The user study will be delimited to the population of HP lecturers and students at Helderberg College and a sample of librarians, health professionals and laypersons connected with the College and/or familiar with the rational therapy approach.

1.9 DEFINITION OF CONCEPTS

The delimitation discussed above essentially establishes a need for the concepts to be used in this study to be carefully clarified.

1.9.1 Database

The concept 'database' is very difficult to define and as Rob and Coronel (1995:256) state: "the term database suffers from many different interpretations". The following definition of the researcher, which will initially guide this study, has been compiled from a literature study and is a summary of various definitions (eg Condon [1978], Date [1981], Davis [1980], Elmasri & Navathe [1989], Grauer & Sugrue [1987], Hawryszkiewycz [1991], Kroenke [1995], Pratt & Leidig [1994], Ricardo [1990], Rob & Coronel [1995], Willitts [1992]).

A database may be defined as a store of interrelated data representing some aspect of the real world, designed for a specific purpose and/or on a particular subject. The database consists of entities, their attributes and the relationships amongst entities which are to be described consistently (ie relational approach). The database is designed to logically organise data or information to simplify retrieval and maintenance. A database can be manual or computerised. If computerised the facilities of computer hardware and software are used to enhance the retrieval and storage of information in the database. A database may be classified as belonging to one of two types, namely reference or source database. A computerised, reference database will be designed in this study.

1.9.2 Database design

Database design is a process in which the structure of the database is specified in a detailed way. These specifications are used to store and manage data in the database. Database design involves meeting stated objectives. These objectives will be explored in section 3.4.1. Approaches to database design include top-down and bottom-up. A combination of these two approaches will be followed in this study (see section 3.4.2). Database design should be a systematic approach to answer the questions raised and which have given value to the potential use of a database. A model to guide database design as a systematic approach is the method that will be followed.

1.9.3 Conceptual schema

A conceptual schema is the outcome of the conceptual design process. The conceptual schema, the 'heart' of the database, is an accurate and complete diagrammatic representation or a formal outline explicitly expressing all the decisions taken on the conceptual level. In the relational approach the conceptual schema represents all the entities, attributes of entities and the relationships among entities (see section 5.4.1-5.4.3) and is defined by the data themselves. For each entity the conceptual schema defines the domain or scope, the entity identifiers to use, gives rules for establishing relationships, rules for the collection of entities as well as for the input and output formats and therefore is the blueprint for the database.

1.9.4 Primary health care (PHC)

PHC is a particular orientation of the health sciences and to which the South African health system is striving to reorient itself. PHC in South Africa may be defined as essential health

care based on practical, scientifically sound, socially acceptable methods and technology which forms an integral part of South Africa's health system. PHC must be made universally acceptable to individuals and families in the community by means acceptable to them, through their full participation and at a cost that the community and country can afford. It is the nucleus of the overall social and economic development of the community. Every person has the right to achieve optimum health and it is the responsibility of the State to provide conditions to achieve this. PHC provides promotive, preventive, curative and rehabilitative services to the whole population to promote self-reliance and reduce dependency on the health care system. However, central to the success of PHC are the promotion of good health through healthy lifestyles and the prevention of disease. This emphasis will be highlighted in Chapter two where the relevance of rational therapy as part of PHC delivery and programmes will be discussed.

1.9.5 Rational therapy

The concept and essence of rational therapy will be discussed in Chapter two and only a succinct definition will be stated here. Rational therapy is viewed in this study as an approach to PHC and as part of holistic health in the current milieu of the health care sector in South Africa. Rational therapy is an approach to health and wellness that is rational, scientific, reflects common-sense and includes and recognises all useful remedial agents (eg sunlight, herbs, charcoal, diet and nutrition, water, exercise, air) which have been proven to be of significant value in both the prevention and treatment of disease. It provides the facts in a holistic, scientific manner that informs any rational being to give reasons for being and improving his/her lifestyle. It requires information for making these informed decisions and changes.

1.10 SYNOPSES OF CHAPTERS

Chapter two will be devoted to a discussion of the rational therapy approach in the context of PHC in South Africa. The need for resources on this topic will be highlighted and the information infrastructure discussed. The main thrust of this research is not to defend or elaborate on the PHC approach but rather to identify the necessary ingredients for restructuring towards PHC in South Africa. Information is an essential ingredient. Nor is it possible within the parameters of this investigation to fully explore the rationale of the rational therapy approach but merely to position it as an approach which can make an invaluable contribution to the goals of the PHC initiative. It is important to identify its main tenets which can form a framework by which to evaluate the information sources that can facilitate this reorientation process. What is of importance is an understanding of these approaches to identify the requirements for selection policy and the determination of the scope of the database. These perspectives on information are necessary for defining terms and policies and procedures relevant to the database. It is also important to explain how the database to be designed can contribute to the information infrastructure.

Chapter three will focus on database design. The concept 'database' will be defined and the database positioned within the larger information system. A comparison will be made between the types of database and the type of database to be designed will be detailed. The objectives of and approaches to database design will be discussed. Various authors' steps of design will be compared in an attempt to establish the steps to be followed for this study. A model for database design will be developed which will outline the steps and methodology to be followed.

Chapter four will focus on the user study. The purpose of a user study is to establish or identify the requirements of potential users'. One of the objectives of a database is to meet

user requirements and to assist in the retrieval of information which will meet stated needs and solve problems. A model of the user will be included to ensure that all the aspects of the user are recognised. Users will be defined in terms of their tasks and functions and categorised as user groups. Data will be collected in a user study to determine user requirements. These requirements form the basis for the design of the conceptual schema in Chapter five. The method to be used for data collection will be the construction of a questionnaire that will form the basis for structured interviews. A combination of qualitative and quantitative research methods will be used to analyse the data collected to indicate the user requirements for the database to be designed. These requirements will be summarised and complemented by the expertise and experience of the information professional. These will form the basis for the determination of the entities, their attributes, relationships between entities and the formulation of policies.

The conceptual design of a database of resources for rational therapy will be discussed in Chapter five. Conceptual design as a step in the design process, outlined in the model developed in Chapter three, will be defined and will form the basis for the development of the conceptual schema. Various concepts associated with conceptual design and the development of the conceptual schema will be defined and discussed. The data and operations dictionaries and the E-R diagram will facilitate the identification of entities, attributes and the relationships between entities for this particular study. The rules and policies governing entities, their attributes and the relationships among entities will be outlined in this chapter. All of these steps are independent of the software selection but are essential in the implementation of the database which is recommended as the subject for further study.

Chapter six will summarise the findings of the study in relation to the problem statement and its context as stated in Chapter one. It is recognised that there are limitations as to what can be accomplished in a research study which concentrates on database design. An extension

of the model proposed in Chapter three will form the basis for recommendations for further study. The implementation and evaluation of the database will form part of a future study. Proposed areas for further research will be identified to maximise the effectiveness and efficiency of the database to be designed.

CHAPTER TWO

RATIONAL THERAPY AS AN APPROACH TO PRIMARY HEALTH CARE

2.1 INTRODUCTION

Restructuring the health care system in South Africa is an initiative by the government to deal with a number of issues which reflect the changes taking place in health care both internationally and nationally. Limitations in the current bio-medical model have led to an upsurge in various approaches (collectively labelled by some as complementary medicine) in an attempt to address various issues and offer solutions to problems in the bio-medical model. Primary health care (PHC) has been adopted as the means to reorient the health system in South Africa.

There has been a shift from health education to health promotion (HP) with its goal of health for all. The shift of focus from being on disease to the goal of optimal wellness or holistic health should be seen as crucial to development of the individual and therefore to society at large. Because PHC could merely be a reflection of the curative nature of the bio-medical model it is important to delineate the field of PHC for the design of the database of this study. Rational therapy as a viable approach is presented in this chapter as one specific focus within PHC.

Rational therapy will be defined and discussed so as to provide a basis for an information infrastructure. An information infrastructure, especially on health should reflect a broad base which includes relevant wholistic resources from both the holistic health and conventional bio-medical approach. The discussion of the various aspects of this chapter focus on the broadening of this base while simultaneously specifying the need to identify information that

reflects the rational therapy approach. A basic issue is the debate about and crisis in health care.

2.2 THE HEALTH CARE CRISIS AND DEBATE

The health care crisis was briefly mentioned in section 1.2.1. This topic forms the backdrop to discuss the concept of rational therapy as a specific approach within PHC. It will also serve to delineate the body of knowledge which will be the focus of the database to be designed for this study. The issues in the international health care crisis have relevance to this study especially in the light of the current moves towards PHC in South Africa.

2.2.1 Health care in South Africa

The factors which require a reassessment of the health care system in South Africa include: the high costs of medical care; inadequate funding; malpractice; medical aid scheme problems; poverty; unequal access to health care and a shift from a purely bio-medical emphasis to the incorporation of other health perspectives, including PHC. The significance of this scenario for this study is that it impacts on the body of knowledge identified for which the database is to be designed.

Capra (1983:333) points out that any system of health care, including modern Western medicine, is a product of its history and exists within a certain environmental and cultural context. As this context keeps changing it impacts on the health care system which has to adapt itself continually to new economic, philosophical, and religious influences. This is where the South African health care system currently finds itself, not so much in a paradigm shift, but rather in a broadening of the conceptual basis. Methods of treatment and prevention that have previously been ignored or even forgotten now have to be incorporated.

A short history of medicine illustrates these trends succinctly:

> "Doctor, I have an earache..."
> 2000 BC - "Here, eat this root."
> 1000 AD - "That root is heathen. Here, say this prayer."
> 1850 AD - "That prayer is superstition. Here, drink this potion."
> 1940 AD - "That potion is snake oil. Here, swallow this pill."
> 1985 AD - "That pill is ineffective. Here, take this antibiotic."
> 2000 AD - "That antibiotic is artificial. Here, eat this root."
> (A short history of medicine 1997).

A recent statement from the South African Department of Health which attempts to clarify the issues within HP as the State initiative in making the transition toward PHC makes the following important point: South Africa has enormous development and health-specific challenges with which to contend (Barnard 1995a:2). The main objections of the current health system are that it is inefficient, inequitable and so fragmented that it fails to meet the basic needs of the population (ANC 1994b:42).

The formulation of a new national health system and enhancement and promotion of PHC are some of the key aspects of the Reconstruction and Development Programme (RDP) (Barnard 1995a:2). Price and Van den Heever (1995:iii) investigate strategic health policy issues for the RDP and state the following:

> Restructuring South Africa's health system is essential for improving the well-being and ensuring the full and equal participation of all the people in the economy and society. Unequal access to health services and unequal quality of health care make it necessary that health policy issues receive urgent attention.

An important deduction based on the above statement is the relationship between an efficient health care system and the development of the people of that country. Phillips (1990:3) points out that although development generally brings improved diets, housing, social change and reduction in infectious diseases, it is also paradoxically usually associated with rises in degenerative diseases, mainly apparently of non-infectious aetiology or 'Western' diseases.

The following brief discussion attempts to identify the limitations of the bio-medical model which currently dominates medical science theory and practice. This discussion will also introduce the various complementary models of health and healing that are subsequently becoming more prominent.

2.2.2 Limitations of the bio-medical model

According to Weil (1996c:65) "[i]t seems most strange that practitioners of the so-called healing art should have such little faith in healing". McTaggart (1996:7) states that "in their own literature, medical authorities openly acknowledge the fact that a good deal of standard medical practice today amounts to little more than 20th-century voodoo". The journal *New scientist* (1994:23) recently announced on its cover that 80% of medical procedures used today have never been properly tested. McAlvany (1997:4) states that there is a growing body of evidence and testimony even from conventional doctors and medical journals that much of surgery performed is unnecessary and in many cases leads to worse health or physical conditions than was supposed to be solved by the surgery. McTaggart (1996:10) says that medical science is, in the main, a triumph of statistics over common sense.

In the 'Issues in medicine' column in *The South African medical journal* Kolbe (1996:234-235) explored the current crisis in medicine and highlighted some key statements that need to be noted: 'profession's confused state'; 'teaching and practice of medicine were too narrowly scientific'; 'humanity of the patient could not be conceptualised within this restricted framework'; 'the public is becoming dissatisfied with ordinary doctors and ordinary medicine'; 'I have never known a time when there were so many public complaints about doctors'. Phillips (1990:22) in discussing health, is of the opinion that some balance needs to be achieved in health services. He further states that technology, state of the art services, the imbalance of use of resources and the interest of many institutions, training systems and

technology and pharmaceutical companies continue to be served by the 'Asclepian cult' favouring medical intervention. Also, many of the ills of the world can be traced to unnecessary, excessive or over-potent medical-technological intervention. He also mentions the influence of multinational pharmaceutical companies in the excessive use of medication and multiplication of useless drugs. Pantanowitz (1993:638) states that the influence of alternative medicine on the public continues to grow and the reason he offers is that an individual need exists which is not being satisfied by orthodox medicine.

The paradigm of Western civilisation's current reality is Scientism, pioneered by the dualistic ideas of Cartesian philosophy and the mechanical, reductionist science of Isaac Newton in which man is separate from nature, mind is separate from body, spirit is separate from matter and God is separate from his creation (Kolbe 1996:234). Specialisation in medicine has resulted in the fragmentation of the human body into its various organs which ultimately loses the focus of the patient as a holistic human being (Carter 1993:xix).

The human body is seen as a machine which needs to be repaired by the doctor, either physically or chemically, when broken down because of disease. This repair usually takes the form of correcting the malfunctioning of a specific mechanism. The concepts of healing, healer, health and healing, wholeness and wellness are viewed with suspicion and believed to be outside of the scientific framework simply because they do not fit into the paradigm of reductionist science. The bio-medical model therefore limits itself to a cellular and molecular biological perspective (Capra 1983:138). The possibility is that it is inadequate in promoting good health as its practices may result in more problems than what is 'cured' by treating one symptom rather than identifying the root cause.

While treating one system, another, or the whole body system may be negatively affected by that treatment. The emphasis on the cure of symptoms, medical technique and the use of

technology is limiting when it comes to the practice of health and healing and promotion of health. To reincorporate the notion of healing into the theory and practice of medicine, medical science will have to transcend its narrow view of health and illness.

The dilemma of modern medical science is its overemphasis on science in its technological sophistication while it lacks knowledge about wellness and health. It lacks both a humanistic vision and an authentic PHC approach that is devoid of the '15 minute visit dictated by many managed-care systems' (Geiger 1997:1637). The significant role of the informed 'client' in the promotion of health is largely ignored.

The fact that the patient is viewed as a machine and not holistically as a human being in the bio-medical approach is reinforced in a book review (Geiger 1997:1637) of Eric J. Cassell's book *Doctoring: the nature of primary care medicine*, in which Cassell states that the patient has been pushed to the margins of 20th-century medicine because of the underlying notion that medicine involves the application of impersonal facts to an objective problem that can be seen separately from the person who has it. Reductionist and atomistic aspects of medical science have crowded out clinical empiricism and clinical judgement. Physicians may become frustrated by ambiguous illnesses that do not fit molecular explanations. Intolerant of uncertainty, they may retreat into technology, which presents what is immediate but not necessarily essential. The significant role of the immune system is being overlooked.

Denial of the personhood of the client has led to many people looking elsewhere for help. The high cost of treatment has also contributed to this shift. *The Reader's Digest South African family guide to natural medicine* (1992:7) makes the statement that "[b]ecause of the rising costs of conventional medical care, more people are taking responsibility for their own health, and are turning to complementary medicine". In taking responsibility for one's own health one must carefully and critically study the available options.

Information and resources about the limited perspective of the health professionals and their possible neglect of the issues of nutrition, employment, preventative health and even the 'art of healing the sick' which includes the interplay of the body, mind and environment are therefore required to make choices among the options being offered. Symptoms may be treated and controlled, but this does not mean there has been a cure. Carter (1993:305) says that we in the West spend far too much of our time and money on curing, when we ought to be preventing diseases, most of which are preventable. We are spending our time and money trying to pick up the pieces instead of trying to prevent the casualties. The emphasis on the use of drugs as medication for all ills is focused on dealing with the symptoms and not with the cause.

Dr Dean Ornish (1990:xxxi), whose programme for reversing heart disease has received scientific acclaim, states that much of the $18 billion spent in 1989 in USA on coronary bypass surgery could have been saved if the medical profession had not 'bypassed' the significant role of lifestyle as a cause for disease, especially heart disease. His programme has proved that many people can begin to reverse their heart disease simply by changing their lifestyle (saving $50 000 for every patient) (Ornish 1990:1).

> Bypass surgery became, for me, a metaphor for the inadequacy of treating a problem without also addressing the underlying causes. We would operate on patients, their chest pain would usually go away, and they were told that they were cured. Most would go home and continue to do the same things that led to the problem in the first place (Ornish 1990:12).

Capra (1983:141) quotes Leonard Shlain who expressed the paradox evident in the bio-medical model: "Some doctors seem to make people well, while others, regardless of their expertise, have high rates of complications. The art of healing cannot be quantified." The toxicity of drugs to an already ailing system overburdens the immune system whose ultimate function is to engage all systems in the 'healing' process. Gold (1997:8), in a recent headline in *The Cape Argus* reinforces this current problem: "Nature-nurture debate hots up over

antibiotics: doctors cornered looking for options". The emphasis on the germ theory as the significant factor in the aetiology of disease has resulted in an underestimation of the importance of lifestyle and personal choice in wellness, health and care for the immune system.

Cousins (1983:227-228) states that the belief that illness is something that comes from the outside is so firmly ingrained in us that we naturally look to outside forces to "do battle with it and evict it". We think that since we are attacked from without that we can only be rescued from without. We therefore have little knowledge of and therefore little confidence in, the numberless ways the human body goes about righting itself. The absence of this knowledge leads to excessive dependence on external agencies, undue fears and sometimes panic which interfere with the proper functioning of the restorative mechanisms of the human body. Cousins (1983:228) states that the human body is equipped to meet most of its own health problems.

According to Hart (1996:23) the following are features of contemporary medical practice:

- concern with organic appearance of disease
- emphasis on cure
- disease perceived as independent of personal health
- all treatment belongs in the medical environment, thus ignoring the environment where symptoms occur.

Capra (1983:136) suggests that the triumphs of emergency medicine have clouded the emergency need for preventative measures and the reality of the world-wide lifestyle epidemic:

> The health of human beings is predominantly determined not by medical interventions but by their behaviour, their food, and the nature of their environment. Since these variables differ from culture to culture, each culture has its own characteristic illnesses, and as food, behaviour and environmental situations gradually change, so do the patterns of disease. Thus the acute infectious diseases that plagued Europe and North America in the nineteenth century, have been replaced in the industrialised countries by illnesses no longer associated with poverty and deficient living conditions, but, on the contrary, with affluence and technological complexity. These are the chronic and degenerative diseases - heart disease, cancer, diabetes - that have aptly been called 'diseases of civilisation', since they are closely related to the stressful attitudes, rich diet, drug abuse, sedentary living, and environmental pollution characteristic of modern life.

McKeown (1976:xiv) identifies some negative aspects of the bio-medical model:

> Medical science and services are misdirected, and society's investment in health is not well used because they rest on an erroneous assumption about the basis of human health. It is assumed that the body can be regarded as a machine, whose protection from disease and its effects depends primarily on internal intervention. The approach has led to indifference to the external influences and personal behaviour which are the predominant determinants of health. It has also resulted in the relative neglect of the majority of sick people who provide no scope for the internal measures which are at the centre of medical interest.

Castleman (1996:xxv) compares conventional and natural medicine indicating differences in their philosophy and outlook. These are summarised in Table 2.1 below. This comparison helps to broaden the base of health, wellness and healing.

In summary the limitations of the current bio-medical model which have resulted in and necessitated a move towards the consideration and incorporation of other models of health, such as complementary and holistic, can be stated as:

- the current mode of thinking is that no matter what you do the doctor will cure
- man is reduced to a machine with each body system or part being fragmented and compartmentalised and therefore the patient is not viewed as a system or a holistic being
- symptoms rather than the cause are the focus for treatment

Table 2.1 Conventional medicine vs natural medicine

Conventional medicine	Natural medicine
Emphasises diagnosis and treatment.	Emphasises disease prevention.
Views the mind and body as separate, with little effect on each other.	Views the mind and body as one, the "bodymind". Anything that affects one affects the other.
Views the body as essentially a machine with disease resulting when parts break.	Views the body as a living microcosm of the universe, with disease resulting when forces that act on it become unbalanced.
Views medicine as a military campaign. Seeks better "weapons" to "combat" disease.	Views medicine as an effort to restore mind/body harmony.
Views the body as the passive recipient of treatments that "fix" it.	Views the body as capable of self-repair and administers treatments to support self-healing.
Patients obey doctors' orders.	Individuals take an active role in their healing.
Primary treatments include pharmaceuticals, surgery and radiation.	Primary treatments include diet, exercise, stress management, social support and herbal medicines.
Focuses on disease.	Focuses on illness, the human experience of disease.
Focuses on pain.	Focuses on suffering, the human experience of pain.
Goal is cure.	Goal is healing, the individual's experience of physical, mental and spiritual wholeness.

- cure rather than prevention
- the role of the immune system is underestimated or even discounted
- methods used to alleviate symptoms in the current bio-medical model are toxic, do not deal with the cause and overload a system in 'dis-ease'
- available information in research is biased towards the curative model thus ignoring 'alternative' information
- aetiology of disease limited to the germ theory
- changing patterns of disease in Third World countries reveal the trends towards prevailing lifestyle diseases characteristic of First World countries
- medical techniques, intervention, sophisticated technology which are focused on trauma and longevity such as in transplants, with a question on the quality of life.

This discussion has identified the problems and limitations of the current bio-medical approach. Therefore there is a need to identify the nature of holistic health. This will assist in the process of the identification of a body of knowledge and relevant resources which must be considered for the database to be designed in this study.

2.3 HOLISTIC HEALTH

In a gallop poll (Gallop poll 1985:46) readers of *Success magazine* were asked to choose three out of 12 factors that they felt were the symbols of success. Fifty-eight percent rated good health as the symbol of success. A decade later the emphasis on and interest in good health as crucial to success, development, well-being and wellness is evidenced in the available literature which also suggests that a growing number of individuals are taking more interest in their personal well-being.

The term 'holistic health' implies whole or wholeness, the whole person, the total well-being and functioning of a system. The various approaches emphasising holistic health include complementary, alternative, preventive or natural medicine. For the purpose of this discussion these terms will not be defined or explored individually in this section. However, within conventional bio-medical literature there is a growing body of knowledge on the importance of lifestyle and personal responsibility for health thus indicating a move towards an affirmation of the concept of holistic health.

'Holism' was introduced in 1925 by Jan Christian Smuts, the South African prime minister and philosopher, as an alternative to the prevailing analytical and reductive way of scientific thinking in which the whole organism and its systems are greater than the sum of their parts. There are three basic aspects. Firstly, disease prevention is emphasised by placing responsibility with the individual patient as 'self-healer' to use his/her own resources to promote health, prevent illness and encourage healing.

Secondly, the patient is viewed as an individual and unique person, not as a symptom-bearing organism. Thirdly, holistic practitioners attempt to make use of the many available diagnoses, treatment and health methods, including both alternative and orthodox medical methods to achieve well-being (Holistic health 1995).

Holistic medicine addresses the whole person, the physiology as a system and includes the person's environment as the focus for various healing and health-promoting practices. This view of health should be an underlying philosophy of PHC which considers the whole person within his environment. Carter (1993:xv) suggests that a possible reason why holistic therapies threaten medicine is that they involve a major change in scientific thought because they imply that current methods are inadequate, and they threaten huge profits of a powerful branch of medicine or a drug company. He lists some of the factors that are contributing to

this health care crisis: detrimental lifestyles; the lack of emphasis on preventive medicine; the suppression of alternative therapies; failure to incorporate alternative therapies into existing health care systems; lack of appreciation for the role of nutrition in disease causation and disease modulation and us-and-them mentality regarding allopathic versus the other healing arts and sciences.

According to Capra (1983:364) health is viewed as a positive state, not merely as the absence of disease, with an emphasis on the psycho-socio-environmental, that is a holistic approach. Health is the condition of the body in which the organ performs its proper function, that is the harmonious action of all the bodily organs and physiological systems. However these functions and the harmonious action may be interfered with, some functions accelerated, some impeded or wholly interrupted. The structure of the organs may be impaired. This disturbance will be accompanied by discomfort and this condition is known as disease.

In holistic health care the emphasis is on restoring and maintaining the dynamic balance of individuals, families and other social groups through preventive self-care and self-education. It means people taking care of their own health individually, within a society, aided by therapists sensitive to this kind of health care. South African chemists' opinion on health is that prevention is better than cure and they stress the importance of a healthier lifestyle (Prevention is better than cure... 1993:19). 'Proactive' health care rather than 'reactive' health care is the current trend. The World Health Organisation's (WHO) declared goal "Health for All" by 2000 can only be pursued by shifting the emphasis away from treating people after they have become ill, to keeping them healthy and promoting healthier lifestyles. A large proportion of health care costs have been devoted to treating diseases which are in fact a product of faulty lifestyle habits. This after-the-fact treatment approach to disease has not resulted in substantial improvements in nations' health. A preventive approach, which

includes individual responsibility for changing life-threatening habits, must be encouraged (Garrison & Somer 1995:xxi).

Carter (1993:307-308) identifies two significant areas into which preventive medicine can be categorised:

- services which are delivered to individuals by health care providers to promote optimal health and wellness and to prevent illness
- information (health education) provided to the public, but where the basic responsibility for implementation or putting it into practice rests with the individual or recipient of that information and newly acquired knowledge.

To improve the health status of every individual in the world the strategy of PHC was developed by the WHO. The need for PHC has been established in section 2.2.1.

2.4 PRIMARY HEALTH CARE (PHC)

Health is one of the most crucial problems in the developing countries. The development of PHC has stemmed in part from the realisation that existing hierarchical systems have failed the vast majority of people. Its promotion stems from an acceptance that health services should try to serve the bulk of people rather than a favoured few. Also, highly facility-oriented, high-tech health care is neither appropriate nor affordable for the majority of the health and development needs of most Third World countries (Phillips 1990:150).

PHC as a nucleus, together with doctors and hospitals, should form an integral part of a country's health system, and of the overall social and economic development of the country. It has an added advantage that it includes preventive health care. PHC generally forms the

first point of contact in clinics. It is close to the people and makes health services and information accessible. When people have access to information on how to prevent disease the first step is made in the move towards PHC. This assists in improving the health care situation (Kellerman 1997:107). PHC should not be regarded as second-class medicine and inferior health care. It should be a rational course of action, responsive to local needs and conditions and, above all will be appropriate as it addresses the health needs of the people. The reorientation towards PHC in South Africa is a key issue relevant to this study. It gives impetus to the fact that a database of relevant resources can be an important contribution to this transition.

The following definition of PHC aptly summarises the various aspects involved and serves to address the issues raised in the previous discussion on the limitations of the bio-medical model.

2.4.1 Definition of primary health care

PHC may be defined as:

> Primary health care is essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and the country can afford. It forms an integral part of the country's health system of which it is the nucleus and of the overall social and economic development of the country. It is the first level of contact of individuals, the family and community with the natural health system bringing health care as close as possible to where people live and work and constitutes the first element of a continuing health care process (WHO 1978:34).

As stated in section 2.2.1 by Dr Zuma (1996) the national health system in South Africa must be driven by the PHC approach. The Department of Health's mission, which embraces the fulfilment of the mental, physical and social well-being of all the inhabitants of South Africa,

emphasises the prevention of disease and promotion of health through community-based services.

2.4.2 Principles and objectives of primary health care

As stated in Chapter one (see section 1.2.2) effective PHC must meet certain demands, namely, it should be available, affordable, accessible, fair and acceptable to the people of South Africa.

Principles of PHC include:

- universal coverage of the population, with care provided as needed
- services should be promotive, preventive, curative and rehabilitative
- services should be effective, culturally acceptable and manageable
- communities should be involved in the development of services so as to promote self-reliance and reduce dependency
- approaches to health should relate to other sectors of development (WHO 1978:16-17).

Health problems and their relationship with lifestyle means that PHC should not only be curative, but it should promote individual understanding of health and healthier lifestyles and as such address the root and cause of ill health. Relevant information is believed to be essential in this approach. An intersectoral holistic approach will be more effective as communities are provided with opportunities to improve their living conditions.

The Department of Health journal *Masipile* included an article entitled 'What is health promotion?' (1997:15) in which the term HP is used for an approach that focuses on prevention of ill health and the promotion and maintenance of well-being within PHC. HP and

education and the provision of the wherewithal and professional skills to prevent and cure illness are important (Phillips 1990:280). In the context of the crisis and debate (see section 2.2) HP is identified as the essence of holistic health as it views health as a balance of the physical, mental and social well-being. It is therefore viewed as an alternate approach (Reddy & Tobias 1994:20).

2.4.3 Health promotion (HP)

In the last decade interest has grown in developing an approach which focuses on the prevention of ill health and the promotion and maintenance of well-being. According to the WHO (1988:7) health is a fundamental human right. The WHO definition of health is: "complete mental and social well-being and not merely the absence of disease or infirmity". This is confirmed by the RDP (ANC 1994b:43) for adoption in South Africa. Good health is a crucial part of well-being both on a personal and societal level. An emphasis on HP should increase the level of human dignity as people are empowered to better care for themselves and their families. Because good health enables people to function, they will be able to use their resources optimally thus resulting in self-reliance and an improvement in the standard of living within communities (Kellerman 1997:106).

The past approach with its emphasis on health education was limited by a focus on disease although it is still seen as one of many essential components of HP and a means of realising the complete objectives of HP (What is health promotion 1997:15). The development of HP has also been given impetus by a growing awareness that improving the health of populations requires not just individual behaviour change and curative care, but social, political and environmental changes that address the underlying causes of ill health. HP focuses on empowering the individual to make appropriate health choices by ensuring that

the individual's environment is conducive to such choices. Broad political, economic, social, cultural and environmental considerations must form part of a HP strategy.

Ben-Tovim (1987:62) states that Third World nations will not benefit from high-technology-based breakthroughs of medical knowledge, but from the development of new means of applying simple, proven, techniques of disease prevention and HP. In response to this need, the concepts of HP and PHC have been given greater emphasis in South Africa.

However, in a careful analysis of the tenets of PHC it has become evident to the researcher that there is a place for the rational therapy approach which emphasises a reasonable, practical approach to health providing simple, proven techniques.

The WHO states that it is of international importance to develop a program of prevention to interrupt the impending epidemic of diseases related to lifestyle which account for 'most morbidity and mortality' (Nedley 1998:xi). McAlvany (1997:1) includes two very pertinent quotes in his article on alternative medicine. The first quote is that of Linus Pauling, two-time Nobel Prize laureate: "I believe that you can, by taking some simple and inexpensive measures, extend your life and years of well-being". The second is an anonymous quote: "You may be the richest man in the world, but if you have lost your health, you are impoverished and have nothing". These ideas are very relevant to this current discussion of rational therapy in the context of PHC and HP in South Africa as discussed above.

2.5 RATIONAL THERAPY

The focus of this chapter has been, on the one hand, to broaden the concept of health care by identifying the limitations of the current, dominant bio-medical focus of medical science,

while on the other hand, to narrow the field of knowledge towards a rational therapy approach which will be the domain of the database being designed.

International scientific studies (numbering more than 250 reports) of Seventh-day Adventists from 1958-1999, known collectively as the *Adventist Health Study* (eg Beeson *et al* [1989], Fnneb [1994], Fraser [1994], Fraser *et al* [1991,1992], Fraser & Shavlik [1997], Giem *et al* [1993], Kuzma & Lindsted [1990], Lindsted & Kuzma [1990], Nieman [1992], Resnicow *et al* [1991], Singh & Fraser [1998]) have shown that they have less illness, lower mortality and greater longevity than the population in general. There was less incidence of cancer and heart disease. Scientists have shown an interest in the Seventh-day Adventists' wholistic philosophy of health which includes the importance of lifestyle, nutrition, use of water, rest, sunshine, air, moderate, temperate living and exercise (Dysinger 1997:140).

2.5.1 Definition of rational therapy

It is important to first define both 'rational' and 'therapy' to establish what these terms mean singly and then in combination as 'rational therapy' with reference to holistic healing. *The Reader's Digest Oxford complete wordfinder* (1993, s.v. 'rational') defines 'rational' as:

> of or based on reasoning or reason; sensible, sane, moderate; not foolish or absurd or extreme; endowed with reason, reasoning, rejecting what is unreasonable or cannot be tested by reason in religion or custom. Reasoned, logical, practical, pragmatic. Sensible, common-sense, commonsensical, practical, pragmatic, down-to-earth, reasonable, well-balanced, sane, sound, normal, clear-headed, clear-eyed, sober, moderate, measured, discriminating, intelligent, thinking, enlightened, prudent, wise, knowledgeable, informed.

The term 'therapy' can be defined as: treatment; healing cure; technique; remedy; remedial programme (*The Reader's Digest Oxford complete wordfinder* 1993, s.v. 'therapy'). Therapy can therefore be seen as treatment, remedy, remedial programme, healing cure or it can, on the other hand, be seen as a technique. Rational therapy must not to be confused with the

concept of rational-emotive therapy in psychology, developed by Albert Ellis in the 1950's (*Baker encyclopedia of psychology* 1985, s.v. 'rational-emotive therapy').

First, rational therapy is both a sensible, practical, logical, common sense, well-balanced, intelligent, thinking, informed technique of prevention and maintenance of health as well as a sensible, reasonable, practical, sound, discriminating, prudent, wise, remedial programme to maintain and restore health and well-being. Paradoxically, this remedial programme is not just an approach to illness but an attempt to achieve optimal health especially in lifestyle change and prevention. The Third World nations need proven techniques of disease prevention and HP (Ben-Tovim 1987:62).

Phillips (1990:22), in his definition of health, recommended that health is largely a function of rational living and personal lifestyles. Individuals need to be made aware of the role rational living and lifestyle plays in their health and well-being. Rational therapy therefore seeks to promote health for each one and in turn for all for the sake of a healthy society.

Florence Nightingale, the famous 'untrained' nurse of the Crimean war who is credited with having developed the field of nursing, wrote in her manuscript *Suggestions for thought* as quoted by Russell (1996:27): "The universe is the incarnation of a divine intelligence that regulates all things through law". For her, the laws of science were the "thoughts of God".

The basis for the rational therapy approach is a belief in God who created humankind and provided laws for health and for the holistic, optimal functioning of the body and mind. Having created humankind, God the Creator knows how the laws of physiology will function best for optimal health. 'Rational' implies a sensible, logical recognition of these physiological laws of health and the laws that systematically govern the well-functioning of the body. This is the heart of 'true' science when there is a holistic perspective and laws are defined

systematically. The tunnel-vision perspective of reductionistic, mechanistic science limited by empirical observation of case studies does not offer a holistic perspective for health.

McAlvany (1997:3) states that there are some therapies that evidence a common sense approach to health. Some of these have been used from Biblical days throughout humankind's history but have been forgotten and neglected in recent decades because of the over-emphasis on antibiotics and drugs. There should be a balance between a preventative and curative approach.

The definition of HP by the Department of National Health supports the principles of rational therapy as follows:

- focus on prevention and promotion of and maintenance of well-being rather than on disease and clinical diagnosis
- improvement of individual health which may require change
- identification of factors that cause ill health (What is health promotion 1997:15).

2.5.2 The tenets of the rational therapy approach

To give credence to the tenets of rational therapy it would be necessary to take an in-depth look at each of the following tenets. However, it is only possible to raise critical issues which will serve as a basis for establishing criteria by which to evaluate information for inclusion in the database (see section 5.4.4).

Robinson (1965:27) comments on the sound reforms in health habits advocated by Seventh-day Adventists that time has demonstrated to be rational and progressive.

2.5.2.1 Natural, rational, scientific approach to life

Cousins (1983:228) highlights the role of the individual in health:

> The notion that the centre of the healing process is lodged with the physician is incorrect. It is lodged within the individual and the wise physician knows how to summon and release it. The individual cannot expect to be relieved of all responsibility in the recovery effort.

Observance of the laws of health and healing facilitate optimal health. Prevention is the basis of optimal health. When there is a state of 'dis-ease' these health laws can be used for the healing process. Paradoxically, at the core of Hippocratic medicine is the conviction that illnesses are a natural phenomena that can be studied scientifically and influenced by therapeutic procedures and by wise management of one's life. Thus medicine should be practised as a scientific discipline, based on the natural sciences, and encompassing the prevention of illnesses, as well as their diagnosis and therapy (Capra 1983:340). Health in the holistic systematic sense is according to Wilcox, as quoted by Willis (1997:269):

> all that pertains to the development, preservation and use of the physical and mental powers. It pertains to the food we eat, the water we drink, the air we breathe, the clothes we wear, the houses in which we live, our time of sleep and exercise and relaxation, cleanliness of the person and premises, rational treatment when ill - in fact, all that contributes to the development and use of the wonderful body which God has given to His children.

Willett (1994:532) remarks that there is strong evidence that vegetables and fruits protect against the most important diseases including cancer, coronary heart disease, birth defects and cataracts. This underscores a natural, yet rational and scientific preventive approach to life and living.

A basic knowledge of the laws of physiology and the systems of the body are essential to live a reasonable life and thus make responsible personal choices essential to one's life and

health. These laws of physiology imply cause and effect and disregard of these has consequences. Thus prevention in effect signifies obedience to the laws of science, both natural and revealed (Ford 1987:825). Physicians who subscribe to a holistic approach view the body as a harmony of interacting processes rather than the compartmentalised, specialisation view of a body part (Trowbridge & Walker 1986:79).

Cousins (1983:229) concludes:

> If it is true that nothing is more striking about how the human body functions than its regenerative drive, it is also true that the regenerative drive works better under some circumstances than others. What we think, what we believe, what we eat and what we do with our bodies are all involved in the circumstances of regeneration.

2.5.2.2 Aetiology (origin) of disease

Based on the assumptions discussed above, the rational therapy explanation of disease is broader than the limited, bio-medical explanation of the germ theory. The emphasis is on the support of the individual by means of rational, sensible lifestyle choices, of his/her immune system's state of well-being. Scharffenberg, in Nedley (1998:xi) states that it is possible to reduce the risk of coronary heart disease by 90% and cancer by 80%.

Therefore any technique to assist the body to prevent disease and maintain good health is to be used wisely. Natural, scientific, simple remedies can help to strengthen the immune system when compromised. Remedial agents must benefit the system and provide aid to the body with the least expenditure of energy. Invasive techniques and the use of toxic agents are considered to burden the system and weaken the vital immune system further.

Trowbridge and Walker (1986:78) suggest that the physicians practising orthodox medicine prescribe medications and therapies for 'correcting' and pushing laboratory tests towards

normal and to resolve and often cover up symptoms of illness rather than identifying the origin of these symptoms. Dr Hyde, as interviewed by Rydzewski (1998:29), observed that people do not get better with medicines that treat symptoms. The medicines just maintain them. "It dawned on me that I was not helping and maybe harming" (Rydzewski 1998:29). There is a real conflict between the wholistic concept of health care and the 'band-aid' approach. Ironically, the body's systems function to maintain the equilibrium and therefore symptoms that are manifested are evidence of nature's effort to correct a problem, restore the internal balance, expel poisons in the system and/or in any way throw off an offending cause. There is a ceaseless effort of the total organism to save the vital organs (Weil 1996b:6).

2.5.2.3 Disease or dis-ease

Disease never comes without a cause. The way is prepared, and disease invited, by disregard of the laws of health resulting in a weakened immune system and its natural defences. This results in a build up of toxic impurities within the system, and it is these impurities that foster germs, while our weakened immune system is dysfunctional. Nature bears abuse as long as she can without resisting and then tries to rid the body of toxins through various means such as headache, chills, fevers, nervousness, paralysis. This means that our first priority in the treatment of such 'complaints' should be to remove the underlying cause, which is generally the 'diseased' state of the system.

Therefore dis-ease is an effort of nature to free the system from these conditions and is beneficial rather than harmful. The body can repair itself with a healing system that continuously operates to maintain health. This healing system can recognise damage and remove that which is damaged and replace it with normal structure (Weil 1996b:75).

2.5.2.4 Focus on agents that assist the body

E.G. White discussed a formula for personal healthy living as follows: "Pure air, sunlight, abstemiousness, rest, exercise, proper diet, the use of water, trust in divine power - these are the true remedies. Every person should have a knowledge of nature's remedial agencies and how to apply them" (White 1942:127). It is within the last thirty years that most of her recommendations, cautions and warnings have been verified scientifically and not been refuted (Nedley 1998:537). The acronym NEWSTART (nutrition, exercise, water, sunshine, temperance, air, rest and trust) has been used by advocates of the Seventh-day Adventist lifestyle programs for both prevention and therapy (Foster 1990:25).

In a book review (the 25 best books 1996:130) of Jethro Kloss's *Back to Eden* in *Natural health* it was stated that "[t]here is a crying need for an old-fashioned remedy book that people can use themselves. *Back to Eden* prescriptions survived modern medicine". Current scientific research is disseminating information on the significant role of these 'true' remedies which are simple, affordable and accessible. Hyde, in the interview with Rydzewski (1998:29) stated that the trend is to de-emphasise hospital-based medicine and rather have small centres doing lifestyle-oriented treatment and education which implies rational therapy such as hydrotherapy, diet, exercise, rest and sunlight.

In discussing the changes in medicine today Hyde (Rydzewski 1998:29) sees natural remedies escalating to a point that startles conventional medicine. He remarks on the current broadening of the base. This viewpoint is significant to this study as the body of knowledge that is to be gathered and identified must include sources that scientifically reinforce the use of these agents. This information must be found and evaluated for inclusion in the database being designed.

It is important to identify the cause of disease and not merely treat the symptoms with drugs. The symptoms may have been alleviated. However it is the patient as a whole human being and not the disease that is to be treated. There is in nature no antidote for the transgression of physical laws. "'If in doubt, cut it out' is no longer acceptable to either the surgeon or his/her patient as they realise that they are more than a 'collection of body parts'" (Smythe 1994:xvi).

2.5.2.5 Focus on the whole person

Cousins (1983:229) suggests that the individual presides over the totality of himself or herself. From his own personal experience backed up by years of research on the role of positive emotions in the chemistry and functions of the body, he emphasises the relationship between the physician and the patient. Medical treatment is not limited to repairing damage but is also concerned with hope and quality of life (Cousins 1983:236).

> The wholistic physician dispenses humanistic medicine that is more person-oriented than disease-oriented. Treatment programs arise from the idea that health care should take full consideration of human needs and be humane in attitude, ethic and behaviour (Trowbridge & Walker 1986:79).

Nedley (1998:1) suggests that the belief that inherited traits (ie genetic factors) primarily determine one's quality and length of life is erroneous. He postulates that there are two factors that our health is primarily dependent on, namely, what we put into our bodies and what we do with our bodies. These concepts are encapsulated in the concept 'lifestyle'.

2.5.2.6 Lifestyle and responsible, rational personal choices

There is a wealth of scientific research that has confirmed that most of the leading causes of death are preventable (Nedley 1998:2). Every individual needs to be responsible for his/her own health. By making informed lifestyle choices individuals can prevent disease and

maintain health. When disease occurs sensible, rational choices can be made as to appropriate methods of therapy and treatment. God has given man laws for a healthy life, for example, nutrition, exercise, use of water, rest, sunshine and air. These simple 'prescriptions' for health are found in many current information sources. In the article entitled 'what is health promotion?' (1997:15) *Masiphile* identifies the need for information for informed choices on the use of wholefoods. Weil (1996c:136) believes that lifestyle significantly influences people's risks of contracting common diseases and certainly affects the ability to heal. He states: "Of all the choices we make, those concerning food are particularly important, because we have great potential control over them". Over the last twenty years the benefits of exercise in preventing disease and contributing to overall well-being have become increasingly recognised. Like diet, exercise is one of the most important factors in healthy living. Exercise is also an important treatment in any program that reverses heart disease and diabetes (Ornish 1990:324).

Streit (1996:22), the editor of health news in *Natural health,* refers to the importance of negative ions in the air. Although little is known about how negative ions affect the central nervous system, researchers at Columbia University and the New York State Psychiatric Institute recently found more evidence of the positive influence of these ions. The researchers tested the effects of negative ions on patients with seasonal affective disorder and found that a half hour of exposure reduced symptoms and elevated mood in more than half of the participants. This type of information reflects the simple, natural, yet scientific approach of rational therapy.

Thomas Edison, as quoted by Ford (1987:iv) said: "The doctor of the future will give no medicine, but will interest his patients in the care of the human frame and in the cause of and prevention of disease". By the right use of the will an entire change may be made in the lifestyle. It means using the power of choice and making informed decisions. Through the use of information proper choices can be made, health principles can be discovered and

followed and disease not only be prevented but many individuals will be able to regain lost health (Nedley 1998:xi). Breslow and Enstrom (1980:483) note the relationship between ways of living and health. By means of research he supports his hypothesis that following good health habits favours longevity.

2.5.2.7 Health information and health education

If the physician and individual are in partnership for the sake of maintenance of health and well-being then there is a need for relevant, credible information which can be shared and used.

> The wholistic doctor is a health educator, a facilitator of the healing processes. He recognises that his function is not merely that of clinician and scientist but also that of physician-teacher (Trowbridge & Walker 1986:80).

HP is a broadening of the concept of health education. It attempts to establish the importance of information and the activities that contribute to better health (Ewles & Simnett 1996:22). This information facilitates the process of HP.

In conclusion, rational therapy is an approach based on a holistic perspective of health, integrating prevention and rehabilitation. The concept of 'rational' must be supported from a scientific, natural, simple basis which is affordable, accessible and supports the HP initiative of empowerment, enablement, advocacy and mediation in strengthening the community action. Therapy is not limited to treatment but in the context of rational therapy there is an overlap between those factors which support both a preventative and rehabilitative approach.

There is the recognition of the importance of the laws of physiology in a systematic approach and the importance of support rather than intervention for the maintenance of health and well-being. Rational therapy supports scientifically proven natural means to prevent disease

and maintain and restore health. It considers the epidemic of diseases in which lifestyle is significantly implicated. The role of personal choice in prevention of these diseases is highlighted. Hyde, in the interview with Rydzewski (1998:29), states that his purpose is to educate and meet people where they are. This is the over-arching objective of the rational therapy approach. Therefore the significance of information and the provision of information to support and undergird this approach is a high priority.

2.6 RATIONAL THERAPY INFORMATION INFRASTRUCTURE

A brief discussion of the information infrastructure in general is necessary to guide the discussion of the rational therapy information infrastructure.

2.6.1 Information infrastructure

Information is closely tied with progress, development, productivity, cultural development and education. A well-functioning information society is dependent on the organisation, use of and dissemination of information in an efficient way. Information is essential to complete the complex and diverse tasks of an information society. Therefore an information society cannot exist without an efficient and functional information infrastructure. An infrastructure refers to the "basic structure" of an organisation and the various services of a community such as transport, sanitation, electricity, roads, schools et cetera. All of the various sub-structures and organisations, including its expertise and manpower, must be organised to make data/information available for informed decision-making and the dissemination thereof and to complete tasks (Boon 1981:109).

The function of the information infrastructure is to generate information as a national resource and to provide channels through which research (Boon 1981:109). From the literature survey

(Alemna [1998], Atherton [1977], Boon [1981], Health Systems Trust [1995], Mansell & Wehn [1998]) the following are identified as some of the components of an infrastructure:

- various resources of information such as libraries and information centres
- management information systems
- computer databases
- information-generating organisations, for example agencies, research bodies
- retrieval tools
- networking both internationally and nationally with experts and professionals
- institutions such as health care providers and centres and health product outlets
- the users of the various resources
- the specialist information scientist who has the knowledge and expertise to combine all of these components into a system to manage the information
- mass media
- resources from the State health department
- regional and local clinics
- health promoters and community health workers.

The main autonomous statutory research organisation in South Africa is the Medical Research Council (MRC) whose main purpose is to co-ordinate all medical and associated bio-medical research through the country. The MRC is assisted by advisory and co-ordinating committees in the fields of the basic medical sciences, clinical science and public health. The MRC is empowered to cooperate with government departments, provincial administrations, universities, colleges, scientific institutions and individual researchers to advance research in the medical sciences. In addition to their research initiatives, one of the MRC's major tasks is to ensure that the medical community, both nationally and

internationally, is kept informed of the latest developments. The Minister of Health and Welfare is also advised on the implementation of scientific research results.

The services provided by the MRC include a Medical Information Dissemination System, the South African Medical Literature Database, training in information retrieval, exchange of knowledge, statistics information service, research and publications. This body is believed by the researcher to offer potential for research initiatives and co-operation in the field of PHC and specifically the rational therapy approach as their current research thrusts and activities are concerned with issues of a PHC nature.

These research thrusts and activities include: nutrition; the prevention, management and impact of human immunodeficiency virus, sexually transmitted diseases and tuberculosis; the relationship between health and development; monitoring, preventing and treating infectious diseases; the provision of accessible and affordable emergency services; research into chronic diseases, ageing and cancer; oral and dental health; the promotion and improvement of child and adolescent health; the physical, mental and social ill health and well-being of women and fertility; mental health; substance abuse and lifeskills. Bridging thrusts include the development of model systems for improved collection of health information; funding, conducting, co-ordinating and disseminating health systems research and HP research designed to improve the health and well-being of the South African population. Accurate and up-to-date information is vital for decision-making, policy formulation and infrastructure development (Medical Research Council 1998).

2.6.2 The contribution of rational therapy resources to the information infrastructure

Helderberg College Library is a resource that can make a contribution to the information infrastructure of South Africa, with specific reference to the health information infrastructure.

It houses a collection of relevant information on the rational therapy approach. It has Internet access and e-mail contact with health professionals who are engaged in research both on a national and international level. Its personnel are trained as information professionals and some are trained in the rational therapy approach.

The HP department at Helderberg College has lecturers who are constantly developing their resources of information on the rational therapy approach for the purpose of lecturing to students, at seminars and workshops. It has students who complete research projects and who in their practicum experiences collect information from their contacts with health professionals involved in PHC. Contact has been made with the Director of HP in the Department of Health and recognition has been given to the approach being used. Formal communication channels for information or resources on the rational therapy approach include: Ministry of Health communiqués; MRC; Medline; Health Sciences departments of universities; regional Department of Health resource centres; Internet; bibliographic retrieval tools such as catalogues, databases. This includes computer links that facilitate interpersonal communication with experts and also provide opportunities for accessing research and other databases to find relevant information. Informal communication channels include: networking; television programmes; contacts; friends/family recommendations, referrals, advice; informal (invisible college) sharing of knowledge and information by health professionals; and browsing in bookshops.

These are potential sources of information or entities the proposed database could include. This has been reinforced by the researcher's experience in the Helderberg College Library, from literature surveys and from contact with various user groups. These sources include books, periodical articles, periodical titles, newspaper clippings, CD-ROM, videos, conference proceedings, audio tapes, posters, pamphlets, study papers, Internet addresses, Internet web pages, names, addresses and speciality of various persons or organisations who may be

consulted, research papers and resource files. The different media type will have implications for design and will be discussed further in Chapter four together with user requirements for media types.

A significant issue is the selection of different resources which reflect the rational therapy approach. In summary the following basic tenets will form the framework for evaluating the information resources to be included in the database:

- rational therapy assumes a natural, scientific approach to life, health and healing
- rational therapy considers the aetiology of disease to include lifestyle choices which has implications for prevention of disease
- rational therapy attempts to identify the cause of disease and emphasises an understanding of the laws of physiology
- rational therapy focuses on agents which are scientifically proven to assist the body in prevention, therapy and maintenance of health
- rational therapy forms a wholistic approach, focusing on the whole person and the interrelationships of factors that contribute to health and/or disease
- rational therapy identifies the importance of making informed lifestyle choices in the prevention of disease
- rational therapy emphasises the importance of health information and the role of health education

It is believed that all of the potential sources of information or entities listed above that meet the criteria of the rational therapy approach identified above are components of a rational therapy information infrastructure that can be made available to the NHIS/SA by means of the proposed database for rational therapy. A search of the Department of Health's web page conducted by the researcher revealed in the NHIS/SA section on *Health information*

evaluation and research/operational and technical policy, that it is one of its goals to establish an information network which could include the database under discussion (Chief Directorate: health information evaluation... 1999).

In conclusion the activities of the Helderberg College Library which are focussed on the selection, acquisition and organisation of health information specifically from the rational therapy approach can make a significant contribution to the national health system and to PHC in South Africa. The contribution to the information infrastructure, particularly a health information infrastructure will be in the form of a database of resources. Its purpose will be to make information or information about entities available for effective decision-making and to enable the accomplishment of tasks by specific user groups. Various health institutions overseas utilise this rational approach to health (especially in United States of America) and employ full-time researchers to scour the literature for information and resources that support this approach with scientifically proven research. Authors are researching and publishing various works such as books and periodical articles which reinforce this approach. It is hoped that by the design of a database of resources for rational therapy attention will be given to this important, rational, common-sense approach to health and disease. Some of the subjects that will need to be covered include alternative, holistic, complementary health, health and healing, NEWSTART, lifestyle medicine, disease, prevention and cure et cetera.

2.7 CONCLUSION

The intention of this chapter was to define and discuss the concept 'rational therapy' within the context of PHC. The discussion has highlighted that this research is both timely and important because of the current emphasis and transition towards a PHC approach in the Ministry of Health and the health care system in South Africa. The MRC is calling for research to identify and disseminate information on the relationship between lifestyle,

prevention and intervention which are essentially the focus of the rational therapy approach. The State is also concerned that various information sub-structures be included in the NHIS/SA. Therefore the database to be designed should form an integral part of this initiative and could make a significant contribution to the development of an information infrastructure in the health sciences, the Ministry of Health and the health care system of South Africa. This supports the policy of the State and its RDP initiatives with regards to health. Rational therapy can make a contribution to the broadening of the base of the conventional, bio-medical model by offering its own distinctive ideas about the prevention and promotion of health rather than concentrating solely on the symptoms of disease and medical intervention techniques. Therefore in the selection of resources all pertinent information which highlights the role of lifestyle choices constitute the resources which must be considered for inclusion in the database. This is the focus of Chapters four and five.

CHAPTER THREE

DATABASE DESIGN

3.1 INTRODUCTION

Chapter one served as an introduction to this study of the design of a database of resources for rational therapy. The current need for this study and its relevance in South Africa was briefly discussed. Chapter two focussed on a definition of rational therapy. The relevance and place of rational therapy in primary health care (PHC) in South Africa was discussed to delimit the scope of the database which is to be designed. This also aided in the determination of the rational therapy information infrastructure.

The design of a database for rational therapy as a significant aspect of a PHC information system and the steps involved in this design are integral parts of this study. As a result of a discussion of the theory of both the design process and the importance of a model, a model for the design of a database is presented in this chapter. This model forms the conceptual basis and includes the steps that constitute the blueprint for design of the database under discussion.

The information system within which the database is positioned and functions forms the basis for the discussion of this chapter. A definition of the term 'database' will be formulated from a literature study and the database life cycle enumerated. The objectives of and approaches to database design as well as the methodology and steps involved in design will be discussed as they impact on the model developed for this study. Since the database must be positioned within an information system, the concept of information system must be clarified.

3.2 THE INFORMATION SYSTEM

Aspects of the information system include 'system', 'environment' and 'information'. The term 'system' is a generalised description of a wide variety of phenomena. A system occurs in a

specific environment and the environment comprises many systems. The constraints and opportunities of the specific environment impact on the system even though the environment lies outside of the system (Walker 1993:9). A system is comprised of components (eg entities, entity store or database and processes) (see section 3.2.1) which interact for a desired result.

Fidel (1987:7) suggests that it is important to look at the environment and enterprise to clarify specifications. For the purpose of this study 'enterprise' would be the data stored relevant to the subject rational therapy. The 'environment' refers to the user groups, or people representing multiple environments, who will make use of the database or information system (see section 4.4.1.1). The environments are defined by the roles or tasks performed by these people (see section 4.4.1.2). In the environment data needs to be shared and integrated, that is consolidated. Therefore different data stores (according to user requirements) are put into one store hereby eliminating redundancy (Fidel 1987:7). By means of consolidation therefore the same data may be stored for various environments but the information may be looked at in completely different ways by the different user groups within the relevant environments. In this study Health Promotion (HP) lecturers and HP students require rational therapy information for different purposes and therefore will look at the information differently.

Information must be clearly differentiated from data on the basis of form and content (Soergel 1985:17). Data is bare facts or raw unprocessed information or facts. Data may be items about people, places, events or concepts which is then stored in a database. Information is data arranged in a meaningful form (Behrens 1994:124). In computing terms this data is information symbolised (ie in a particular form) so that it can be read by a computer. Information is then derived from the stored data by rearranging, selecting, combining, summarising or performing other operations on the data (Ricardo 1990:53). Rob and Coronel (1993:622) state that information is transformed data, namely messages, which have the potential to support decision-making.

Therefore an information system is a particular type of system, a coherent, functioning system in itself, but should also be seen in the context of a wider information transfer network system. For the purpose of this study, the database under discussion could be seen in the context of the wider national health information system of South Africa (NHIS/SA) as well as the information infrastructure for rational therapy discussed in Chapter two (see section 2.6). The design of a database for rational therapy is seen as a potential solution to the problems introduced in the PHC approach in Chapter one with special reference to rational therapy as an approach in PHC.

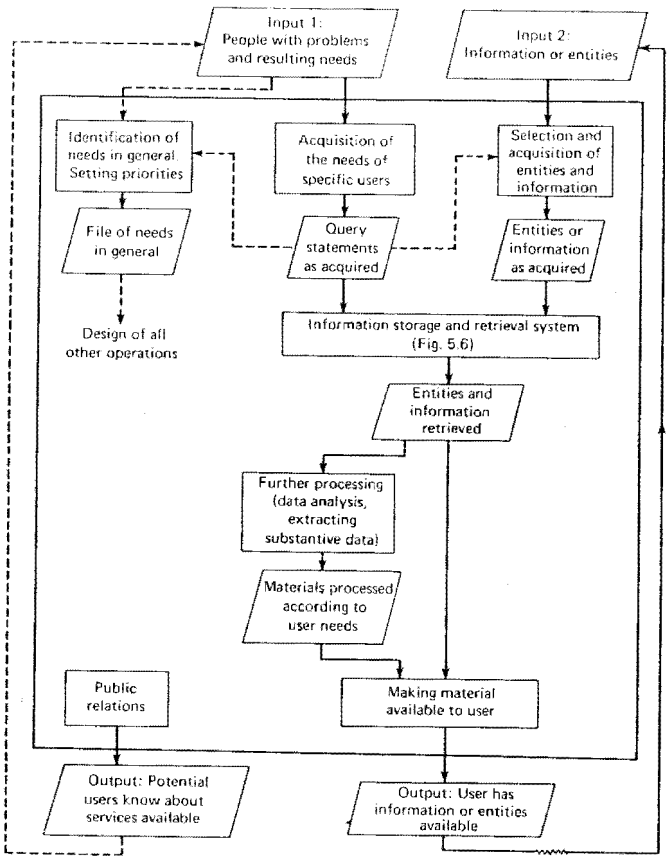
It is the function of the information system to supply the user with the information needed so that user problems can be solved (Soergel 1985:4). These problems could include the lack of information on rational therapy within the PHC approach; the lack of an organised collection of information for rational therapy; the absence of a database of resources for rational therapy, et cetera (see section 1.2). Information systems therefore serve to collect, manage, control and disseminate information for use in problem solving.

The capacity to synthesise data and provide information is rooted in the design of the information system and specifically in the design of the database. In order to develop a model for design, the components of an information system must be identified.

3.2.1 Components of an information system

The components of an information system are depicted in Figure 3.1: acquisition of needs (Input 1); acquisition of information or entities (Input 2); information storage and retrieval system (ISAR) and processing components which make information and information about entities available to the user (Output) (Soergel 1985:41).

Figure 3.1 The structure of an information system (Soergel 1985:47)



In this study the preferred term is 'requirements collection and analysis' (eg Connolly, Begg & Strachan [1996:125], Kroenke [1995:212]) thus replacing Soergel's (1985:41) concept of 'acquisition of needs'. The components of the information system are governed by the objectives that the system is aiming to fulfil and are influenced by the external environment within which the information system operates (Walker 1993:9). In the requirements collection and analysis phase of design 'needs' are identified which are later translated as query statements (see Figure 3.1). Requirements collection and analysis is the focus of Chapter four.

Soergel's model identifies Input 1 and Input 2 in an information system. Input 1 refers to people with information requirements or problems who require information to solve these queries. Input 2 refers to information and information about entities to be found outside the system in the wider information infrastructure. Input 1 is formulated into query statements which reflect the actual requirement of the user perceived by him/her as a problem. For example, do you have

information on a natural, simple, first-aid remedy for snakebite? By means of a query the user is linked to relevant, current information from Input 2 by the ISAR system. Input 2 consists of entities and information about entities. The ISAR system matches the two inputs in a structured way according to pre-established rules and system conventions.

The output of the information system refers to a change in a person's information need. He/she now has the required information or entities containing the information. In relation to rational therapy, output could, for example, facilitate the decision-making process of the user who has a query relevant to his/her personal health, for example, charcoal is a remedy for snakebite. Soergel (1985:42) states that this result may lead to a change in the need, for example the user's query thus may broaden or become more specific influencing the problem and resulting needs. This will influence Input 1. This process could lead to a change in Input 2 in which the user becomes aware of new information and new entities. This could thus influence the information and entities found outside the system (eg charcoal can be used as a first-line defence against poisons in general) (see section 3.4).

The information system also has a life cycle which is inherently linked to the life cycle of the database (see section 3.3.2) that supports it (Connolly *et al* 1996:124). A brief discussion follows.

3.2.2 Life cycle of an information system

Not only does an information system have a life cycle but so too does the ISAR or database as a component of this information system (see section 3.3.2). It is very difficult to divorce database design from the larger information system design and life cycle and vice versa as the design of a database takes place within the constraints of the wider information system (Rob & Coronel 1993:234). Therefore the phases of this iterative life cycle must be introduced to place the database design in context (Rob & Coronel 1993:234). Many authors (eg Hawryszkiewycz [1991], Rob & Coronel [1993], Rowley [1996], Soergel [1985], Vickery & Vickery [1992]) outline

the life cycle phases. The researcher has chosen to follow the approach used by Rob and Coronel (1993:234) who divide the systems development life cycle into five iterative phases:

- *Planning*

  Includes a general overview of the current system, objectives are defined and a feasibility study is done.
- *Analysis (requirements collection)*

  In which problems are examined in greater detail, user requirements are examined in detail, existing hardware and software systems are studied, expected output requirements, inputs, processes and the appropriate conceptual data model are specified and all entities, their attributes and the relationships among the entities within the database are discovered and described.
- *Detailed systems design*

  In which the processes of the system are completed.
- *Implementation*

  During which the hardware, software and operating software are installed and database design is implemented.
- *Maintenance and evaluation*

  Occur on an ongoing basis.

A subsystem or component of the information system is the ISAR.

3.2.3 Information storage and retrieval (ISAR) system

Any formal search for information involves some interaction with the ISAR component of an information system (Walker 1993:9). The ISAR is a system in itself and includes the database which stores the entities or information about entities (Soergel 1985:59). The typical components of an ISAR system consist of inputs and outputs, the matching mechanism (including the database) and a series of activities. These include the selection of documents,

conceptual analysis of documents, organisation of document representations, storage of documents, conceptual analysis of queries, matching of documents and queries, and delivery of documents (Walker 1993:9). The structure of the ISAR is depicted in Figure 3.2.

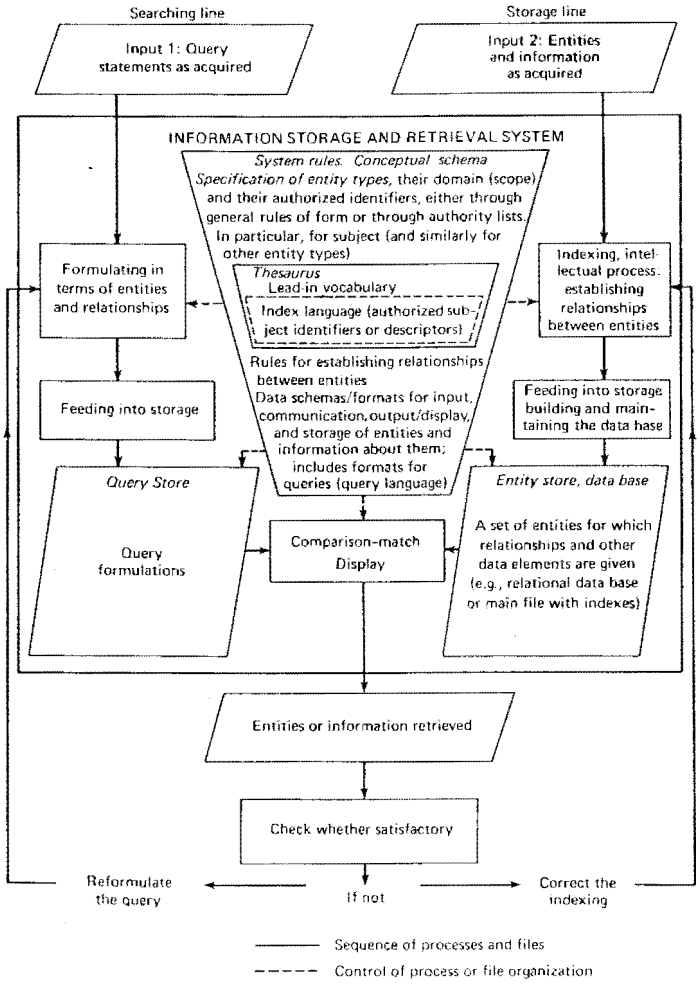
The ISAR system has two inputs. Input 1 is query statements in which descriptions of the information or needed entities are formulated. Input 2 refers to the entities or information about entities as acquired (see Figure 3.2). Entities can include reports, periodical articles, people, books, et cetera. Once these two inputs have been brought to the system they must be matched. The task of the ISAR system is to match these two inputs.

The output of the ISAR system consists of entities (eg books, periodical articles) or information about entities and their relationships (eg the bibliographic description of books on the subject cancer). These outputs, or responses to queries and factual answers to queries hopefully will solve, or assist in solving the problem that gave rise to the query (ie user requirement satisfied) (Soergel 1985:57).

Database design is based on decisions made about the ISAR system. The entity types determine the system rules and conceptual schema. Based on the information about the information infrastructure (see Chapter one) and the ideas that are to be gathered from the requirements collection and analysis in Chapter four, the scope of the database will be determined. The relationship between entities as well as the data schema or data structure must be identified. This is the focus of Chapter five. This will influence the input format as well as the output format.

Soergel (1985:17) suggests that a database is the heart of the ISAR system, consists of information stored, is a component of the information system and therefore is a database.

Figure 3.2 The structure of an ISAR system (Soergel 1985:58)



3.3 THE DATABASE

It is important to discuss the concept 'database' in order to arrive at a definition that will facilitate a clear understanding of what a database is, how it fits into the larger information system and the types of database available for different purposes.

3.3.1 Definition

Wertz (1992:1) sums up the potential confusion about the concept 'database' by stating that there are inconsistencies in the use of terminology and a lack of clarity about the term itself and even the way in which 'database' is written, either as data base or database. Jones and Monk (1997:xi) concur that "the term 'database' has become one of the most used and abused computing phrases of modern times". In the literature study of the term 'database' this became

increasingly apparent. The difficulties due to the lack of clarity about data and information was dealt with in section 3.2. From an extensive literature survey a comprehensive definition of 'database' will be formulated by focussing on the following authors: Behrens (1988), Bopp and Smith (1995), Bradley (1997), Connolly *et al* (1996), Elmasri and Navathe (1989), Fidel (1987), Jones and Monk (1997), Kroenke (1995), Pratt and Adamski (1994), Rob and Coronel (1993, 1995), Soergel (1985), Tenopir and Lundeen (1988), Walker (1993), Wertz (1992) and Willitts (1992).

According to Fidel (1987:5) a 'database' is "a store of data about a selected part of the real world that is intended to be used for particular purposes" and therefore is designed, built and loaded for a specific purpose. This database, as defined by Fidel (1987:5) differs from other data stores in two ways. Firstly, the data stored have to be about a part of the real world, called the enterprise, that is represented in the database. Secondly, the data are stored to answer information needs arising for particular purposes, each purpose defining a particular environment (user group) of the database. A database is also a common pool of shared, logical, interrelated data, where each item of data is stored only once. Connolly *et al* (1996:14) state that the purpose of a database is to "meet the information needs of an organisation". The 'organisation' would be Fidel's (1987:7) 'enterprise' as explained in section 3.2.

Soergel states that a 'database' is a system of one or more relations or files and can be defined independently of the storage mechanism. The connotation is that these relations are stored in machine-readable form, the database being an entity store; storing entities or information about entities (Soergel 1985:207). According to Kroenke (1995:13) a database is self-describing, providing data independence, which, in addition to the user's source data contains a description of its own structure; is a collection of integrated records and is a model of a model. Pratt and Adamski (1994:9) refer to this source data as 'entities'. These entities are connected through relationships (Soergel 1985:23). A database is a structure that contains entity sets and the relationships between these entity sets.

Rob and Coronel (1993:233) define a database as being a carefully designed and constructed repository of facts which is part of a larger whole, that is an information system, which provides for data collection, storage and retrieval and facilitates the transformation of data into information. The database is part of an information system. Further, the information stored in an information system is called a database (Soergel 1985:17). Therefore, in a broad sense 'database' may be construed as being synonymous with information system, or more narrowly as referring to the entity store of an ISAR system.

Elmasri and Navathe (1989:3-4) define a database as a collection of logically related data, that is known facts, that can be recorded and which have implicit or inherent meaning. According to Willitts (1992:9) this collection of data is accessible to multiple users and multiple programs, maybe even at the same time. The data in a database is arranged to facilitate some set of activities so that it may be accessed and altered in an efficient manner (Wertz 1992:1). Wertz (1992:2-3) lists some properties that a good database should possess which also help to clarify what a 'database' is: the elimination or minimisation of redundancy, data independence, consistency, ease of integration and sharing, logical organisation to simplify retrieval and maintenance by relationships.

A database as a format for information can be either manual or computerised. Behrens (1988:124) defines a database as "an organised collection of information which has been stored as electronic impulses". Walker (1993:1) identifies the database as the heart of the online retrieval system that is available for searching for the information that it contains. Tenopir and Lundeen (1988:1) define a database as a collection of computer searchable textual information or a system that includes several individual files used for different purposes. Rob and Coronel (1995:2) also include the dimension of the database as an electronic data storage depot. Bradley (1997:7) states that the term 'database' refers to a collection of records stored on a computer. The electronic database expands searching capabilities and has the speed of a computer. Dynamic access points facilitate the ability to list, combine, and reorder information. Hereby storing is done in a more functional way and retrieval is improved (Kluegel 1995:86).

Arising from these various definitions and for the purpose of this study the term 'database' may be defined as having the following characteristics. A database:

- is a store or a collection of related data (or information), representing some aspect (eg entities or information about entities/descriptions of entities) of the real world
- is designed for a specific purpose (eg to meet the information needs of a specific organisation, individual user, to solve problems or to answer questions and make decisions)
- is designed to logically organise data/information to simplify retrieval and maintenance
- consists of entities (or information about entities), their attributes and the relationships amongst the entities
- describes entities consistently
- use the facilities of computer hardware and software to enhance the retrieval and storage of information.

As the information system has a life cycle, so too does the database as a fundamental component of the information system. The database life cycle describes the history of the database within the information system (Rob & Coronel 1995:274).

3.3.2 Database life cycle (DBLC)

This life cycle can be divided into six phases according to Rob and Coronel (1993:238). The database design, with its own life cycle, slots in at the analysis (requirements collection) phase of the information system life cycle. Inherent in these six phases are various steps which detail the activities undertaken:

- *Database initial study*

  Has as its overall purpose the analysis of the current situation, the definition of problems, constraints, objectives, scope and boundaries which leads to the development of the database design objectives and requirements to be met.

- *Database design*

  Which focuses on the design of the conceptual schema that will support operations and objectives. This is the most critical DBLC phase in making sure that the final product will meet user and system requirements. The definition of data and data characteristics are also an integral part of this phase.

- *Implementation and loading*

  Involves the installation of the DBMS, the creation of the database and the loading and conversion of data.

- *Testing and evaluation*

  Involves the testing of the database, making the necessary changes and evaluation of the database.

- *Operation*

  Which is the use of the database for the desired purpose.

- *Maintenance and evolution of the database*

  Is the phase in which changes are introduced and enhancements are made (Rob & Coronel 1993:238).

This research project is mainly concerned with the second phase of the DBLC, that of database design which, as a follow-on of the initial database study phase, when implemented, will hopefully meet the stated requirements for the database design. The first phase is necessary to determine the need for and the context of the database and the requirements to be met as stated by the users. The background to this project was sketched in Chapters one and two, and the user study in Chapter four will determine the requirements for design as related to the user and information needs.

There is a great range of information available to be accessed by searching in electronic format. Different databases not only contain different types of information but are also useful for a variety of purposes (Walker 1993:1). The type of database to be designed in this study will have an influence on design objectives, the model developed, the solutions chosen and will be influenced by the problems addressed in Chapters one and two and the requirements of the users.

3.3.3 Types of database

Databases may be classified in various ways (Braun 1998:xxi). One way is by form of data representation. Data may be in the form of words (word-oriented), numbers (number-oriented), images (image-oriented), or sounds (sound-oriented). Multimedia databases, combining a variety of forms, are becoming more popular and growing in number. These distinctions of form affect the file structures and software for search and retrieval; thus the structures and search techniques vary considerably among the four basic classes.

According to the *Gale directory of databases* (Braun 1998:xxv) the subject matter is usually the primary determining factor for user selection of a database. However, the form of the database is nevertheless important as Tenopir and Lundeen (1988:72) state: "one of the early decisions in design is whether to include the full text or just a bibliographic surrogate of documents in the database".

The two basic types of database which are discussed here are differentiated according to the purpose of the database in terms of user requirements; whether bibliographic control is the main aim or whether document retrieval and access to full text are equally as important.

For the purpose of this study these two types will be categorised as reference and source databases.

3.3.3.1 Reference databases

Reference databases are the most common type of database. Rowley (1996:159), as well as Bopp and Smith (1995:92), state that reference databases have as their objective to refer or point the searcher to the original, actual sources of information. Basically this type of database comprises machine-readable computer lists of indexes and abstracts covering a range of subject disciplines and areas. Some may be multidisciplinary but limited to particular document types while others may be more focussed in subject coverage but inclusive of a wide range of formats. Details included range from the minimum details required to trace the document to lengthy abstracts or summaries included with the basic reference as well as subject descriptors, et cetera. These databases may refer to articles in journals, to theses and dissertations, to books, et cetera (Bradley 1997:7). Therefore, searching a bibliographic or reference database produces document records or the surrogate of a document, not the documents themselves (Soergel 1985:208).

The reference database is therefore a bibliographic control tool to collect all available entities and information about entities into a computerised system for retrieval to solve problems as formulated by users in query statements. Analytical processes such as cataloguing, indexing, abstracting and classification are used in making the surrogate records (Harter 1986:97).

Reference databases can be subdivided into bibliographic databases and referral or directory databases and are often termed bibliographic databases. The referral or directory database provides details such as names, addresses, phone numbers and other information about individuals or organisations (Tenopir & Lundeen 1988:2). Referral databases act as pointers to further information, but can also be classified as source databases as they may contain the full-text of a directory which could then be regarded as a source document (Rowley 1996:161). The referral directory becomes part of a reference database relating people as sources of information.

3.3.3.2 Source databases

Source databases, also termed non-bibliographic databases, are different to reference databases in content, style and format (Kluegel 1995:93). These databases contain original entities, whether they are full-text, numeric, textual-numeric, et cetera and are usually of a factual nature. In contrast to the reference database where the user still has to find the actual entity wherein information is contained or stored, information is readily available in a source database (Convey 1989:10).

Full-text databases contain the entity itself and bibliographic information. This leads to the actual incorporation of the actual entity in the database, for example encyclopaedia, periodical and/or periodical article. This increases the range of material and resources immediately available for reference, for searching and/or retrieval (Rowley 1996:161). Source databases may also be numeric (statistics) or textual-numeric (statistics and text), the original material also available for perusal and use.

The most desirable bibliographic retrieval tool would be a computerised textual database or text retrieval package:

> "as distinct from database management systems which are designed to handle textual or text-based records in single, distinct databases. These may be full text documents or bibliographic records with abstracts allowing for powerful searching, use of indexes, for words and phrases within records or particular fields" (Bradley 1997:145).

However the constraints of a system such as size of computer, hardware, software, staff, time, cost, plus other factors dictate the design and set boundaries and other constraints.

In this study a reference database will be developed. Its primary aim will be to store information about entities which will refer the user to the actual entity to alleviate the problems identified in Chapter one which are to collect, organise, make available and accessible, information for rational therapy. Essentially the information and information about entities for rational therapy

will be stored in this database which functions as a bibliography or index to the contents of the collection. A computerised database facilitates the organisation of material for easy reference and retrieval.

3.4 DATABASE DESIGN

There are several questions to be asked when discussing the subject of database design. Firstly, what is database design? Secondly, what are the objectives of database design? Thirdly, are there any approaches to database design that may be adhered to? Fourthly, are there any processes or procedures that must be followed (in some sort of sequence) for a good design to be achieved? This section aims to provide answers to these questions especially in the context of the design of a database for rational therapy.

Database design, according to Rob and Coronel (1993:2) is the design of the structure, a very detailed specification, which will be used to store and manage data. A well-designed database ensures data management and is an information generator. Fidel (1987:vii) identifies four distinct functions, sequential by nature, which are involved in developing a database. These functions are analysis, design, coding and testing. During the analysis phase, the database designer defines what a database should do to make it most useful to potential users by studying user needs, or data requirements analysis and documentation. In the design phase the designer concentrates on software and hardware considerations and defines how the database will perform its tasks. Coding refers to the actual implementation of the design. Testing is carried out before full-scale installation of the database to examine how well it will perform.

In order to clarify the design process the objectives of database design must be identified.

3.4.1 Objectives of database design

There are two perspectives on the objectives of database design. The first perspective involves clearly specifying the objectives that the database is to fulfil and the second perspective refers to the objectives to be met while designing the database. Setting objectives for the design and for the database itself provide criteria for future evaluation purposes.

A very important, all-encompassing objective of database design is to design a useful database. A useful database will provide pertinent information or information about relevant entities to users for problem solving and decision-making (see section 4.4.2.3). To achieve this objective, user requirements must be determined so as to design a database that will be useful to the users. The design process undertaken must enable the design of the structure of the database, in an efficient and effective way, to provide this information or information about entities (Elmasri & Navathe 1989:457). The database, within the information system, must collect, store and retrieve data and also transform data into information (Rob & Coronel 1993:23). Fidel (1987:3) suggests that this process requires a systematic approach. This implies the procedure, methodology or sequence, which will be followed in design (see section 5.2).

Creating a database for information retrieval means the achievement of another objective, that of representing real-life objects in rigorously structured and formal terms. A further objective of design is to develop or follow a procedure to capture these 'unruly' objects, as Fidel terms real-life objects (Fidel 1987:3), so that information about them can be stored in the neatly structured and orderly database. Both the inputs and outputs of the system have to be identified. Also, entities and the relationships among entities have to be described and represented. These are very important objectives of any database design. Therefore rules and conventions to represent entities in a systematic manner must be developed so that they can be checked for consistency before data are actually collected. This is another objective of design. To achieve this the designer needs to ask questions about what should be represented, the details, that is, what the users need to know and how the items of data from different sources relate to each other.

Jones and Monk (1997:58-59) list nine objectives of database design. The design should make full and efficient use of the facilities provided in a cost-effective way to accomplish goals at a given level of quality, namely, the system should be efficient. Integrity as an objective means that the database should be an accurate reflection of the 'enterprise' it serves. Privacy and security are very important as unauthorised access and physical corruption could result in serious damage to the database. The conceptual model must be simple, that is, implementable and the database must be flexible to be able to respond to change and maintainable for the future. Significant objectives are compatibility of data for possible future merging of the database and portability, that is being able to implement the database on a variety of hardware and software.

In summary therefore, in designing a database for rational therapy, the following overall objectives must be achieved:

- determine user requirements for design (problems, needs, questions to be answered, entities required, information about entities required)
- design a useful database which will provide information or information about entities to users for problem-solving and decision-making
- ensure the design of the structure of the database will result in an efficient, effective manner of operation
- collect, store and retrieve data and transform data into information
- employ a systematic approach to design
- determine inputs and outputs
- represent the real-life objects in rigorously structured and formal terms
- develop a procedure to represent entities
- represent entities and relationships among entities
- develop rules and conventions to represent entities in a systematic manner

- specify a design that will achieve the stated performance requirements for the system as listed by Jones and Monk (1997:58-59)

3.4.2 Approaches to database design

There are two basic approaches to database design: top-down and bottom-up. Top-down design starts by identifying the data sets and then defines the data elements for each of those data sets. This involves the identification of different entity types and the definition of each entity type's attributes. Bottom-up design first identifies the data elements and then groups them together in data sets. Attributes are defined and then grouped to form entity types (Rob & Coronel 1993:264). Wertz (1992:18) recommends using a combination of the two approaches and this will be the approach followed in this study.

3.4.3 Methodology and steps of design

The earliest step in design is the intuition of the information scientist who recognises a need for an ISAR system. A purpose is identified. Methodology assumes a systematic approach to answer the questions that have been raised and which have given value to the potential use of a database. Fidel (1987:3) suggests that this approach "provides an orderly and comprehensive check and refinement on personal intuition". Wise planning is essential to undergird the design process.

Methodology has to do with rules and postulates and involves recommendations about places, sub places and tasks (Rowley 1996:202). It has to do with the right sequences, the people who should perform each task, the documents for each place and management, planning, control and evaluation of developments. This infers a procedure that can be followed and a framework within which the 'real-life objects' can be represented in 'rigorously structured and formal terms', that is a database (Fidel 1987:3). The methodology to be followed in this study therefore has to

be outlined. It is believed by the researcher that this systematic approach to database design can best be outlined in a model for design which is the focus of section 3.5.

The literature study undertaken to determine the steps in the design process included the following authors: Connolly *et al* (1996), Elmasri and Navathe (1989), Fidel (1987), Green (1996), Kroenke (1995), Rob and Coronel (1993, 1995), Soergel (1985) and Wertz (1992).

Their versions of the steps are compared in Table 3.1. Elmasri and Navathe have been grouped with Connolly *et al* (1996) as they list the same steps in design. The steps that are deemed relevant to this study will be discussed in section 3.5 and will form the basis for the proposed model.

Requirements collection and analysis is generally seen as an integral part of the general information system life cycle rather than part of database design *per se*. However requirements collection and analysis is a very important step preceding the actual design as it forms the basis for design and therefore is included as a step by various authors. This will be elaborated on in Chapter four. The entire focus of the design process is placed on the user, on data and their characteristics and interrelationships which are determined in the conceptual schema. There are various perspectives on conceptual, logical and physical design as can be seen from Table 3.1. They may be viewed as separate steps which logically follow on from each other. Another view is to have conceptual design as one step, followed by a combined logical and physical design step. The conceptual design step may be included with the logical design step and termed logical design followed by the physical design step (see section 6.4.2).

For the purpose of this study conceptual design will be viewed as a separate step in which the logical content of the database and the system rules will be determined. Logical and physical design and the associated choice of software will not form part of this study.

Table 3.1 Steps in design

Connolly *et al* (1996:125)	Fidel (1987:9)	Green (1996:208)	Kroenke (1995:212)	Rob & Coronel (1995:244)	Soergel (1985:381)	Wertz (1992:19)
1. Database planning	1. Study of the problem (requirements collection, analysis)	1. Requirements analysis	1. Requirements definition	1. Database initial study	1. Determine user requirements & abilities	1. Identify a problem & propose a solution
2. Systems definition	2. Representation of data in formal terms	2. Conceptual database design	2. Tentative logical database design	2. Conceptual design	2. Develop the collection & obtain relevance judgements	2. Draft a plan
3. Requirements collection & analysis	3. Selection of rules for data collection	3. Choice of a database management system	3. Review logical database design in light of requirements & make required changes	3. Logical design	3. Design & construct the ISAR system	3. Research the existing situation
4. Conceptual design	4. Steps 2 & 3 create conceptual schema	4. Data mapping into a logical database design	4. Convert logical design to physical database design	4. Physical design	4. Operate the ISAR system	5. Identify entities, relationships & data elements
6. Logical design		5. Physical database design	5. Implement the database with software	5. Implementation and loading	5. Evaluate ISAR system performance	5. Identify user views and elements contained in user views
6. Physical design		6. Database system application		6. Testing and evaluation		6. Modify the entity model as required
				7. Operation		7. Re-evaluate & redefine if necessary
				8. Maintenance and evolution		8. Develop the details of the proposed solution
						9. Normalise the result
						10. Determine data volumes & accessing patterns
						11. Complete final database design
						12. Complete technical design & programming
						13. Conduct testing, documenting, data conversion, training and implementing

3.5 MODEL OF DATABASE DESIGN FOR THIS STUDY

The model proposed in this study (see Figure 3.3) is a reflection of the significant concepts involved in design as identified in Table 3.1. It is largely based on a combination of the design steps of Fidel (1987:9), Soergel (1985:381) and Wertz (1992:19).

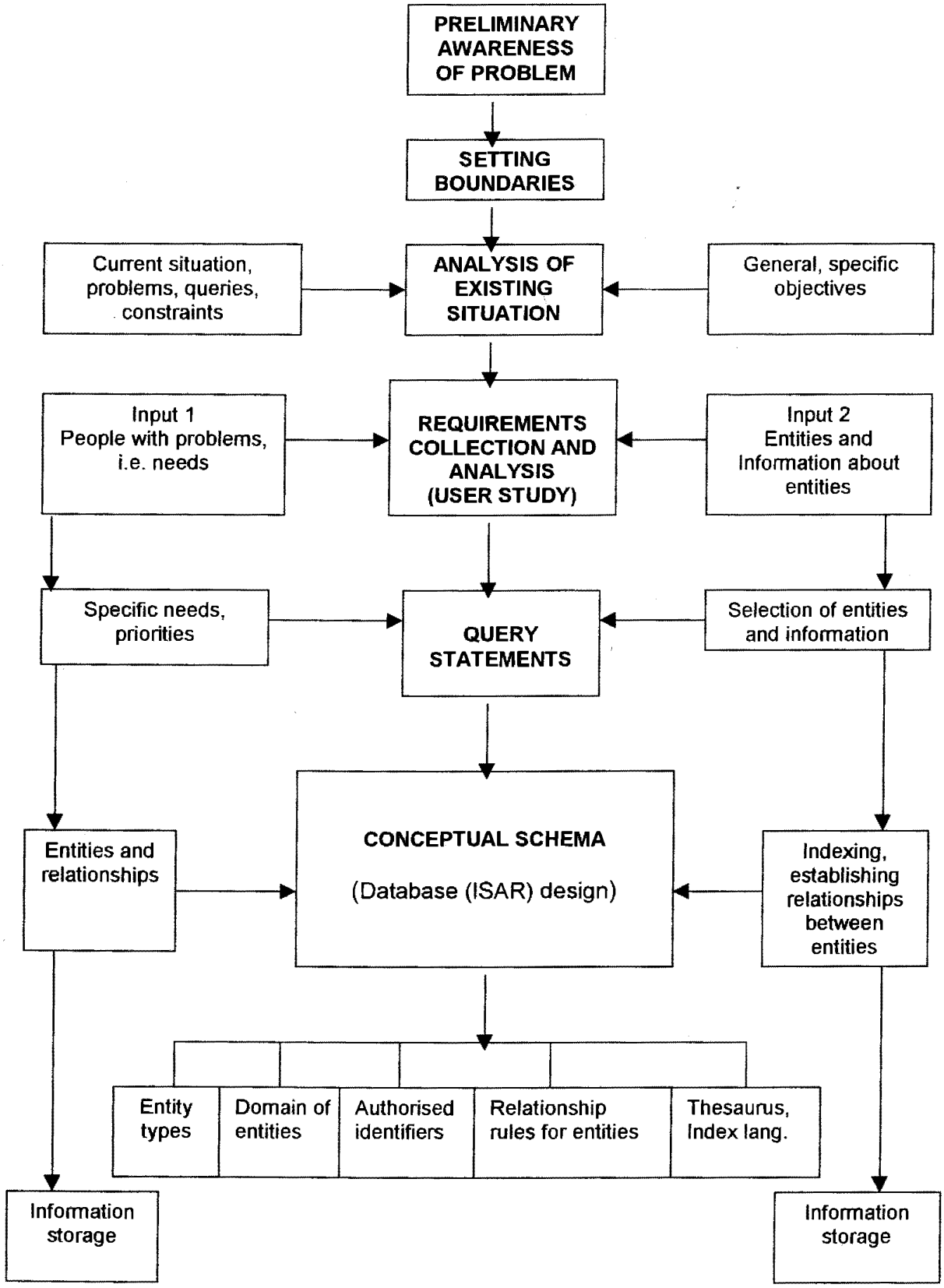
The key concepts in this section of the chapter, namely 'design', 'model' and 'database' give direction to the intent of this section and ultimately serve as the basis for this study. 'Design' refers to the steps involved in planning or constructing something. A design is a preliminary plan or sketch. It has purpose or intention (*Reader's Digest Oxford complete wordfinder* 1993:391). A model of a process is a simplified description in diagrammatic form and is used as a way of summarising and explaining relationships or of predicting the outcomes of a given situation (Morgan & Welton 1986:4).

Therefore the model proposed for the purpose of this study will represent the following steps involved in the design of a database of resources for rational therapy.

- *Preliminary awareness of problem*

The need for a database is initiated by the fact that there is a problem which needs to be solved. Steps are followed in the process of solving that problem. The problem has been explored in Chapters one and two. Currently there is no organised information system in South Africa which would link user needs and user queries to information and information about entities for rational therapy. There is therefore a need for an organised collection of information and entities for rational therapy to support PHC in South Africa. Various solutions could include a special collection housed in a specific location with its own bibliographic retrieval system; incorporation of bibliographic descriptions into the existing library catalogue; the librarian acting as link between the user and the collection. However it is believed that a computerised system of resources, that is a database, designed to relate information, entities and users and solve user problems by desired outputs would be the most timely, cost effective and efficient method.

Figure 3.3 Model of database design



- *Setting boundaries*

  The proposed solution of a database does not imply the design of an ISAR system for the whole Helderberg College Library although the library is relatively small and somewhat specialised. The database would be dedicated to the storage of rational therapy resources thus setting its boundaries and therefore determining the inclusion or exclusion of resources which determines its scope. The objective of the database is to provide feedback as output, which is information and entities, so that the potential user queries about rational therapy can be solved. The database will be limited to information about entities, that is a reference database.

- *Analysis of existing situation*

  This is a step-by-step procedure for problem solving, decision making and more specifically a method for finding out how objectives, once determined, can best be achieved (Soergel 1985:71). Problems and constraints in the existing situation must be analysed. Currently there is no systematised way in which the information and entities and user needs/queries can be linked. Although there is access to information and entities in the formal system of the Helderberg College Library which includes the catalogue, online databases, Internet and informal systems which include private collections, sharing of materials among students and lecturers and the HP department collection, it is difficult for the user, with the present system which is not geared for rational therapy retrieval, to access these resources as there is no documentation or catalogue of each entity and the information contained in these entities.

  The user groups located at Helderberg College and in the immediate environs include HP lecturers, HP students, laypersons, health professionals and librarians. The inputs can be specified, query statements made and formalised, but there is no systematised way of putting the two inputs together, that is, people with problems, needs and queries and the information and entities themselves.

The number of potential users as well as their specific requirements are a constraint. Other constraints which may influence future decision-making include the costs of implementing such a system, the hardware and software requirements, the staffing needs and time. The generation of possible solutions gives direction to the design. An understanding of the present situation and the desired future system helps to set objectives that can be met to solve the problems identified. The size of the database and the information and information about entities must be considered.

Objectives help determine a clear sense of purpose. The general objective of a proposed ISAR system or database would be output which would consist of entities or information about entities and their relationships presumed relevant for a query which would solve the problem reflected/expressed in the query. A specific objective would be the solution of a query such as information about the use of charcoal for inflamed eyes. The clarification, verification and specification of both general and specific objectives is an on-going process which is further refined in the requirements collection and analysis which will be discussed in Chapter four.

- *Requirements collection and analysis*

The information professional's task is to gather input from the potential and specific users. This input reflects their problems, their needs and their queries. Formal research techniques, such as a questionnaire, must be used to actively seek out these problems, needs and queries. The user needs will be matched to the output of the ISAR system. The output of the ISAR system is the actual collection of matching entities or information about such entities and making this available to the user (Soergel 1985:44-45). In collaboration with users during a structured interview, the information professional will determine specific needs. This whole process is a corporate problem-solving process (Soergel 1985:46). A statement of need is a query which forms the heart of the links made between Input 1 and Input 2 of the system.

Input 1 refers to people with problems, needs and queries. Input 2 is the identification of information and information about entities. Presently in the Helderberg College Library there is a collection of entities and information about entities included in the catalogue. The ISAR system to be designed will function to match the two inputs, that is for each query statement it searches the collection of entities acquired and finds those that match the specific objective. This step involves the process in which data will be collected to establish the requirements by means of a user study.

Knowledge of needs is of prime importance in the design of an ISAR system (Soergel 1985:49). Design includes more than waiting for a query requiring an entity. It must be pre-empted. Input 1 follows through to inform the design process which is the conceptual schema. What is expected of the ISAR system, query formulations, system rules and specifications are identified. This is then tested against user needs. Input 2 follows the selection of entities, indexing, relationship storage and retrieval. Query statements are there to link the user with entities or information. This is the purpose for which the database is designed.

- *Database design*

  The actual design of the database will be the focus of Chapter five in which the conceptual schema will be outlined.

- *Conceptual schema*

  The conceptual schema consists of system rules and conventions for entering and extracting information. This defines the logical and intellectual content of the database (entity store of the ISAR system) (Soergel 1985:59). This is also the subject of Chapter five. The specification of entity types and entity identifiers, relationships, et cetera are determined in this step. (In this study the preferred term is entities). The ISAR system structure emerges in the conceptual schema (Soergel 1985:56). Query statements from the study of needs becomes the focus/perspective from which the indexer examines incoming entities.

An anticipated query list and its components can be drawn up, called query formulation. Indexing means that a file provides access to the entities from these queries. The indexer or information professional determines entities and relationships involved and expresses these in the language used in the ISAR system. The entities and information matched against query formulation comprise the database.

- *Database implementation, testing and maintenance*

  This will be recommended for further study and therefore will not form a part of this study.

3.6 CONCLUSION

The intention of this chapter was to define 'database' and develop a model that would outline the steps necessary for design and provide a basis for the following chapters. The database is positioned within the ISAR system which is a component of the wider information system for PHC. Reference and source databases were compared so that the type of database relevant for the purpose of this study could be established. The objectives for design guide the design process and determine the success or failure of the design. It was decided to use a combination of the top-down and bottom-up approach to design.

Now that the model has been developed (ie Figure 3.3) the next step is to establish the user requirements in a user study. This is the focus of Chapter four. Together with the model and the user requirements the design step of the development of the conceptual schema can be accomplished. This is the subject of Chapter five.

CHAPTER FOUR

REQUIREMENTS COLLECTION AND ANALYSIS

4.1 INTRODUCTION

The initial awareness of the problems associated with the availability of credible information for rational therapy which could support the primary health care (PHC) initiative in South Africa were outlined in Chapters one and two. These included the lack of a national health information system, the crisis of confidence in the bio-medical approach and the consequent emergence of alternative health perspectives. The need to design a database which, by making information available, could facilitate the positioning of the rational therapy approach, becomes imperative.

To design a database for this purpose means that the design process must be carefully formulated and a model which serves as a basis was proposed in Chapter three (see Figure 3.3). The previous chapters focused on a discussion of the initial or preliminary awareness of the problem, the boundaries to be set and an analysis of the existing situation. The following step in the design process is the collection of requirements and analysis of the data which, when interpreted, details the user requirements which inform the next step of design, the conceptual schema.

The goal of database design is to ultimately determine that the output will satisfy the users' queries and through feedback will then evaluate the effectiveness and efficiency of the database. Therefore the user is the focus of this part of the study. The research methodology must be based on a literature review and the steps of empirical research followed. The researcher has to establish who the user is, collect data from the user which reflects his/her requirements and analyse these using a combination of quantitative and qualitative methods.

The goal of Chapter five is to use the user requirements and continue with the next step in design according to the model, the conceptual schema.

4.2 THE USER AS FOCUS OF STUDY

The main objective of this study is to design a database of resources for rational therapy to be used by health promotion (HP) staff and students, laypersons, librarians and health professionals who require entities and information about entities which will be made available, accessible and retrievable by means of the database under discussion. This database should efficiently and effectively meet the requirements of the users. Therefore the user requirements must be collected as data from the users. This data must be analysed and interpreted in the user study which is the thrust of this chapter. A literature review of the following serves to inform this user study: Crow (1992), Elmasri and Navathe (1989), Fidel (1987), Frants, Shapiro and Voiskunskii (1996), Herwins (1990), Lancaster (1979), Lane and Chisholm (1991), Mayhew (1992), Mouton and Marais (1991), Newman and Lamming (1995), Norlin, Cardman and Davis (1992), Preece (1993), Recommendations... (1992), Redmond-Pyle and Moore (1995), Rob and Coronel (1993), Shneiderman (1992), Soergel (1985), Vickery and Vickery (1992) and Yang (1997). The following aspects will be discussed: the importance of user studies for database design, the user as information seeker (which is sub-divided into user profile and user tasks), requirements for database design from a user perspective and the tasks of the information scientist in relation to user requirements. The issues raised will be reflected in a model of the user which forms the basis for the user study.

4.2.1 The importance of user studies for database design

A user study must be conducted before any system can be conceptualised (Lancaster 1979:322). Fidel (1987:20) suggests that the needs of actual and potential users who participate in the environments of a database need to be explored to discover their

requirements for the database. Environments are defined in terms of the roles or tasks performed by people and the information needs generated by these roles or tasks (Fidel 1987:8). Therefore in this study reference will be made to user groups. Designers want to find out what 'picture' of the enterprise is needed so as to construct a database that users, who are part of a database environment, can use to retrieve required information (Fidel 1987:20).

In a user study the users are given the opportunity to 'speak their needs', from their experience (Mouton & Marais 1991:204). Context is important in understanding a situation. The researcher gathers data about numerous aspects of a situation and from this constructs a comprehensive picture of the reality that the user experiences and has perceptions about. Methods must be determined by which to systematically study the user to ensure that all facets have been taken into account, namely:

- The user as one using a system
- The utilisation of the information system by that user
- The information behaviour of the user including searching methods, techniques, preferences
- The task as perceived in terms of need by the user
- The requirements of the user in terms of output as a response to queries formulated by the user.

An information system can only be optimally effective if it was designed in direct contact with its future users (Recommendations ...1992:151). Therefore the more comprehensive the set of information needs, that is user requirements which have been accounted for in the development of information storage and retrieval (ISAR) systems, the more successful is the satisfaction of information needs (Frants *et al* 1996:373). This includes data about information-seeking behaviour and problem solving. The database is not designed for the computer programmer but rather for the user to achieve his/her requirements.

Herwins (1990:160) explains that user-centred research explores all segments of human behaviour so that the user can be served better and systems can be designed that more closely relate to human intelligence and behaviour. Elmasri and Navathe (1989:10) suggest that in the user-centred approach real data about the users are used as a basis, whereas in the problem-based approach the process of what the user does and what they require is the focus. Both of these approaches are important as the focus is on both the user and their information-seeking behaviour to solve task-related problems.

4.2.2 The user as information seeker

The focus of research in Information Science is shifting from the study of retrieval behaviour to the user's searching behaviour (Fidel 1991:246). The future success of information systems depends on understanding what is really happening in human information seeking and retrieval, that is the user's information need. Those who provide information services have to match requests with information (Fidel 1991:260).

Newman and Lamming (1995:47) suggest that it is useful to gather evidence of repeatable behaviour performed by humans to understand the methods and steps used. Interacting with a computer is actually a matter of processing information. Understanding this process is basic for design. The key to understanding activities is to study the people who perform them (Newman & Lamming 1995:72). This data must be collected.

There are two aspects to understanding the user as a seeker of information, namely: the profile or characteristics of the user and his/her behaviour as he/she perform tasks and roles.

4.2.2.1 User profile

Crow (1992:172) states that it is important to develop a profile of the types of user which includes knowledge about their level of skills, anticipated expertise, familiarity with and frequency of use of systems. Mayhew (1992:30) suggests that the internal characteristics of the user, their external environment and its characteristics are significant aspects. Shneiderman (1992:25) identifies the following important aspects of a profile: personality, background, work style, motivation, physical, intellectual, perceptual, motor abilities and differences, cultural, international diversity, disabilities and age. Rob and Coronel (1993:287) explain that users have different computer backgrounds.

Besides identifying the personal attributes of the user the researcher also has to identify information needs and have a clear picture of the user's problems.

4.2.2.2 User tasks

Addressing the needs of the user implies that the task he/she is expected to perform is understood by the designer. The task needs to be analysed and is a practical way of ensuring the user's perspective is adopted (Redmond-Pyle & Moore 1995:70). The system needs to support user tasks. The human element in data transformation is a central feature (Preece 1993:22). From these requirements the designer identifies general and specific objectives that the database must fulfil. Vickery and Vickery (1992:117) identify the following as tools which are used for information retrieval: catalogues, bibliographies, abstracts, indexes, electronic message stores, et cetera.

Exploring information-seeking and retrieval behaviour is a powerful way of improving one's understanding of the user (Fidel 1991:261). Researchers such as Bates (1989), Guthrie (1988), Guthrie and Dreher (1990), Kuhlthau (1989, 1993), Marchionini (1992), Marchionini

and Shneiderman (1988) have explained the need for models to describe tasks as well as models of information-seeking to characterise the process of searching behaviour for desired information. Examples of these models include models of intermediaries and end-users, end-user mental models and models of individual user differences which describe various processes of searching behaviour from a particular perspective. This information could contribute to a better understanding of the user. Such models offer an insight into design and how users interact with systems for design purposes (Yang 1997:72). Vickery and Vickery (1992:113) explain that the information-seeking behaviour of individuals (like most other human activities) tends to conform to an habitual pattern. The design process should consider these search patterns. It is very important that the researcher know the actual users for his/her particular study.

4.2.3 Requirements for database design from a user perspective

Norlin *et al* (1992:8) warns that there is no 'typical user' as people search in a variety of ways and for many reasons. However, although this complicates the design process, the goal should be to make the system as accessible, useable and useful for as many users as possible regardless of the diversity of profiles and tasks. The availability of information is a key issue. The user becomes aware of a lack of certain information needed to solve a problem or make a decision. These needs differ according to the characteristics of the users and tasks they are to perform.

The focus should be on the human aspect rather than on computer requirements. The following user requirements have been identified. Firstly, information is needed to solve problems, make decisions and support their research (Newman & Lamming 1995:29). Secondly, the system should be user-friendly. This 'foggy' term must be clarified in the user study. Thirdly, usability of the system implies that users have simplicity, speed, precision, feelings of competence, mastery and control over the system (Shneiderman 1992:73).

Fourthly, the interface for information retrieval, as Crow (1992:170) emphasises, must strike a balance between realising the full potential of the information in the database and simplifying the information retrieval process. The ultimate success of the interface will be judged by the users themselves by their ability to locate the information they seek (Crow 1992:184). Vickery and Vickery (1992:119) make the following significant statement:

> "Output begins when an enquirer approaches the system with an information want – a desire to fill some gap in knowledge. A query expressing this want is formulated... This formulation process may be assisted by a human intermediary or by a computer interface. The query is matched against index keys... resulting in the selection of certain messages from store..."

When the enquirer is satisfied by the information delivered the output process is concluded. The quality and success of a search is indicated by a combination of the following factors: the time taken to complete the search, the cost, the range of information received and its pertinence (Vickery & Vickery 1992:376).

Rob and Coronel (1993:287) summarise user requirements for an information system. The system should be easy to use, provide security measures and be fully integrated which will eliminate redundant data. These user requirements then yield the system requirements. Building on this Rob and Coronel (1993:287) emphasise that a good conceptual design must be able to gather information that enables one to accurately identify the entities, describe their attributes and relationships. The entity relationships must accurately reflect real-world relationships. The model of the database design (see Figure 3.3.) details the conceptual schema. The user requirements are intended to inform the conceptual schema (see section 5.5). This is a part of the design process.

Design must not be based primarily on current information habits, desires or preferences, as these are often biased by the users' preconceptions of what an information system can do. Therefore, the responsibility of the information scientist, who will design the system, is to probe deeply, to study problems, to draw inferences about the entities and information about entities

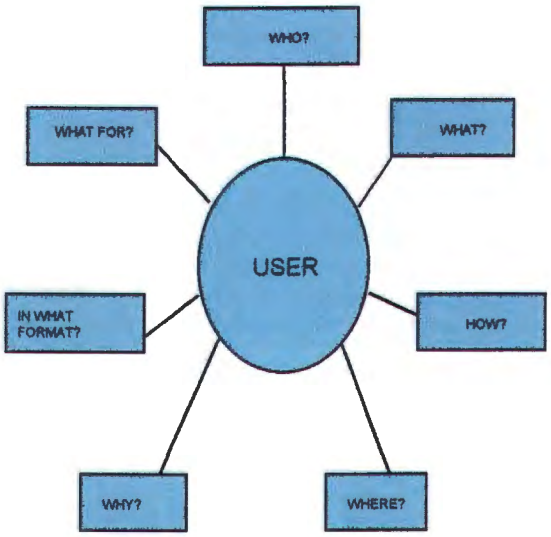
required, as the user is not an expert in these areas (Soergel 1985:98). It has been established that the user and his/her requirements are the heart of the design process as informed by a user study.

4.2.4 Role/task of the information scientist in relation to user requirements

An information system makes possible the transformation of data to information (Debons, Horne & Cronenweth 1988:6-7). Boon (1992) emphasises the need to provide information which will aid in personal and societal development. To facilitate this Orna and Stevens (1995:35) list various responsibilities of the information scientist: definition of information to achieve given purposes; location of information in a wide range of sources; transformation of information from the outside world into the mind of the individual, that is knowledge; storage of information; making stored information accessible and retrievable; presenting information in a form suitable for users and applying information technology to help in all processes.

From the above discussion of the various aspects of the users, a model of the user in which research questions are identified forms the basis of the user study.

Figure 4.1 Model of the user



- *Who?*

  Who are the people to be served? (Soergel 1985:94). How important are their decisions or problem solutions? How valuable is their time? What are their characteristics, backgrounds and skills? What is the level of their language competence and ability to communicate? Do they do their own searches? Do they use the information or entities or do they pass it on to others? Demographic and biographical information describing the user aid in answering this question, that is a profile. The tasks and roles that the user performs, with reference to information, must be identified. A 'good' system must be able to cope with various types of users, from the novice to sophisticated user (Tenopir & Lundeen 1989:81). The actual and potential users must be included in the study.

- *What?*

  What are their problems? What information or entities are needed to solve these problems? What is the scope of the information or entities needed? What searches are to be expected? (Fidel 1991:246). The question 'what?' includes what the user needs as well as what system will be used, for what purpose and which is the most suitable. The relationship between the human and machine is vitally important as the system must support the activities performed by the user (Mayhew 1992:73). The concepts of 'ease of use' and 'user-friendliness' play a role in this human-machine interaction. The user must express his version of the definition of these concepts.

- *How?*

  The way the user interacts with the system is done via the interface which is the point of communication between the user and the system (Newman & Lamming 1995:44). Will the system function according to the users' requirements? These criteria must be detailed by the users and are considered as requirements.

- *Where?*

  The need for information has to do with where the information can be found. The interface plays an important role as its success can only be measured by the users who are able to

easily, quickly and logically locate the information they seek (Crow 1992:184). This defines the efficiency and effectiveness of the system. The environment in which this human-machine relationship exists must be conducive to satisfying needs according to the criteria of the user. Where can I find information to solve my problem, make decisions and do my tasks? 'Where' is also related to the availability and accessibility of information.

- *Why?*

  Users seek systems that will allow them to do more, better and faster (Mayhew 1992:5). This need for information is what directs the tasks of users and their information-seeking behaviour. Humans are variable and so too are the tasks they must accomplish, the problems that they encounter as well as the information that they believe will satisfy their need and solve their problems.

- *In what format?*

  Users want information and information about entities in a convenient format. The information system must enable the user to achieve his/her goals. According to Shneiderman (1992:8), most users do not want to be encumbered by the computer. A well-designed interactive system responds to the action of the user and it is almost as if the interface disappears thus enabling the users to concentrate on their work and what they want to do with the system.

- *What for?*

  Users need to carry out their tasks safely, effectively, efficiently and enjoyably. They need relevant, specific, current, up-to-date information (Preece 1993:14). This information is perceived as the solution to the problem that is actually a question that needs an answer. This is their ultimate goal. Information-seeking is the behaviour of the user to solve problems, make sound decisions and correct mistakes with the information acquired.

The purpose of the user study is to collect responses to the research questions above and analyse this data to inform the design. This implies a systematic approach.

4.3 RESEARCH METHODOLOGY

Every research project requires a method. Methods reflect a particular philosophy or methodology. Methodology is the exact plan and procedure for carrying out research and obtaining valid information (Sanders & Pinhey 1979:12). Babbie (1998:18) terms 'methodology' the science of finding out.

It has been established in section 4.2 that the user is the focus of research. In quantitative research the human being is the object of study, whereas in qualitative research the human being is the subject of study (Rockhill 1982:9). A combination of qualitative and quantitative research methods would enable a comprehensive user study. According to Bruyn, as quoted by Rockhill (1982:8) this enables the researcher to both allow the users to explain their own inner reality, from their own frame of reference, that is the qualitative approach, as well as to explain the external behaviour as observed in terms of 'uniformities and regularities which can be measured and predicted', that is quantitative approach. A combination of these approaches will be used in this study to collect user requirement data.

Quantitative research is "an approach to research in the social sciences that is more highly formalised as well as more explicitly controlled with a range that is more exactly defined" (Mouton & Marais 1991:155). The data is analysed and interpreted from a numeric perspective, that is quantified. In this way it is possible that research may be limited by coding and standardisation and valuable data could be destroyed (Marshall & Rossman 1995:44). This approach however has general acceptance as the scientific method for research. It has a role in this study.

On the other hand qualitative research is an "approach in which the procedures are not as strictly formalised where the scope is more likely to be undefined and a more philosophical mode of operation is adopted" (Mouton & Marais 1991:156). The user is given the opportunity

to speak his/her needs and problems from the context of experience. This is important in understanding the user in his/her situation. The phenomenon 'speaks for itself' (Mouton & Marais 1991:163). The researcher has a research goal rather than a hypothesis and theory is found from the data instead of the data proving a theory. The inductive method is used to understand the situation without imposing pre-existing expectations on the setting (Mouton & Marais 1991:204). Implications are identified which provide a framework in which policies and rules and conventions can be developed.

According to Marshall and Rossman (1995:142) this approach requires a sound rationale which infers an intensive literature review. The purpose is to identify assumptions underlying the questions to be asked of the user, demonstrate the researcher's background knowledge of the relevant topics and current research, to evidence that this has been positioned in the broader context of knowledge as a topic of relevance by placing the research questions in the larger empirical traditions and to clarify concepts (Marshall & Rossman 1995:28).

According to Marshall and Rossman (1995:143-145) credibility is evaluated on the basis of the following:

- *Credibility of findings*

  The inquiry is conducted in such a way that the subject is accurately identified and described, the boundaries of the study are adequately stated and the in-depth description includes the complexities of the situation thus ensuring validity.
- *Transferability and generalisability of findings*

  Findings may be applied by the investigator in another setting. The fact that a literature review is the basis for collecting data and analysis of requirements means that the findings can be generalised.
- *Dependability*

Because the user is the focus of the study flexibility is a key attribute. The researcher must continuously account for changing conditions and adapt as required to refine understanding of the situation.

- *Confirmability*

  The data collected help to confirm the general findings and the objectivity of the research (Marshall & Rossman 1995:145).

From the data collected categories or dimensions of analysis emerge as a researcher begins to make sense of, and organise the data to construct a comprehensive picture of reality. The perceptions of the users, who are seen as active agents in constructing and making sense of the realities they encounter, are included. The subjects must respond in terms of their own meanings. The researcher therefore interprets the real world from perspective of subjects (Mouton & Marais 1991:205).

This user study will use a user survey. This method is widely used in Library and Information Science to study populations by selecting and studying samples from these populations (Cherry 1990:18). Behrens (1992:225) lists three components of qualitative research: data; analytic and interpretive procedures and written or verbal reports. Data provides the material basis for the phenomenon being investigated, for example transcripts of interviews and ideas from questionnaires. Analytic or interpretive procedures are followed to arrive at findings based on data, which allow for the development of theories. Techniques such as coding of data are used to conceptualise the findings and to identify significant implications that are reported on in a written or verbal report. Concepts must be analysed in depth for understanding as the phenomenon must be discussed and described for the purpose of understanding (Mouton & Marais 1991:160).

In qualitative research there are methods for collecting data such as participant observation and in-depth interviewing which allow the researcher to get close to the data. The steps to be followed in research must be identified.

4.3.1 Steps in empirical research

From a literature study (Babbie [1990, 1998], Bailey [1994], Behrens [1992], Busha & Harter [1980], Cherry [1990], Fidel [1987], Kidder & Judd [1986], Leedy [1988], Marshall & Rossman [1995], Mouton [1996], Mouton & Marais [1991], Nachmias & Nachmias [1987], Neale & Liebert [1986], Oppenheim [1966], Ritchie [1990], Sanders & Pinhey [1979], Saslow [1982], Singleton, Straits & Straits [1993], Taylor & Bogdan [1984]) the steps that will be used in this user study are:

- *Goal, that is clarification of purpose and problem formulation*
- *Research design*
- *Sampling*
- *Data collection*
- *Analysis of data and interpretation*
- *Reporting results*

These steps will be discussed under separate headings (see section 4.3.1.1-4.3.1.6).

4.3.1.1 Goal

Babbie (1998:108) identifies the clarification of purpose as a step that precedes the design of the study. Bailey (1994:12) suggests that a research project must have a clearly stated goal. The goal for this research project is to collect and analyse data, by means of a user study to identify user requirements which will form the basis for the conceptual schema, the subject of

Chapter five. The research questions posed in section 4.2 need to be answered. Instead of stating an hypothesis the research goal serves to describe that which exists as accurately as possible and to collect data on the phenomena which are under investigation (Mouton & Marais 1991:44). This is known as descriptive research in which sample surveys and in-depth interviews are relevant data collection research strategies (Mouton & Marais 1991:51).

Sanders and Pinhey (1979:36) remark that the goal can have a significant impact on the research design.

4.3.1.2 Research design

Babbie (1998:106) suggests that an idea or interest needs to be explored by means of empirical research. This requires strategies, a research design or overall plan to be used by the researcher to systematise the researcher's personal intuition (Fidel 1987:3). The researcher had an idea or intuition that there was a problem with regards to rational therapy information as an approach to PHC in South Africa. The situations to observe, whom to interview and what to ask are all significant issues to be addressed in research design. It reflects the major rational decisions made to identify the best approach to answer the research questions posed (Marshall & Rossman 1995:42) (see section 4.2). Mouton and Marais (1991:32) stress that research design ensures that the research findings are valid and takes note of the practical considerations and possible limitations.

Soergel (1985:44) suggests that once the existence of a need has been identified or determined in collaboration with the user, the problem must be analysed and specific needs for information or entities determined. Marshall and Rossman (1995:42) suggest that reference to a pilot study can support both the rationale for the user study as well as the ability to conduct such a study. The pilot study also identifies the advantages of using qualitative methods for generating research questions (Marshall & Rossman 1995:43). During the pilot study, the

researcher can test the questions, familiarise the respondents with the format and refine the concepts.

Therefore in April 1997 the researcher constructed a simple questionnaire to ask Helderberg College HP students and staff some basic questions about their requirements, subject interests and problems experienced with information and information about entities regarding availability and accessibility of rational therapy information, to satisfy their queries. With the introduction of the HP course at Helderberg College in 1996 and contact with the various user groups, the researcher, as librarian, became aware of the users' problems. In consultation with the head of the HP department, a department forum slot was allocated in which the researcher explained the purpose of the survey to staff and students and requested their participation as respondents. The data collected evidenced the need for further in-depth investigation and the need for a database. Subsequently, this has been the focus of the researcher.

An extensive literature review on research methodology and design, user studies, surveys, questionnaires and interviewing resulted in the researcher's overall plan which is as follows:

- To use the information gleaned from the pilot survey experience to design a questionnaire to be used as a survey and as the basis of an interview for a sample of users. The researcher will play a participant observer role and will facilitate discussion with each of the respondents so as to collect as much significant data as possible.
- To use the survey to analyse the data collected in as objective a way as possible.
- To interpret this data in both a qualitative and quantitative way to identify user requirements which will inform the conceptual design process.
- This interpreted data will reflect the users' information needs for Input 1 (see Figure 3.3).

A survey consists of asking questions of a representative cross-section of the population, called survey respondents, at a single point in time. Data collection is completed in as short a time period as possible (Bailey 1994:106). A standardised questionnaire is administered to a sample of respondents to get data for analysis and interpretation (Babbie 1998:147,255). Respondents can complete questionnaires themselves but it is useful to use a situation in which face-to-face interviews can facilitate exploration and clarification of the requirements (Fidel 1987:37). Interviews allow for flexibility and probing which enhances the success of data collection (Vickery & Vickery 1992:83). This serves to decrease the number of 'don't knows' and 'no answers' as well as allowing for clarification of confusing questionnaire items, and identifying the user's nuances and connotations of concepts to maximise the goals and time and cost involved in the survey (Babbie 1998:108). At the start of the interview, the researcher should clarify, explain and justify the goals of the study to the respondents as they are giving their time and must feel that the research is worthwhile and beneficial to them.

Respondents can be observed within their environment as well as their communication behaviour (Babbie 1998:264). Cherry (1990:18) suggests that finer discriminations can be made and more complex topics handled. Some of the problems that must be noted are: flexibility may make analysis difficult, interview bias and interaction could be problems, recording of responses could be difficult and in a survey of a large population the use of interviewers could be time consuming and costly (Vickery & Vickery 1992:83).

The questionnaire to be used in the survey had to be an upgraded version of the one used in the pilot study. Bailey (1994:108) states that the key word in questionnaire construction is 'relevance', namely relevance of the study's goals, relevance of the questions to the goals of the study and relevance of the questions to the individual respondent. In closed-ended questions, the respondent is asked to select an answer from among a list provided by the researcher but all the possible expected responses must be included. This may be dealt with by the addition of a category 'other (please specify)' (Babbie 1998:148). It is critical that the

questions are appropriate and achieve the goal of the research project by collecting critical data. Open-ended questions can be used when there are too many potential answer categories to list on the questionnaire and are preferable for complex issues that cannot be condensed into a few small categories. More opportunity for creativity or self-expression by the respondent is allowed. Vickery and Vickery (1992:186) suggest that a good question elicits a contradictory answer and serves to eliminate a hypothesis or inferred conclusion. The researcher who is trying to solve a research problem gains a clearer picture of the user's task as they ask questions because the questions assist in the process of getting to know what is merely a hunch or an idea. The replies of the respondents help to evaluate if the answers solve their actual problem. It could be possible that a clearer question may need to be asked. A disadvantage of allowing the respondent to express opinions is that lazy respondents who need writing skills and the ability to express their feelings may find the questions too general and begrudge the time and effort to complete the questionnaire (Bailey 1994:121).

Questions are examined for bias, sequence, clarity and face validity (Marshall & Rossman 1995:95-96). They must be precise and unambiguous (Babbie 1998:151). Bailey (1994:113) states that the wording of the question, such as difficulty of words used, degree of formality of language, et cetera, can greatly affect the answers received. A general rule for writing questionnaire items is that the shortest version that conveys what is intended is best.

The questionnaire format and layout is critical. The researcher must consider the questionnaire from the user's perspective and ensure that it is an easy and pleasant task. It needs to be spread out and uncluttered which alleviates respondents missing questions, misinterpreting questions and demoralisation resulting in laziness to respond. Boxes adequately spaced apart allow the respondent to check one response from a series and are the best option for a professional look (Babbie 1998:154). Ordering of questions may affect the answers given (Babbie 1998:158).

Attention was paid not only to the subject substance of the questions, but to the way in which they were phrased, their sequence in the questionnaire and the layout of the questionnaire. Bearing in mind the critical issues about the user and the research questions generated in the model of the user, the researcher developed the questions believed to be relevant to establish the users' requirements in this the data collection step of research.

For additional guidance and advice on questionnaire and sampling methodology, the researcher consulted a statistician (Nzamutuma 1998) who made a few suggestions that were taken note of, for example, the addition of an 'Other' category in certain cases. It was suggested that the interview setting would be useful for clarification especially to achieve the purpose of the survey. The advised changes were made and the questionnaire finalised to be used in the survey.

The next step in empirical research is to select a sample of individuals who will provide the data for analysis and interpretation.

4.3.1.3 Sampling

The population for a study is that group (people) about whom one wants to draw conclusions. The ideal is to study the entire population or universe to give more weight to the findings (Bailey 1994:83). However, if the researcher is not able to study all the members of the population of interest then a sample is selected, that is a subset or portion of the total population (Bailey 1994:83, 109). The sample size is dependent upon the nature and size of the population and the purpose of the study (Bailey 1994:96). Purposive sampling enables the researcher to use his/her research skill and prior knowledge to choose respondents (Babbie 1998:195). Specific categories of individuals must be identified for study (Mouton & Marais 1991:38).

Therefore the task is to select representatives from all the subgroups of users within each environment (Fidel 1987:21). A useful procedure suggested by Fidel (1987:21) is to identify user subgroups by listing all the functions that are involved in accomplishing a purpose and then classify what types of users are performing each function. The specific user groups for this study are those individuals identified according to the task he/she performs for whom the database is to be designed. Usually individual people are chosen, termed a unit of analysis, who can most adequately provide data for study and observation (Babbie 1998:92). For the purposes of this study both actual and potential users of the database being designed must be consulted.

The cohesive factor for the population chosen for study in this survey is an interest in health from a specific perspective, that is rational therapy in the context of PHC. The user groups are identified for the sample according to the tasks or functions they perform as summarised in Table 4.1.

Table 4.1 Functions/tasks of user groups

No.	User group	Interest in rational therapy	Research	Lecture	Study (FTE)	Public seminars	Resource files	Consult	Systematise info	Reference assistance
20	Student	X	X		X	X	X			
5	Lecturer	X	X	X		X	X	X		
3	Librarian	X	X						X	X
6	Layperson	X	X				X			
5	Health prof.	X	X	X		X	X	X		

The student user group consisted of full-time equivalent (FTE) Helderberg College HP students in first to third year ranging in age, background, language and computer literacy. The lecturer user group need information for the development of study manuals, course notes and handouts, specifically for their lecturing. Therefore they must keep up-to-date with the latest scientific research. The three qualified librarians working in the Helderberg College Library were selected for inclusion in this survey as they are important role players in the provision of

information, especially that of rational therapy for HP students and lecturers at Helderberg College. The librarians' task is to ensure that information is systematised for reference assistance purposes to provide information or information about entities for problem solving. Their input is essential.

A purposive sample of six laypersons was identified. For the purpose of this study the layperson is defined as one who has a personal interest in acquiring self-help information on the rational therapy approach. The input of these laypersons is believed to be important as their involvement in the broader community, for example in the management of a whole-foods outlet, identifies them as representative of the broader community who are interested in personal health, lifestyle issues and the rational therapy approach.

A purposive sample of health professionals who have qualifications in the health sciences (undergraduate and postgraduate level) and who are currently working as a professional in some area of the health sciences was identified. This sample of respondents have previously requested information on the rational therapy approach to PHC in South Africa and follow this approach in their professional work. They require current, relevant, scientifically proven information for research, for their practice and work, for dissemination to patients and clients, for lectures, seminars and awareness campaigns. They are believed to be important to this survey as they are on the cutting edge of the development of this approach. The sample included two nurses, a research chemist, a physiotherapist and a lifestyle counsellor.

4.3.1.4 Data collection

Using the designated research method/s and tools, namely the survey, a questionnaire was given to specified survey respondents in an interview situation where observation could take place. Individuals as units of analysis were chosen as representative of user groups, for study. The appropriate number of copies of the questionnaire was photocopied and each respondent

contacted by the researcher to set up an interview schedule. The respondents were briefly informed of the purpose of the interview. There was general consensus as most were familiar with the procedure because of the pilot survey. It was determined that the most convenient time to hold the interviews would be the second and third weeks of August 1998 and each respondent indicated the time that would best suit them. A venue in the Helderberg College Library was found to be the most appropriate and convenient venue for this purpose.

At the scheduled time each respondent made him/herself available for the interview. The researcher made certain that they were comfortable and relaxed and thanked them for being willing to participate in the research study. Respondents were briefly informed of the procedure to be followed, that is a structured interview based on a questionnaire. The researcher would ask the question and the respondent would respond appropriately. For closed-ended questions the respondent could indicate their choice/s to the researcher who would fill these in appropriately or could fill their choices in themselves.

Once the basic procedure was outlined the interviews took place. Each question was asked in sequence and where necessary, clarification and elucidation were given. The researcher recorded respondents' answers as verbatim as possible to eliminate bias, misconception and misquoting. Respondents were observed by the researcher and whenever there was any hint of confusion or unfamiliarity with terminology, the researcher would ask further questions to guide the understanding.

This process was completed as scheduled and the next step was to analyse and interpret the data collected.

4.3.1.5 Analysis of data and interpretation

The data from the completed questionnaires must be coded so that both quantification and qualitative analysis and interpretation can be completed. Wherever possible, categories must be identified into which data can be classified. The most important aspect of this step is to establish user requirements. These will be inferred and assessed by the researcher as implications for design. A summary of these implications will conclude this chapter but are the basis for the design process to develop the conceptual schema which is the subject of Chapter five (see section 5.5).

4.3.1.6 Reporting results

The findings of the user study must be reported and in this study they will be discussed in sections 4.4 and 4.5. These user requirements form the basis of the conceptual design step which is the subject of Chapter five.

4.4 DATA ANALYSIS AND INTERPRETATION

In this step of the empirical research process the researcher examined the completed questionnaires to extract data for analysis and interpretation. Each question of the questionnaire (see **Annexure 1**) was analysed to discern patterns, similarities and categories of data which could be used to determine and assess user requirements for the design process. The researcher manually tallied the data to establish findings from both a quantitative and quantitative perspective. Inferences from the users' responses and comments were drawn to assess the requirements of the users.

The procedure of the following discussion is to categorise the questions according to the relevant topic, to indicate the intention of each question, the analysis of the data, interpretation

of the findings and the resulting implications for design. The following topics will be discussed: information about users; tasks/functions; computer literacy; information-seeking behaviour; user requirements and assessed needs; entity types; subject vocabulary control; user-friendliness and the user interface.

4.4.1 Information about users

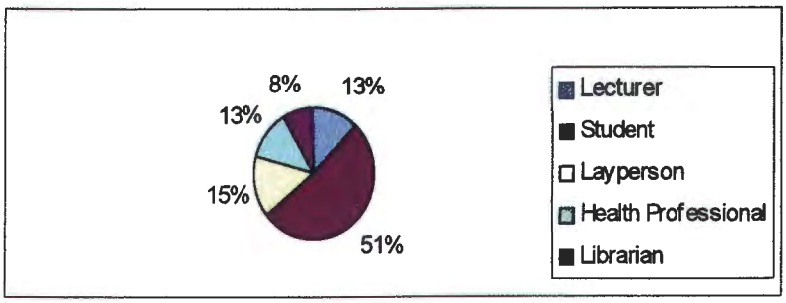
The model of the user (see section 4.2) raised questions that must be dealt with. The intention of questions 1, 2, 3, 4, 7 and 22 was to gather data about the user, their tasks or functions, computer literacy, their information seeking behaviour and the relevance of a database of resources for rational therapy in fulfilling their tasks or functions, both immediate and for future needs.

The users are classified into groups according to functions and tasks as discussed below. Reference will be made to user groups.

4.4.1.1 Respondents

The intention of question 1 was to indicate which group each of the respondents represented. Not only was this important information for the categorisation of functions and tasks in relation to their information requirements for example in question 3, but it also served as background for categorisation and quantification of data for analysis of the questions. Collectively their responses served as representative of ideas from a user group. Table 4.1 identified the survey respondents according to their functions in the respective user groups. The pie chart (see Figure 4.2) illustrates the spread of the respondents in their user groups.

Figure 4.2 Respondents



The profile and description of each group of respondents was outlined in section 4.3.1.3. The categorisation (see Table 4.1) of individuals into the various groups was done on the basis of the researcher's perception of their respective tasks and functions, their relationship with information, how they use it and what they need it for.

4.4.1.2 Tasks/functions

There are three aspects to be investigated in this section. Firstly, the researcher intended to survey the respondents to collect data on their perception of their tasks and functions. Secondly, relative to these tasks and functions were their expressed problems with regards to the availability and accessibility of information from a rational therapy approach. Thirdly, the researcher wanted to assess the need for a database of resources for rational therapy to solve their problems. Therefore the intention of questions 3, 7 and 22 was to validate the researcher's perceptions of the user groups' tasks, establish any additional areas of responsibility, to identify problems encountered and lastly, to derive, from this data, the implications for database design.

Question 3 was designed to elicit data relative to the information requirements of the user to fulfil his/her tasks or functions, that is the purpose for which information on rational therapy was needed. It is important for design purposes for the user to clarify his/her concept of what

his/her task is in order to understand the task of each group. A discussion of the various user groups' tasks based on Table 4.2 follows below.

Table 4.2 Tasks/functions

USER GROUP	ASSIGN-MENT	PERSONAL HEALTH CHOICES	RESEARCH	LIFESTYLE COUNSELING	PRACTICAL APPLICA-TION	NATURAL REMEDIES	PROBLEM SOLVING	SCIEN-TIFIC BASIS	LECTUR-ING
LECTURER	20%	20%	60%	40%	40%	40%	20%	100%	20%
STUDENT	60%	40%	35%	30%	35%	10%	10%	20%	0%
LAYPERSON	0%	66%	0%	50%	50%	17%	17%	50%	0%
HEALTH PROF	20%	60%	40%	80%	40%	40%	20%	0%	0%
LIBRARIAN	66%	33%	55%	33%	66%	66%	0%	33%	0%

- *Lecturer*

  According to the lecturers their information requirements are for resources which support the rational therapy approach to assist in fulfilling their roles as lecturer, lifestyle counsellor, student mentor, researcher and for compiling resource files and student manuals. They are also consulted for information about the use of natural simple remedies that are scientifically proven. The criteria for information is that it is scientifically proven (100%).

- *Student*

  Sixty percent of student tasks involve the completion of practical and written assignments to meet the requirements of the HP courses. This involves research for credible, scientifically proven rational therapy information - which is a significant problem. Information is also required to make informed, personal health choices. As trainee lifestyle counsellors they need information to compile resource files to facilitate rational choices to be made by clients. They suggest that networking can assist them (see section 4.4.1.4).

- *Layperson*

  Laypersons require rational therapy information for practical use both for themselves (66%) and for dissemination to others about whom they are concerned (50%), that is family members, friends and other interested persons. They require scientifically proven information on the rational therapy approach.

- *Health professional*

Eighty percent of health professionals' information requirements are for the purpose of lifestyle counselling. This includes preventative information required for education about lifestyle choices, both on a personal level and for clients. A part of their task includes referring a client to information that is credible in which suitable natural remedies are discussed or to health professionals with expertise in this area.

- *Librarian*

  The librarians' task is to assist the user by making information and information about entities on rational therapy available and accessible. Their task is related to the tasks or functions of user groups identified above: finding information to assist in the completion of assignments, making informed personal health choices, lifestyle counselling, the use of natural remedies in practical situations, in problem solving and rational decision-making.

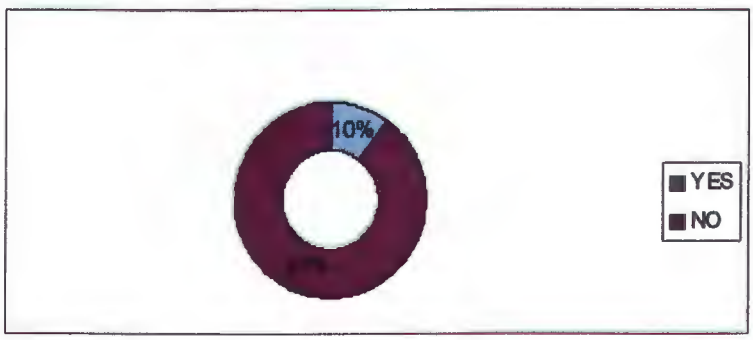
A significant finding which impacts on the role of the librarians was that all user groups indicated that scientifically proven information about rational therapy was imperative and is a prerequisite for the inclusion or exclusion of sources in the database (see section 5.4.4). Therefore guidelines and/or rules indicating the criteria by which to judge the credibility of sources is implied. This user requirement also aids in the determination of the scope of the database, that is only credible sources concerning rational therapy will be included. The responsible librarians will therefore have to be trained in the rational therapy approach. Together with this background knowledge and expertise they will be responsible to select according to prescribed guidelines the relevant sources to be included in the database. Part of this task is to know the content of courses and theoretical and practical assignments and also to consult with lecturers to assist and advise the user in the fulfilment of their tasks. The intent of the database is to assist the user and by noting their requirements the design process can be maximised for their tasks to be fulfilled.

The user's perception of the extent to which they feel that their information requirements are being met is dealt with in questions 7 and 22. What has been established is that they need information to fulfil the various aspects of their tasks.

The intention of the two parts of question 7 was to establish whether respondents felt that their information needs were being met, qualified by the accessibility and availability of this information. This is relevant from a design perspective, both for the establishment of the need for a database and the purpose and objectives of the database. From the pilot study it became apparent that the problems were essentially that of the accessibility and availability of information to meet information needs. Therefore question 7 dealt with important aspects of the user's perception of the extent to which they think that this is so.

The intuition and findings of the researcher in the pilot study were validated by the responses to this question. According to Figure 4.3 it was established that the need for rational therapy information is not being met (90%). The Helderberg College Library does not have enough resources.

Figure 4.3 Adequate information available



Reasons offered for the lack of adequate information available are that the information is scattered and that it takes too much time to sift through what is available to determine if there is relevant, useful information for this specific approach. Ironically, the responses included that information needs are not being met as there is too much information complicated by the

uncertainty of the credibility of this information. The concern about the credibility of available information was underscored again. The point was made that there is a large, growing body of information in health care, especially in the area of alternative health and therapies, which does not necessarily qualify as rational therapy information. This requires 'digging' and research to identify pertinent information. From these responses it was concluded that the potential in terms of available information to meet the user's information needs is there. Information is widely available. However, the user is concerned about the availability of credible, up-to-date, rational therapy information that they can access. It can be inferred from these responses that there is a need of the user for credible information to be made accessible. This would solve their problem of a lack of available information. The implications of these findings for question 7 and question 22 are discussed below.

The intention of question 22 was to determine whether respondents viewed a database of resources for rational therapy as a solution to their information requirement problem and opportunity was given for reasons to be stated.

Common to all groups was the perception that a database would organise resources and thereby make them available and accessible quickly and with ease. Therefore it would be less time-consuming to find relevant information and the research process would be assisted. This would both inform, as well as make the user aware of current information and research findings in a growing body of knowledge. The information could be used for scientific study and would give credence to a philosophy of health, namely the rational therapy approach and contribute to its acceptance. A variety of sources on a specific topic, for example the role of diet in the prevention of cancer, would give more credence to the rational therapy approach. Information about entities would be centralised even if the entities were not all centrally located. This would facilitate the fulfilment of their tasks. Again this reinforced the fact that a database is perceived as necessary to organise a rational therapy collection of resources. It was assumed that the responsibility for the selection and organisation of resources and the

design of the database would be undertaken by an individual or group of individuals, most likely the Helderberg College Library staff who are information professionals.

The following are important implications of the findings of questions 7 and 22. The credibility of information is a requirement. 'Credible' infers that the information must be evaluated before selection so that the database can be trusted to meet information needs. Therefore library staff must be knowledgeable of this specific approach to be able to perform their specific tasks. A database as an organised collection could fulfil the requirement, for example of the health professionals and interested laypersons, that information should be selected by an expert who, using their queries, searches and provides the required information efficiently and effectively. This implies that design must cater for both end-user and intermediary (librarian) searching. As output is an important consideration, the most effective and efficient retrieval methods must be used (see section 4.2.3). The implication of user requirements for current information is that responsibility must be assumed for the continual update of the database. This requires a policy for the frequency of update. The task of the librarians is to scan for and be aware of trends, current research, completed research and new, relevant sources for inclusion in the database.

The users' background knowledge and skills especially with reference to the use of computers are also important to the designer.

4.4.1.3 Computer literacy

The intention of questions 16-18 was to assess the computer literacy skills of the users. Computer literacy is a skill which is needed to use computers for a task. It is the researcher's goal to design a computerised reference database. Part of the overall design process includes a choice of suitable software. This is beyond the scope of this study. However, user

requirements of a computerised system, the level of computer expertise and familiarity with software have implications for design.

Table 4.3 Computer literacy

USER GROUP	LITERACY	COMPUTER ACCESS	MICROSOFT OFFICE	WORD PERFECT
LECTURER	100%	100%	100%	40%
STUDENT	100%	85%	100%	5%
LAYPERSON	83%	100%	83%	0%
HEALTH PROF	100%	0%	80%	60%
LIBRARIAN	100%	100%	100%	66%

Table 4.3 indicates that 100% of the lecturers, students, health professionals and librarians are computer literate. Eighty-five percent of students indicated that they have access to a computer although as registered students they all have access to a computer in the computer laboratory. It would appear that this question was therefore interpreted to mean access to a personal computer. Eighty-three percent of laypersons indicated that they were computer literate which included access to a computer. Although all health professionals were computer literate none had access to a computer. This fact has implications for future use of the proposed database if at some future date the database is made available on a wider scale, for example, on the Internet. These health professionals would nevertheless still have physical access to the database at Helderberg College.

Although the conceptual schema is independent of the software selection the user must be the focus of the database design. Questions 19-23 are also implicated in these findings. From the responses the researcher can infer that there is potential for a computerised database to assist users especially for those who have already become aware of the importance (and problems) of computers for searching for information. The lack of opportunities to use computers must be noted. Many users expressed the need for access to the Internet and/or relevant databases. There is a perception that computers help with searching for information.

Therefore the researcher must note what the user requires from a computerised system that they perceive is user-friendly, that is simple to use and needs little training to operate the system. Staff and students of Helderberg College are given instruction in Microsoft Office and their familiarity with this software must be noted. This is relevant to a choice of software that must be made at a subsequent stage (see section 6.6). Their general level of computer literacy impacts on the design process with reference to the amount of training required and the help needed to use the system.

From the literature review it was established that the user's information-seeking behaviour needs to be understood (see section 4.2.2).

4.4.1.4 Information-seeking behaviour

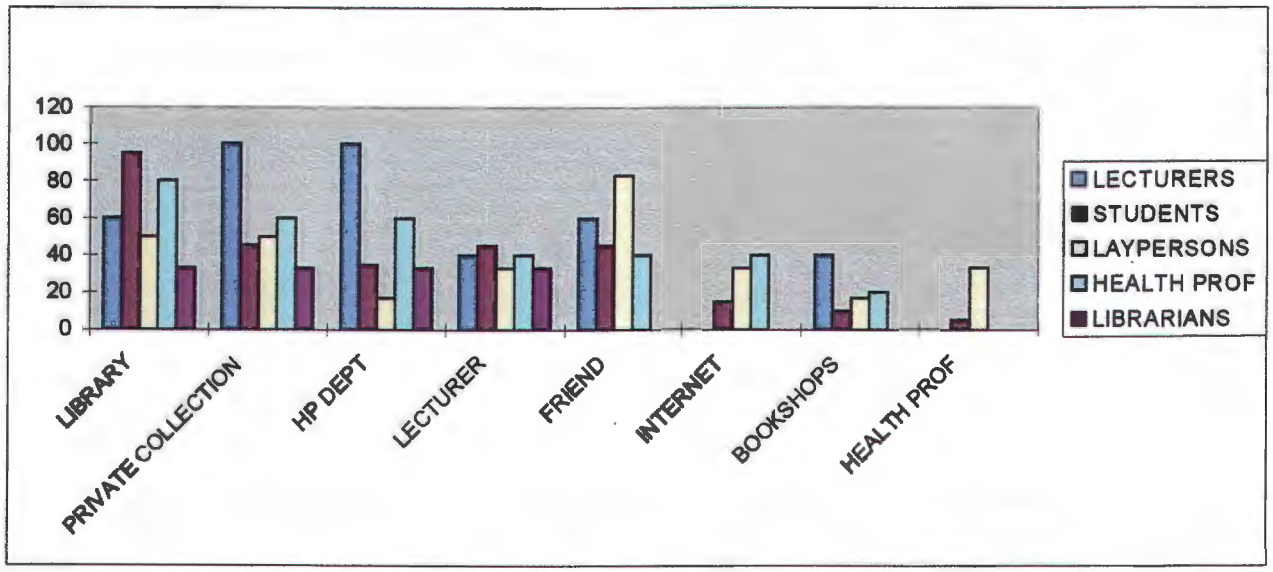
The following aspects will be discussed, namely resources and sources of information, methods used, tools for retrieving information, access points and database searching in an analysis of questions 2, 4, 5, 24 and 25.

The purpose of question 2 was to have the respondents indicate which of the listed, and other resources, are currently used to satisfy their information requirements with regard to rational therapy information. From the pilot study it was determined that the HP staff collection housed in the Helderberg College HP department office as well as other private collections were considered to be important resources. Therefore the researcher stipulated certain resources for consideration by the respondents' and added an 'Other' category so that the respondents' were free to indicate resources deemed to be significant to them.

From Figure 4.4 it can be seen that 95% of students, 80% of health professionals and 60% of lecturers included the library as a resource. Yet, in question 7 one of the findings was that they suggested that there is not enough rational therapy information available in the library. It

may be that respondents use other 'libraries' as well as Helderberg College Library, but no respondents asked for clarification as to which library was being referred to. However, the researcher did probe and ask respondents why they had indicated that the library was a

Figure 4.4 Resources and sources used



source of information to them. A large percentage indicated that they always tried the library as a source of information even though they thought that they possibly would not find what they needed there. This indicates to the researcher that respondents do value the library as a potential source of information for the database.

Figure 4.4 highlights the importance of the HP department collection of resources especially among lecturers. The HP department collection consists of resources collected over a period of time by the lecturers and is housed for the convenience of HP staff in the HP department office for use by both staff and students. This collection was developed with the rational therapy approach as its basis and is a very important potential source of information.

Networking was viewed as an important means of obtaining information. This was highlighted in the pilot survey as well as in the interviews conducted. For the sake of clarity it must be noted that in discussion the researcher clarified that this actually is a method of information seeking. But it infers that people as experts in their field are viewed as sources of information as are agencies and organisations. The invisible college therefore plays an important role which must be taken into account. The best method to deal with these resources must be determined.

Several implications can be inferred from the findings of question 2. Firstly, the potential for use of the library as a resource is there but the rational therapy information must be systematised to facilitate accessibility. It is a requirement of the user that the services the library offers are efficient and effective. The library staff therefore has a responsibility to enhance and increase the value of the library as a resource as many respondents indicated their reliance on the library to fulfil its role as provider of information. The function of the library is to cater for user information-seeking behaviour and ensure that what users need is available and accessible. A database of resources is viewed as a potential solution. A second implication of the findings is that lecturers could be consulted as experts to establish criteria for the selection and inclusion of entities and information about entities in the database as they are trained in the rational therapy approach. They analyse and select entities for inclusion in their collections. Thirdly, the researcher must consider the HP department collection as well as other well-used private collections for possible inclusion in the database. This requires a policy of inclusion and exclusion (see section 5.4.4).

A further implication is the responsibility devolving on the one responsible for other collections resulting from increased demand and use of these sources and the problems involved. Only information about the entities as well as the collections where they can be found will be stored in the database. Although the information is available there are constraints on accessibility. This may hamper the research process. An advantage is that more sources could be made

available which will benefit the library system and relieve some of the pressure to supply information. This would address some of the problems of accessibility and availability (see section 3.3.3.1). An implication is that the user must be able to identify the location of these resources. The sources contained therein must therefore be specified, for example, by the inclusion of location identifiers or codes. There would need to be a loan policy for the different collections. Because human networking is seen as an important way of finding information or solving problems, the researcher, as designer, must make decisions about what should be done with this essentially referral or directory type information.

Question 24 deals with the availability and accessibility of the entities. The concept 'resource centre' refers to the fact that sources in, for example a private collection may not be available for loan, that is borrowed. What is available in the database is the information about the entity. Therefore consideration will have to be given to the 'owner' of the resources to determine the general availability or limited use of sources. The responses are reflected on a continuum from restricted use to non-restricted use. The need for information dictated for some that sources must be available. Restricted use is related to the value, scarcity, form or demand on the information source. Users suggested that as far as possible master copies should be kept. The implication of these findings is that the users place a high value on information about rational therapy and they need to have certainty of the availability of this information in a database.

One of the intentions of question 25 was to determine whether the database of resources for rational therapy would be considered a resource by the various user groups once they had left the environment of Helderberg College. This question is related to questions 2 and 24 in that the researcher's intention was to establish what resources were used and whether the database would be considered as an important resource in itself, not limited to the College environment only but on a wider scale.

The implications were more far-reaching than the researcher originally thought and may need to be researched in another study. What must be considered is that which has bearing on the database as a resource and its role in the wider health information infrastructure. The database centralises a collection by giving information about entities. The entities can be housed/collected in various locations. Usage of these entities could therefore be restricted. A future implication is the potential of Internet availability and its relationship with the database. This would require that individuals had both computer and telecommunications access. If they did not have online access then a service would have to be offered by the library at Helderberg College to allow them to request information or searches done on their behalf which impacts on staffing and staff time. The costs involved in postage and photocopying would also have to be considered. Another consideration would be whether a fee-based service would be offered or whether the database and the associated services would be available on a subscription basis. A decision would have to be taken on a current awareness service. If the College started a distance education programme then the database of resources could support this. This raises many issues. These will be referred to in Chapter six under recommendations for further study.

A second aspect of information-seeking behaviour is to establish how users find information, that is their methods. This infers difficulties experienced in the methods of searching. Therefore the individual processes to access information may throw light on group information-seeking behaviour. The intention of question 4 was to determine how respondents find information. This could enlighten the researcher about habits and patterns of information seeking. Instead of prescribing methods the question was open-ended so that the user could freely describe their searching process.

In the analysis of data the researcher classified methods into those which are 'library-related' or not library-related, that is other. Library-related connotes those methods which the library offers as service or can take responsibility for in making information available. Any other

methods refer to those methods outside of the jurisdiction of the library. In Figure 4.5 it becomes apparent that the library and its services are perceived as important resources. In Figure 4.6 other methods were identified and the implications are that these need to be considered for potential inclusion in, for example the database.

Figure 4.5 Library-related sources

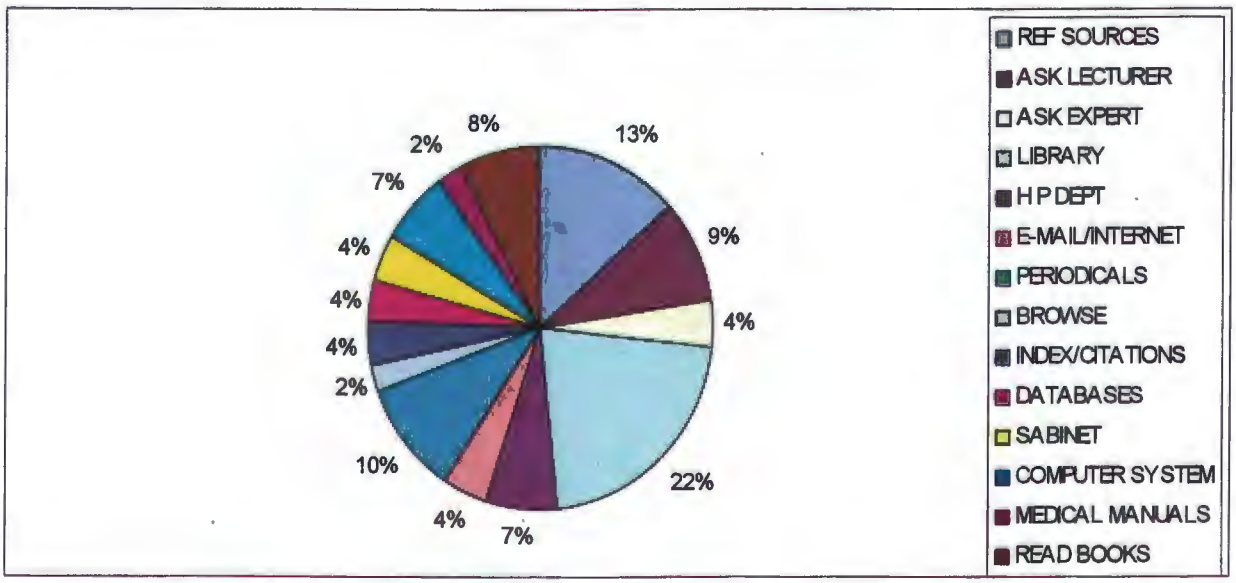


Figure 4.6 Non library-related sources

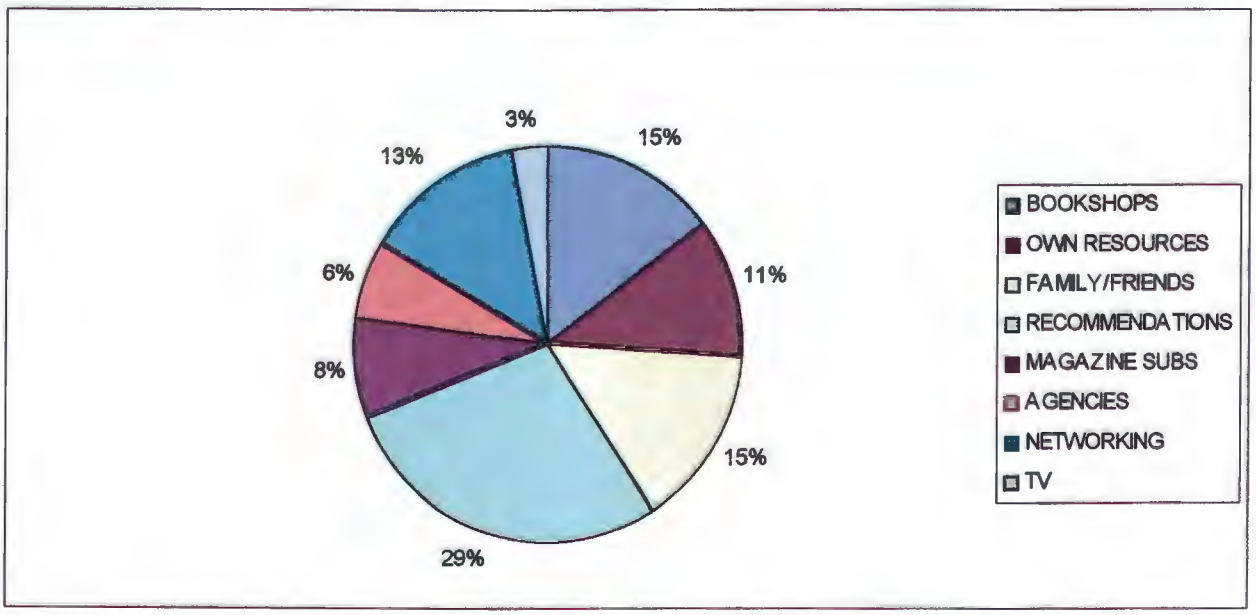
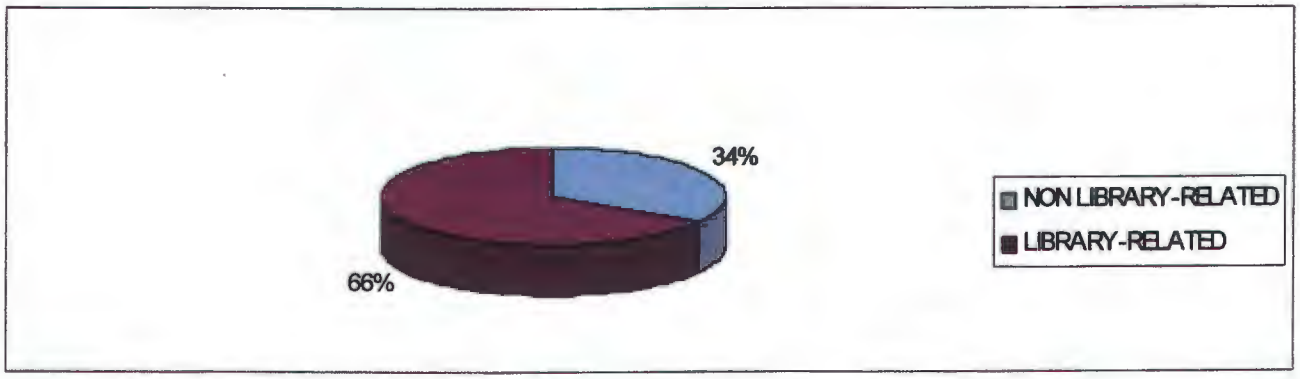


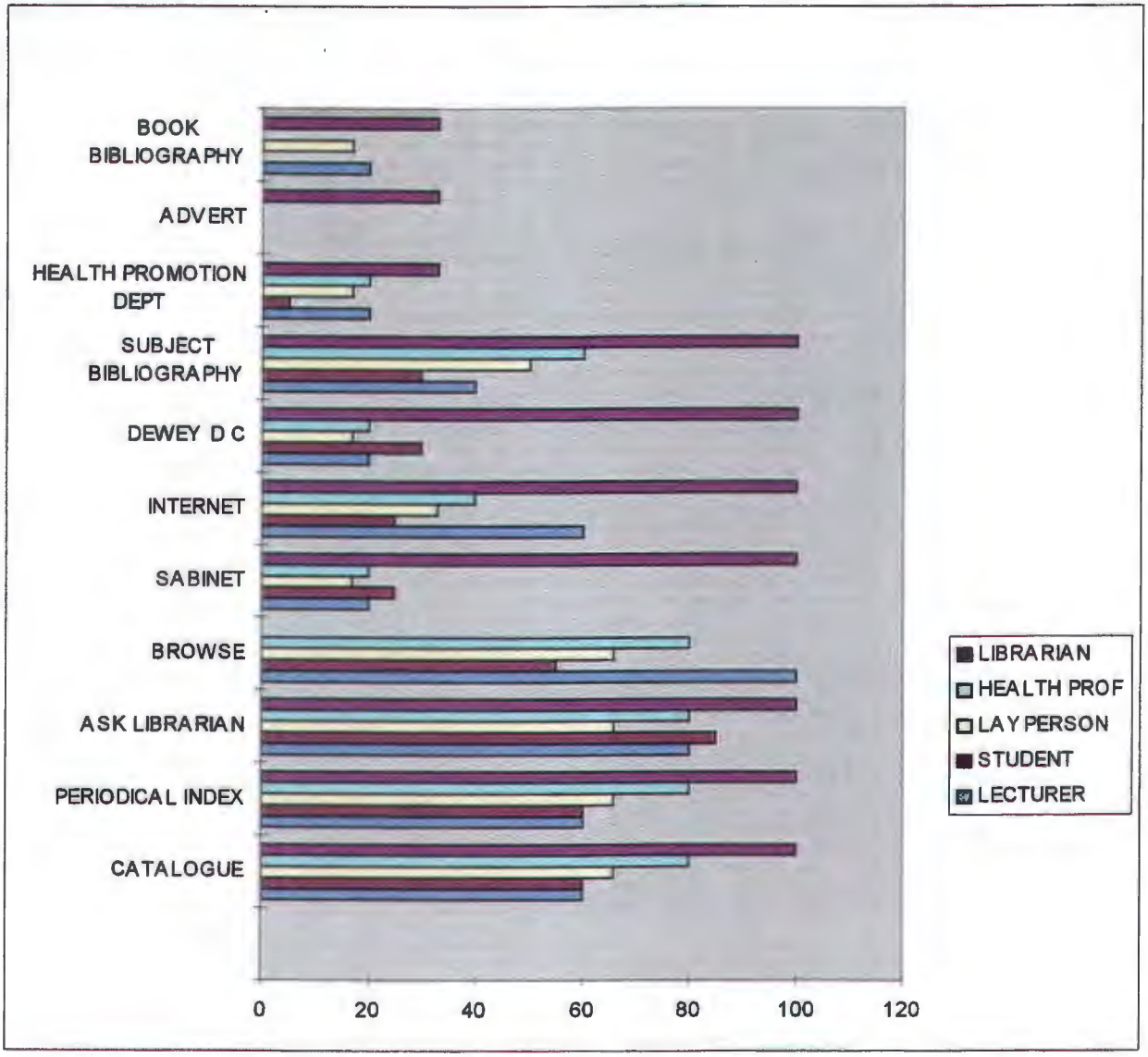
Figure 4.7 Proportion of library to non library-related sources



Therefore these could be included as part of the services of the library. This impacts on the constraints that need to be addressed including the selection policy. Sixty-six percent of the resources are library-related (see Figure 4.7).

Question 5 was intended to determine user familiarity with and use of various library tools (see section 4.2.2.2) such as the catalogue, indexes, knowledge classifications such as the Dewey Decimal Classification system, subject bibliographies, et cetera. The initiative of the respondent was also challenged. The specific intention is to relate information practice and principles and library policy to the design process as far as possible. The question was to assess how the user would cope with this. A knowledge of the catalogue and indexes could mean that the user would be able to recognise similar formats, searching methods, access points and tools reflected in the database operation. SABINET Online provides access to various databases. It is currently used by the library to search on behalf of users and they are aware of this service. Most users have developed a mind-set about the services the library can currently offer. Most of these services are performed by intermediaries, such as librarians. Their task is to assist with the retrieval of information through the use of bibliographic retrieval methods. The question assessed both awareness of these factors and raised awareness of their services. The database is intended to enhance these services.

Figure 4.8 Tools used to retrieve information



From the findings reflected in Figure 4.8 it can be inferred that an informed user would already be knowledgeable about library procedures and conventions and would therefore use this knowledge in searching the database. The organisation of knowledge according to classification schemes, cataloguing rules, indexing rules, et cetera therefore could be used as a base for the design of the database. It is also apparent that the library could familiarise its patrons with its services to a greater extent.

The researcher is aware of the tendency of users to conform to habitual patterns of information searching. Therefore it is essential to identify the user requirements about their stated

preferences of possible access points. This was the purpose of question 10 in which various possible access points were listed. 'Other' would cover any possibility neglected but important to the user. No one responded to the category 'other'. From Table 4.4 it can be seen that the user study verified this fact. Question 11 asked respondents for a ranking of their search preferences with regards to chosen access points in question 10. Question 12 identified the various combination of access points the users' preferred.

Table 4.4 Access points

USER GROUP	CHOICE 1	CHOICE 2	CHOICE 3	CHOICE 4	CHOICE 5
LECTURER	SUBJECT	TITLE	MEDIA TYPE	AUTHOR	COMBINATION
STUDENT	SUBJECT	TITLE	COMBINATION	AUTHOR	MEDIA TYPE
LAYPERSON	SUBJECT	AUTHOR	TITLE	MEDIA TYPE	COMBINATION
HEALTH PROF	SUBJECT	AUTHOR	TITLE	MEDIA TYPE	COMBINATION
LIBRARIAN	SUBJECT	AUTHOR	TITLE	MEDIA TYPE	COMBINATION

The type of media was not believed to be significant unless a specific medium (type of media) would be the most suitable for use in a particular situation, such as a video or poster for a public health seminar. Respondents raised the issue of 'combination' which was clarified in the interview. It was necessary to establish whether a database would have to accommodate a search using a combination of access points such as a given author and a specific subject. The importance of the subject in combination with title was followed by a combination of subject with author. This also helps to prioritise the most useful access points to be included.

The implication of the users' requirements with reference to specific access points must be accommodated in the database design. This implies, for example using 'author' as access point to facilitate retrieval necessitates control and authority policies. These would include subject vocabulary control and indexing policies.

The knowledge about database searching was assessed by question 19. The findings are that most users are novices (see Table 4.5). However they are computer literate and this fact must

be maximised. The researcher included questions 20 and 21 about Internet use to assess users' familiarity with the Internet and their skills in using the network. It was necessary to determine whether the complex information-seeking behaviour and skills could be transferred to the database searching process. The researcher also wanted to discover whether users had access to the Internet and whether they perceived it to be a valuable resource. It also gave an indication of the level of competence to sift through large amounts of data and searching techniques.

The findings (see Table 4.5) indicated that librarians, lecturers and laypersons had used the Internet considerably more than students and health professionals, as they had access. The students and librarians do not have continual direct access due to line problems. These problems are currently receiving attention and improved access to the Internet should be available shortly. Health professionals indicated that they did not have the time to search for themselves but considered it valuable. There was general consensus about its value but all were cautious. The credibility and authenticity from a scientific perspective and the rational therapy approach were of concern.

Table 4.5 Knowledge of database searching

USER GROUP	DATABASE SEARCHING	ACCESS TO INTERNET	USED INTERNET
LECTURER	40%	60%	60%
STUDENT	35%	50%	35%
LAYPERSON	17%	100%	50%
HEALTH PROF	0%	0%	0%
LIBRARIAN	66%	66%	66%

The implications impact on the following: user interface, user-friendliness of the system, structure of the database and expectations of users about a database. Other implications include the amount of training required, the availability of a help facility and how extensive this should be, screen design, menus, instructions and the choice of software which must be taken into consideration. The need for librarian assistance either as an intermediary or in a help

capacity has implications in terms of time, costs, availability and training of staff. All of these issues are pertinent to conceptual design. Users' requirements are significant for the determination of system conventions, rules and guidelines and identify those entities and the relationships among entities which will facilitate a systematised, efficient and effective design.

Several implications could be gleaned from these findings. The database should be made available on the Internet for wider use. This was verified by question 25. These findings have future implications. The researcher must investigate the inclusion of sources from the Internet which implies that guidelines would have to be established by which these sources could be critically analysed and judged suitable for inclusion. This would include the responsibility of surfing the Net on a regular basis. An implication of the time constraints of health professionals means that an intermediary would need to be considered with its own implications. Although the database will assist the library to fulfil its task, it will also mean that there will be additional responsibilities implicated.

Information is needed about the user's requirements with reference to entity types, the use of subject, relationships, user-friendliness and user interface.

4.4.2 User requirements and assessed needs

In the model of the database (see Figure 3.3) there are specific aspects to be dealt with in the conceptual schema, namely entity types, domain of entities, authorised identifiers, relationship rules for entities, thesaurus and index language. The user's requirements with specific reference to these must be identified. Some of this is technical and therefore, although the questionnaire did not directly question the user on these issues, these needs must be assessed by the designer. Brief reference is made to these requirements in this section, merely to highlight significant implications. The discussion of the conceptual schema is the subject of Chapter five where detail is required.

4.4.2.1 Entity types

Entity types are termed entities for the purpose of this study. The intention of question 6 was to determine the entities to be included in the database for rational therapy. 'Media type' was the term used for ease of understanding. Media type includes the following entities: books, periodicals, periodical articles, CD-ROM, posters, pamphlets, audiotapes and videos. Specific types were stipulated and the category "other' was included to cover any that the user identified as essential.

Figure 4.9 indicates the various user groups' preferences about entities. The designer needs to take note of these preferences and recommendations as far as possible. Figure 4.10 shows the entities preferred and in order they are: video tapes, periodical articles, books, pamphlets, periodicals, audio tapes, CD-ROM, posters, contact people, experts, Internet, newspaper clippings, subject files, research papers, databases and visiting speakers.

This will impact on the scope of the database and the associated attributes of entities and their domains which must be identified and established. The relationships among entities will also be a major consideration. Compilation of a data dictionary listing the entity types and their attributes and the rules for domains of the attributes must be done (see section 5.5).

The detail about entities with reference to the design process will be discussed in Chapter five. From questions 6, 8-10, 11, 12 and 23 it can be inferred that the respondents require the database to link and use relationships between entities. Relationships are therefore significant in the design process (see section 5.5.2).

Figure 4.9 Media type

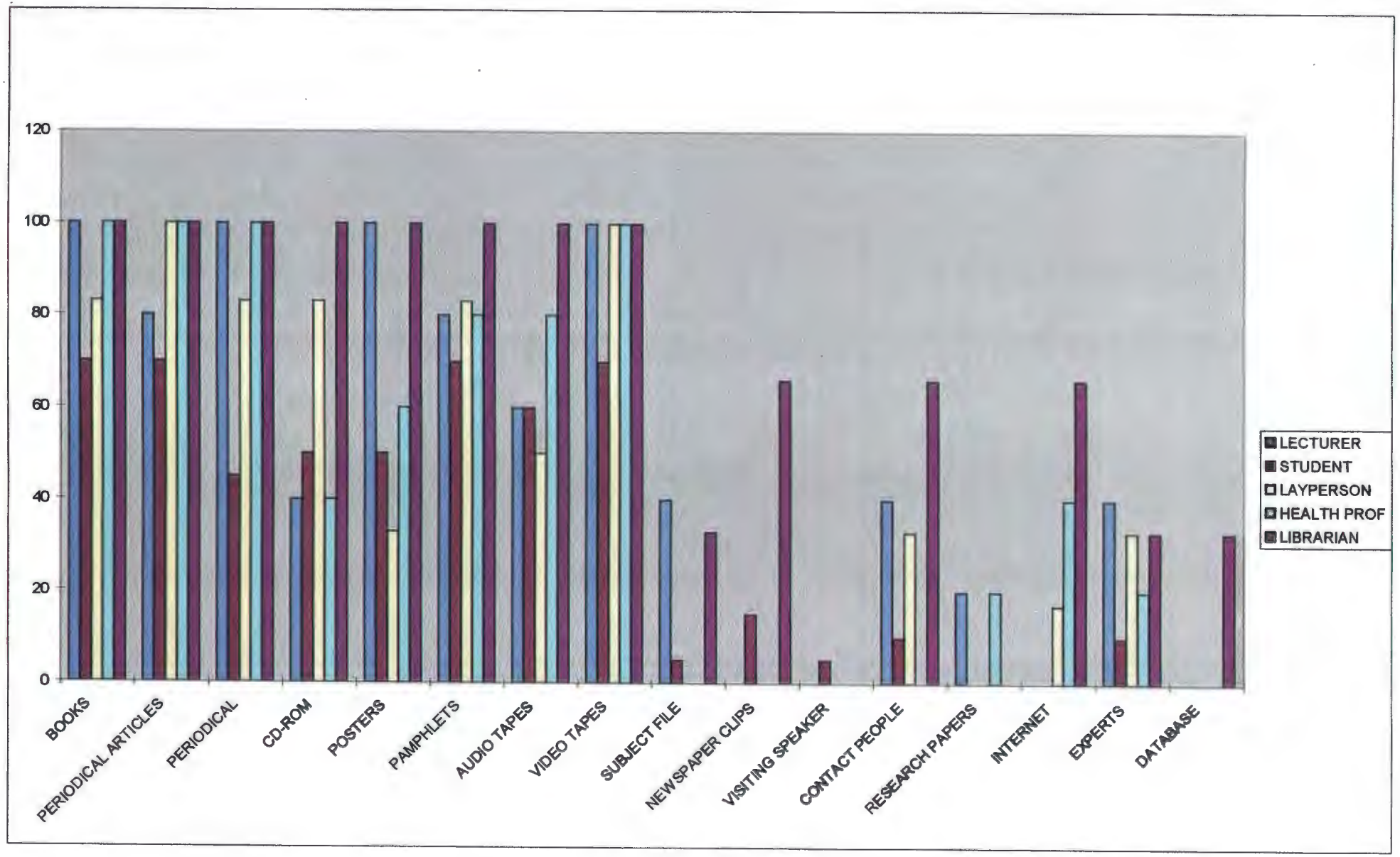
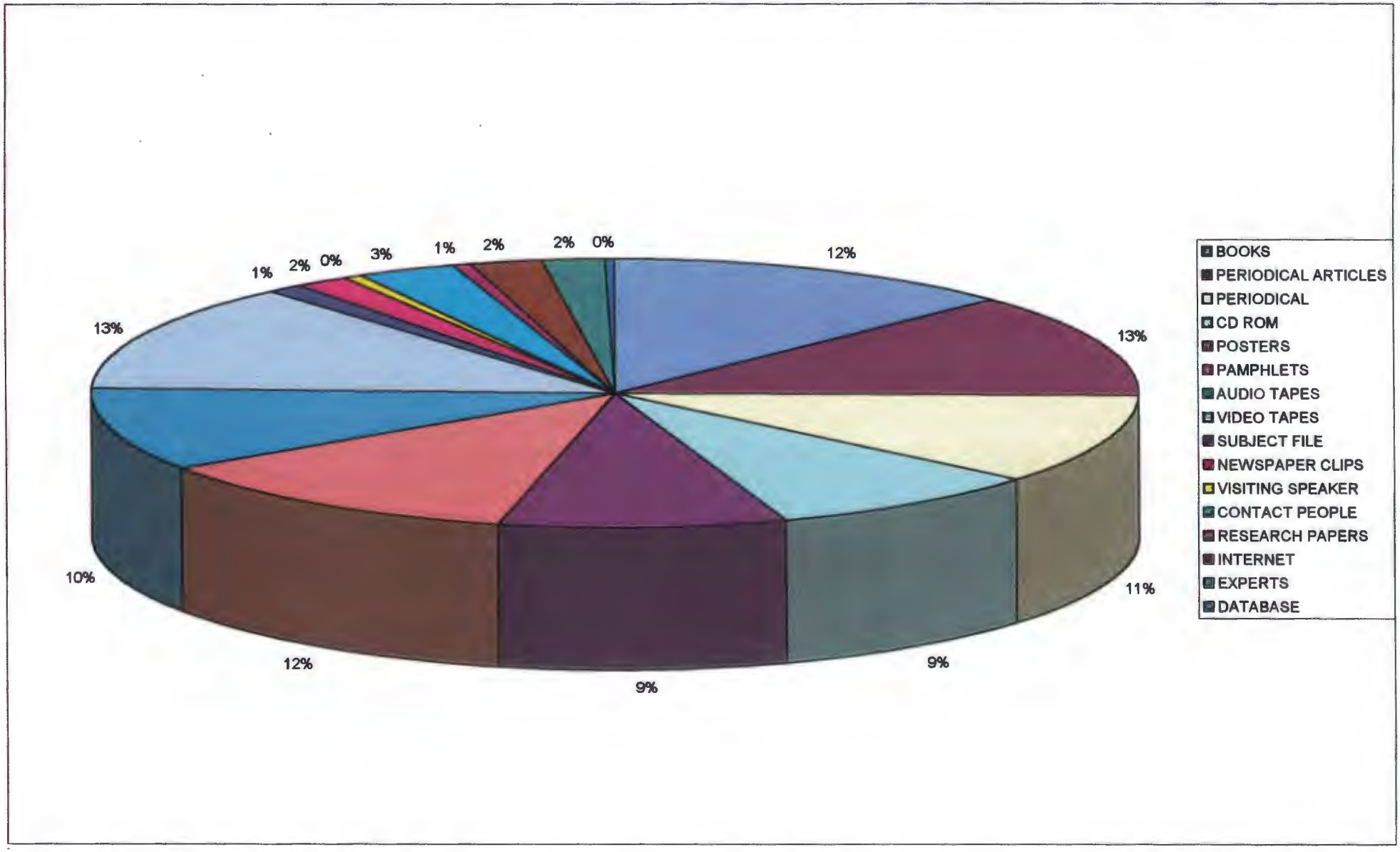


Figure 4.10 Proportion of media type



4.4.2.2 Subject vocabulary control

Question 8 was dedicated to the identification of a list of subjects that are believed to reflect the essences of a rational therapy approach. This would enable the researcher to develop categories under which information could be classified. This would serve to initiate subject vocabulary control and the development of a thesaurus. The subjects used must be pertinent to the user. Limiting the number to 10 in the question was an attempt to ensure that the respondent selected the terms thoughtfully thus prioritising the list. The compiled list of subjects suggested is included as **Annexure 2**.

The findings indicated that there is a wide range of information to be selected and many different subjects could be used for searching. The sources to be included would thus be influenced by the choice of subjects. The establishment of guidelines and rules for subject vocabulary control is therefore necessary to provide uniformity and consistency in the form of indexing policy, et cetera.

A knowledge of related, pertinent subjects will alert the researcher to the related terms which need to be used for both information-seeking as well as for the selection of credible, pertinent sources of rational therapy information. The inclusion of question 9 was to determine related terms with which the respondents are familiar and use for searching (see Table 4.6). NEWSTART is an acronym for the eight basic principles of rational therapy. However, it is rare that any information will be found under this subject and therefore the related terms must be used. It will be important to include information on each of the principles reflected in the acronym, viz. nutrition, exercise, water, sunshine, temperance, air, rest and trust.

Table 4.6 Subject preference

USER GROUP	1ST CHOICE	2ND CHOICE	3RD CHOICE	4TH CHOICE	5TH CHOICE	6TH CHOICE
LECTURER	WHOLISTIC	NATURAL REMEDIES	PREVENTIVE	LIFESTYLE MEDICINE	COMPLEMENTARY	ALTERNATIVE
STUDENT	WHOLISTIC	NATURAL REMEDIES	LIFESTYLE MEDICINE	PREVENTIVE	ALTERNATIVE	COMPLEMENTARY
LAYPERSON	NATURAL REMEDIES	WHOLISTIC	LIFESTYLE MEDICINE	PREVENTIVE	COMPLEMENTARY	ALTERNATIVE
HEALTH PROF	LIFESTYLE MEDICINE	NATURAL REMEDIES	WHOLISTIC	ALTERNATIVE	PREVENTIVE	COMPLEMENTARY
LIBRARIAN	NATURAL REMEDIES	WHOLISTIC	LIFESTYLE MEDICINE	PREVENTIVE	COMPLEMENTARY	ALTERNATIVE

The implication of this is that the terminology must be standardised. Both key terms and related terms must be determined. The database must lead the user in the search process. Therefore a clear understanding of the search process includes the subject descriptors used (see section 5.5).

4.4.2.3 User-friendliness

Because of the confusion (emphasised in the literature review) about the understanding of this concept 'user-friendliness', it was important to ask the respondents a relevant question, that is question 14 to assess user perceptions. This will help to clarify user requirements of the system. The concepts offered in response included simple presentation, simple instructions; easy to access needed information; find needed information as quickly as possible; specificity; easy location and retrieval; understandable terminology for the novice user; easy to use; referencing (links) to similar topics; minimum of steps for fast retrieval; confidence in own ability to use the system; little or no training required; explanatory; make life easier; guidance through processes and procedures; clear options presented on the screen; prompting; able to use key terms; no stress or fear.

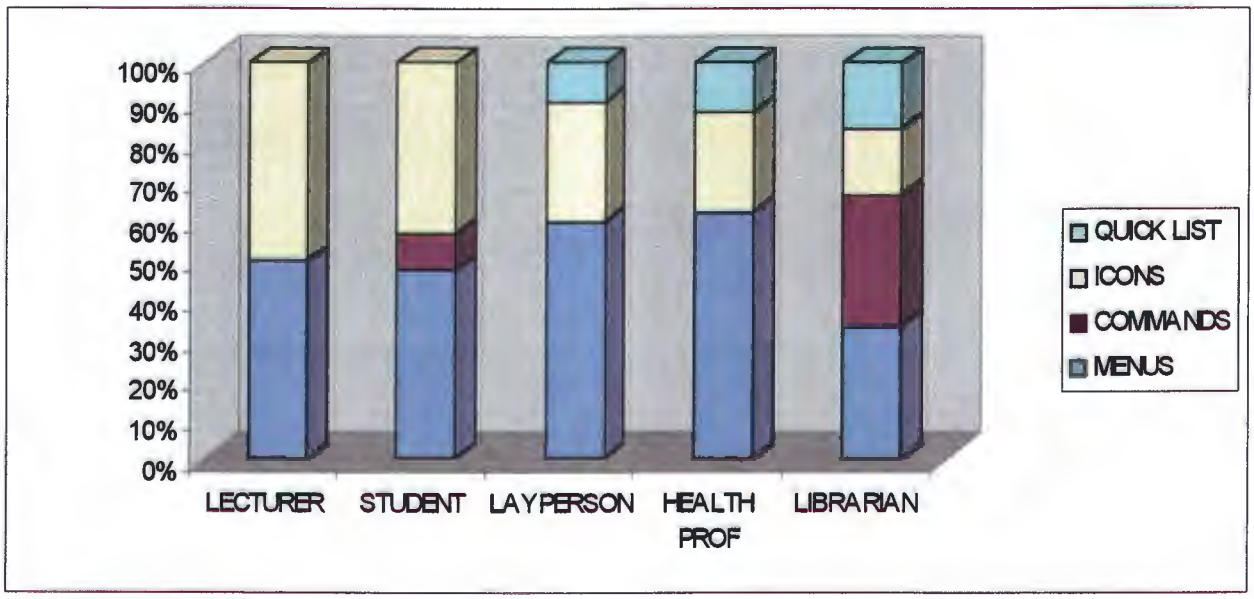
The expectations of the respondents expressed in question 23 together with the understanding of the concept of user-friendliness are implicated. The way the database is designed either determines its success or its failure.

Implications include the rules and system conventions which have to be established to optimise the system and make it as user-friendly as possible, that is easy to use, systematic, specific, efficient, effective, accessible, instructive and clear. This will include the relationships among the entities which will facilitate easy access.

4.4.2.4 User interface

Question 15 intended to establish respondents' requirements with reference to the user interface.

Figure 4.11 User interface



Although the researcher will not design the user interface for the database in this study, it is nevertheless an important aspect. There were three methods offered to determine the

method/s considered suitable for the user when searching by subject for information retrieval. The use of menus, commands or icons were offered. The interview facilitated an explanation of the second option when necessary, as most had an understanding because of their familiarity with Microsoft Office and the use of text or message boxes. The findings of question 15 indicated that users would feel most comfortable with a menu-driven system as can be seen from Figure 4.11.

The intention of question 26 was to purposely make the question open-ended and ask respondents for any comments or suggestions. Their comments both reinforced the need for such a database which could be made available on a wider scale to make it more accessible and available and to promote the rational therapy approach and offered suggestions for development, such as advertising, the awareness of current information as well as the need for developing a source database.

For the sake of clarity the significant implications that have been discussed in the previous section's data analysis and interpretation will be summarised.

4.5 SUMMARY OF USER REQUIREMENTS

The purpose of identifying these is to develop descriptions, rules, conventions and policies as guidelines to inform conceptual design, the subject of Chapter five. Therefore the implications as stated above in section 4.4 are summarised below.

4.5.1 ISAR system for rational therapy

It was established that users require an ISAR system to manage rational therapy resources so that their tasks can be fulfilled. This would facilitate the organisation and systematisation of resources for retrieval to answer query statements. This would ensure availability and

accessibility of credible resources. A computerised system would be of potential use as users are computer literate although they have a novice's knowledge of database searching. The design should ensure that their requirements for user-friendliness are assessed and wherever possible realised.

4.5.2 Credible, scientifically proven rational therapy information

A significant user requirement is for credible information that has been selected by an expert who is knowledgeable about the rational therapy approach using criteria that have been established in consultation with relevant user groups. A characteristic of credibility is that information must be scientifically proven. A database of credible resources would contribute to the credibility of the rational therapy approach.

4.5.3 Scope of the database

The emphasis on the credibility of information facilitates the designation of the scope of the database by the criteria or policy identified for the inclusion or exclusion of sources. As far as possible the entities identified and preferred by the user will be accommodated. User requirements specified the need for entities and information about entities which can be supplied by a reference database.

4.5.4 Task of the library staff

The users require that the library staff are knowledgeable about rational therapy and are trained to develop the collection which will be reflected in the database. Users expect that the library staff will take responsibility to update, maintain and operate the database. An additional responsibility is for an intermediary to undertake a search on behalf of the user. The task of the library staff is to support the tasks of the various user groups.

4.5.5 Use of Library and Information Science practices and policies

Library and Information Science practice is aimed at fulfilling information needs. Therefore its practices and policies reflect a systematic approach to the collection, organisation and retrieval of information. These accepted policies, rules and conventions should be reflected in the design of the database.

4.5.6 Subject vocabulary control

Users require subject access to information. However, they are also concerned about the relationships among entities with reference to their common attributes, such as title information, author information and in various combinations. As subject access is the preferred method of searching, subject vocabulary control is of prime importance. The vast amount of information in health care and the lack of reference to rational therapy as a subject descriptor necessitate the development of an indexing policy and a thesaurus which requires continuous modification. This requires careful analysis of information sources demanding a broad general knowledge of both the rational therapy approach and related approaches such as alternative, complementary, wholistic and preventive health.

4.5.7 Future use and recommendations

These user and system requirements will be discussed in Chapter six.

4.6 CONCLUSION

The focus of Chapter four was to collect and analyse data in a user study using a combination of qualitative and quantitative research methods to establish user requirements. Information about users, that is user profile and user requirements and assessed needs were considered.

This is an essential aspect of the database design process. Output has to do with satisfying users' queries. User's queries reflect their problems for which they need information. These user requirements are an integral part of a successful database design process and form the basis for the conceptual schema which is the focus of Chapter five.

CHAPTER FIVE

CONCEPTUAL DESIGN

5.1 INTRODUCTION

The conceptual design was initiated at the beginning of this study where the problem to be investigated was identified, concepts were defined and the context for this study was delineated. The structure of the database must be specifically designed according to the users' requirements. These user requirements are then organised during the conceptual design process. According to the model outlined in Chapter 3 (see Figure 3.3) the conceptual schema is the result of a processing of this information about user requirements specified in the previous chapters. The conceptual design and the resulting conceptual schema is therefore the focus of this chapter.

Conceptual design as an iterative process will firstly be defined and discussed. This conceptual design process results in the conceptual schema, which is the blueprint for the database. The data dictionary will list and describe the entities, attributes of entities and the policies or rules which govern these. The operations dictionary evidences the functions or operations of the entities and the relationships among entities. The relationships among entities will be graphically represented. The Entity-Relationship (E-R) model is the graphic tool used to illustrate the relationships among entities. The system rules, guidelines, policies and conventions undergirding the conceptual schema form the last element of conceptual design and a discussion of those relevant to the design of this database will be included where applicable.

The goal of database design is to ensure that a database contains items and concepts that are meaningful to the user and the system as a whole (Jones & Monk 1997:16). To secure a successful design the impact of every decision must be clearly seen and weighed against the

priorities for the design of the database (Fidel 1987:16). This chapter therefore focuses on information constitution with the accompanying rules, system conventions and policies that govern the database.

5.2 CONCEPTUAL DESIGN

Conceptual design, in the context of database design, is a process which ultimately should result in an abstract model, illustrated by a diagram, of a database structure that represents real-world objects in the most realistic way possible (Rob & Coronel 1993:617). In this process a detailed "architectural plan" based on the requirements collection and analysis step is developed for the database (McFadden 1988:272). The focus is on information needs, information sources, information users and information constitution (Rob & Coronel 1993:248).

Fidel (1987:10) identifies three levels of design, namely the internal, external and conceptual levels which are necessary to complete the process of design. Batini (1992:11) states that conceptual design is by far the most critical phase of database design as decisions on this level are made concerning the representation of the whole enterprise in the database independent of the way they are stored (internal level) and viewed (external level) by the various users. Despite being independent of decisions made on the internal and external levels the conceptual level is the only stable link between them as they are more dynamic and more likely to be changed (Fidel 1987:12). Decisions made on the conceptual level result in the conceptual schema which lays the foundation for the other phases of design. Conceptual design consists of three consecutive processes: the study of the problem, the representation of data in formal terms and the selection of rules for data collection (Fidel 1987:14).

The study of the problem involves identifying the users' requirements. Three steps are involved in this first process. The first two steps were discussed in Chapter four in which representatives of user groups were identified and interviewed about their potential requirements. This is the source for establishing each element of data. Following on this the data was organised in a

useful way (see section 4.4). The third step is to construct a data dictionary which lists and describes the entities, their attributes, the authorised identifiers of each entity and the rules or policies governing these. The data dictionary also includes a definition of each data element (Fidel 1987:14). The construction of a data dictionary is part of the focus of this fifth chapter, together with the second and third processes discussed below (see section 5.5).

The outcome of the second process is the representation of data in formal terms in a graphic way. This represents the elements and their relationships in an E-R diagram (Fidel 1987:15). The enterprise is represented using the information needs that were identified to formulate the elements that should be included in the database and how they should relate to each otherThe third process is the selection of rules for the representation of the elements formulated before and for the ways that they can be related to one another. These three processes which formally represent elements and their relationships and the rules devised together create the conceptual schema.

In summary, conceptual design is a process in which the user requirements are used as the basis for developing the conceptual schema in which the data are represented in relationship with each other. It includes the policies that are established as guidelines by which the database will function.

5.3 CONCEPTUAL SCHEMA

The conceptual schema is a diagrammatic representation, or a formal outline that explicitly expresses all the decisions on the conceptual level. The conceptual schema should be a complete and accurate representation of the data requirements of the enterprise and is the 'heart' of the database (Soergel 1985:138). Overall the conceptual schema serves as a guide for collecting and organising the information to be included in the database which is part of the ISAR system. The database, as part of the ISAR system, functions to retrieve information or entities from the system. The conceptual schema therefore contains the logical structure of the

entire database as seen by the designer and is the basic 'blueprint' of the database design (Rob & Coronel 1993:617).

The conceptual schema defines the intellectual or logical content of the database (the entity store of the ISAR system) and consists of rules for entering and extracting information or entities from the database (Soergel 1985:59). It is developed from the user needs and requirements. In addition to taking cognisance of user needs, the conceptual schema should be based on the type of query which will be put to the database and on the subjects which will be covered by the queries. Care must be taken to include only relationships which are really necessary and those which the user will look for (Soergel 1985:139).

The conceptual schema then represents the entities of the enterprise, the attributes of those entities and the relationships among entities and is defined by the data themselves (Connolly *et al* 1996:51). For each entity type the conceptual schema defines the domain or scope, that is, what entity values are covered. It indicates what entity identifiers to use, either by giving an authority list of all entities with their authorised identifiers or by giving general rules of form. It also gives rules for establishing relationships. When the designer designs the conceptual model he/she tries to determine present and future information needs and attempts to develop a lasting model of the organisation (Elmasri & Navathe 1989:7).

Therefore, in summary, the conceptual schema is the logical content of the database in which the entities, entity identifiers and the domain of each entity to be stored are specified as well as the relationships among them. It determines the rules for the collection of entities as well as for the internal and external formats and therefore is the blueprint for the database.

The researcher followed the conceptual design process to formulate a conceptual schema by firstly representing the user requirements in the data and operations dictionary. These are defined below and practically evidenced in section 5.5.

5.4 DATA AND OPERATIONS DICTIONARIES

In the data dictionary information about data (termed metadata), about entities, their attributes and the relationships among them relevant to the database, is stored (Fidel 1987:224). It is in the data dictionary that any changes made must be recorded (Rob & Williams 1995:4).

Related to the data dictionary is the operations dictionary which forms the skeleton of the E-R model. Each entry in the dictionary lists several entities that relate to one another. These relationships among entities in an operation's entries represent those relationships that in real life are needed to accomplish the operation (Fidel 1987:94). Operations are defined as the specific activities that together constitute a function. When all the operations from the operations dictionary are integrated into an E-R diagram the major part of the diagram is completed. This operations dictionary is ultimately incorporated into the data dictionary by evidencing the relationships among entities.

In addition to the user requirements gleaned from the user study and incorporated in the data and operations dictionaries, information derived from potential users can be complemented by the designer, as there was no guarantee of a comprehensive coverage of data requirements in the requirement collection and analysis step of design. Designers should use their judgement to determine how these items of data should be related to other entities in the diagram and to establish the necessary relationships.

Rules, guidelines and conventions too must be formalised. The purpose is to answer questions so that the actual representation of facts and objects is complete and unambiguous (Fidel 1987:154). Any anticipated problems identified during the data collection process are dealt with by specifying rules to resolve them. This facilitates consistency and reliability. The rules for each entity, relationship and attribute are recorded in the data dictionary (Fidel 1987:147). The E-R diagram ultimately represents the data dictionary which is the basis of a conceptual schema (Rob & Williams 1995:15).

The three components of a data dictionary are explained below, namely entities, attributes and relationships.

5.4.1 Entities

Types or sets of entities are more important to the designer of the conceptual schema than individual entities. Most items of data are clearly entity types rather than individual entities. However the term 'entity' is most often used to designate 'entity type' and this is the term used in this study.

An entity is a 'thing', an object or concept, real or abstract, that is uniquely identifiable and is identified as having an independent existence, whether it be a physical or a conceptual existence. The entity represents a set of 'objects' in the 'real-world' with the same properties. A name and a list of properties, termed attributes, can identify each entity (Connolly *et al* 1996:166).

Types of entities relevant to this study include supertype and subtype entities and composite entities. In the case of entities that share common characteristics the generalisation hierarchy is used to represent these. In the relational context the generalisation hierarchy depicts a relationship between a higher level supertype entity and a lower level subtype entity. The supertype entity set is usually composed of several unique and disjoint (non-overlapping) subtype entity sets (Rob & Coronel 1993:166).

A composite entity is an entity designed to transform an M:N relationship into two 1:M relationships (Rob & Coronel 1993:616). The composite entity is existence-dependent on the other entities. Therefore no null entries are possible in the composite entity (Rob & Coronel 1993:164). This will be practically evidenced in a later section of this chapter when M:N relationships are encountered among some of the entities required for this study (see section 5.4.3).

An authorised identifier is a string of symbols representing an entity in a database. To each entity is assigned one unique identifier (Fidel 1987:149). Besides this unique identifier, there must be a mechanism that enables one to find which string of symbols represents which entity. This minimises confusion when it comes to input, for example each author's name is uniquely identified by a specific number which represents the attributes of that author. This also facilitates uniformity in output.

5.4.2 Attributes and attribute domains

Another fundamental concept in the data dictionary is the 'attribute' which is a piece of information about an entity or about a relationship. An object or a fact is an attribute when it is not of interest by itself but only when it is connected to one, and only one, entity or relationship and in addition, it has no attribute itself. If however, an object or a fact might be of interest regardless of the entities and relationships to which it is connected, or if it has attributes, it must be classified as an entity (Fidel 1987:114).

In developing a database a designer examines objects and facts and represents them with a string of symbols. This string of symbols representing an attribute of a particular entity is called a value of the attribute. To ensure an orderly and efficient construction and operation of a database a designer must describe for each attribute what kind of values it can take. These strings of symbols that can be used to represent an attribute form the domain of the attribute. A domain is a set of values that could be assigned to represent an attribute (Wertz 1992:26).

5.4.3 Relationships among entities

Soergel (1985:21) suggests that information can be represented by a set of entities connected by relationships. This is termed the relational approach (see section 1.9.1). Therefore in the operations dictionary, which is incorporated eventually in the data dictionary, these relationships, which are associations among entities, must be established. With the two

fundamental concepts of entity and relationship the designer can begin to construct the E-R diagram.

Relationships among entities may take one of three forms. A one-to-one relationship (written as 1:1) exists if any entity in entity set A can be matched to only one entity in entity set B and an entity in entity set B can be matched to only one entity in entity set A. A one-to-many relationship (written as 1:M) exists if any entity in entity set A can be matched to only one entity in entity set B, but an entity in entity set B can be matched to many entities in entity set A. A many-to-many relationship (written as M:N) exists if any entity in entity set A can be matched to many entities in entity set B, and an entity in entity set B can be matched to many entities in entity set A. The relational approach requires the use of 1:M relationships. If M:N relationships are encountered a bridge must be created between the entities that display such relationships. This bridge is an entity composed of the authorised identifiers of each of the entities to be connected. This entity is known as a composite entity (see section 5.4.1).

To determine the type of relationship between entity sets two questions need to be answered. Firstly, can one entity in entity set A be matched to more than one entity in entity set B? Secondly, can one entity in entity set B be matched to more than one entity in entity set A? Two 'no' answers indicate a 1:1 relationship. One 'yes' and one 'no' answer indicate a 1:M relationship. Two 'yes' answers indicate an M:N relationship. The proper definitions of the relationships between entities are crucial to the database's proper operation (Rob & Coronel 1995:3).

The relationships among entities included in a generalisation hierarchy (see section 5.4.1) are depicted between a higher level supertype entity and a lower level subtype entity. Supertypes and subtypes maintain a 1:1 relationship (Rob & Coronel 1993:166). This will be evidenced later in the chapter (see section 5.5.2).

The inclusion of individual entities in a database requires that a selection policy be established which lists the criteria for inclusion or exclusion of entities.

5.4.4 Selection policy

A key issue in any ISAR system is the selection of resources to be included in the database. These resources must have potential use for the user. Therefore the user requirements and objectives of the system must be considered in the process of identifying relevant and useful items from the available pool of materials. These are then included in the database. This choice is made according to stated and/or implied criteria. It does not specify the actual selection procedure but offers a set of general guidelines which are to be applied in a systematic and consistent way (Pao 1989:76-77). By default a selection policy identifies logically the exclusion policy.

In the following section the user requirements identified in Chapter four will be used as the basis for developing the data dictionary.

5.5 USER REQUIREMENTS AND DEVELOPMENT OF DATA DICTIONARY

User requirements collected and analysed in Chapter four are the foundation upon which the data dictionary is developed. Tables 5.1 and 5.2 reflect user requirements with reference to input, output, entities, access points, database requirements, resources and selection policy.

The objective of the selection policy for this database is to obtain, from a variety of established, recommended, expert sources, information that is scientifically proven and credible, for inclusion in the database. Each entity must have bibliographic details by which it is described in the database. Established collections, including the private collections of the HP staff who are considered experts, will help to provide a basis for criteria with which to select other resources.

Based on the user requirements, the information professional has to identify and describe the entities, determine the attributes of each entity, identify the authorised entity identifier and state the policies that will govern each entity.

5.5.1 Entity descriptions, attributes and policies

Consistency in cataloguing methods can be applied to database management. The objective is for better control over source materials. The *Anglo American Cataloguing Rules* (AACR2) give standardised guidance for achieving consistency when entering information such as personal names and the names of organisations (Clark 1991:4). The researcher decided to follow bibliographic practice as far as possible in determining the exact form of the entry and the authority data which aids in standardisation of input and output assisting in information retrieval. This policy was affirmed by the users in the user study who recognised the value of library practice and policy (see section 4.5.5).

The entities, their attributes and the policies that have been determined are represented in this section in tabular form at the end of the chapter. These tables (ie Tables 5.1-5.26) form an integral part of the conceptual schema. Tables for the following entities, determined both from the user requirements and from the expertise and experience of the researcher are outlined below: User, Location, Subject, Related, Broad, Narrow, Unauthorised, Mediatype, Book, Print, Graphic, Computer, URL, Audiovisual, Directory, Author, Publisher and Source.

5.5.1.1 User

The researcher decided to include the user as an entity to develop a user profile. It is important to note the details of the users including the group to which they belong to identify their specific tasks and functions and to determine their subject preferences and interests. The user may be interested in more than one subject which creates a problem in the relational approach that must be addressed. This aspect will be dealt with in section 5.5.2 dealing with the relationships

among entities and the possible creation of new composite entities. Table 5.3 is a description of the user as an entity and the attributes relevant to a description of the user. The policies or rules guiding the selection of this entity and its attributes are incorporated in the table.

The UserID has been chosen as the authorised identifier for the User entity and is underlined to indicate this. The authorised identifier in each following table will be underlined. User password has been included as an attribute of the entity User to facilitate user access from other locations when available or required, for example on a network or the Internet. One of the requirements stated by the users was that they would make use of the database even after leaving the College environs. Therefore contact details such as e-mail address, fax number, et cetera need to be kept to fulfil this requirement.

5.5.1.2 Location

A very important user requirement identified in Chapter four was for the location of an entity to be indicated. It is necessary for each entity to have one location. In Table 5.4 the policies and rules for Location as an entity are determined. For duplicate entities their unique accession number will differentiate the copies and specify the location. A standardised name will be used for each location and will be uniquely identified by the LocID which is the authorised identifier for this entity.

5.5.1.3 Subject

The most important entity identified from user requirements was Subject (see Table 5.5). Associated with Subject are the following issues: indexing, vocabulary control and thesaurus construction. To facilitate an answer for subject queries other entities in relationship with Subject that need to be included are related terms, narrower terms, broader terms and unauthorised terms. This will serve to guide the user in the searching process. This is an important consideration when it comes to user-friendliness (see section 4.4.2.3). Separate

tables (see Tables 5.6-5.9) have been formulated for each of these entities to deal with the complexity of the relationships among these entities. For clarity the subject has been identified as an entity but the concept 'descriptor', defined as a term assigned to an entity to describe its subject matter, will be used to designate each individual term. Descriptors are the working terms of a vocabulary and are also known as index terms or keywords (Harter 1986:37).

Indexing is the key to a retrieval system. Chang (1993:30) states that a good indexing scheme provides for faster retrieval and makes maintenance of the database easier. The purpose of indexing is to provide access to information. Title is considered an access point. The title of any entity included in the database will be dealt with in the indexing process as the title generally reflects the subject terminology and is stated using key terms. Descriptors will be added to the Subject entity as part of the indexing process and will be represented in a subject thesaurus.

Vocabulary control is a controlled list of index terms which are used as an authority list (Lancaster 1971:1). These are used in indexing entities as well as in searching for these entities (Pao 1989:116). The term chosen is the one most often used by the users or, according to the designer, is the one most appropriate for the concept. It assists in the comprehension of the subject matter by suggesting and providing leads to the most precise, accurate and appropriate index terms (Pao 1989:118). Vocabulary is controlled by choosing preferred terms from among a group of terms with similar meanings. The indexer and searcher are directed to the preferred term by *use* or *see* references. A *see* reference is made to control the use of synonyms, near-synonyms and quasi-synonyms. A combination of two methods will be used for vocabulary construction in this study. Firstly, a representative set of entities will be indexed to establish and confirm or modify the list of terms suggested by the users in the user study (see Annexure 2 and section 4.4.2.2). Secondly, reference will be made to glossaries, publications, back-of-the-book indexes, subject bibliographies, and subject specialists to verify the preferred terms and establish any neglected, yet relevant terms (Lancaster 1972:27-28). Vocabulary control and the development of a thesaurus is an on-going process which has to be continually

evaluated against the information and resources collected in this specific area of knowledge (literary warrant) and taking into consideration the users' requirements (user warrant) (Pao 1989:128). Chifwepa (1998:81) suggests that where there are well-defined user groups one can be more selective in the language used and there is more specificity because the assumption is that a closed lexicon is shared.

A subject thesaurus will provide standardisation ensuring consistency for the descriptors, which is very similar to the function of an authority list, such as that used for an author or a publisher. This facilitates the searching process, a requirement stipulated by the user.

For the purpose of this study a thesaurus is defined as a controlled vocabulary of semantically and generically related terms covering a specific area of knowledge. According to Pao (1989:119) a significant element of a thesaurus is that it displays hierarchical and associated relationships among terms as well as providing definitions for the scope of terms. There are three types of term relationships, namely synonymous, hierarchical and associated. As a tool for information retrieval a thesaurus is meant to be a guide for input and output (Pao 1989:120). It controls terms, explains how they should be used, resolves ambiguities through scope notes, translating natural language used in documents as well as the topics searched by the user into a mutually precise language. The functions of a thesaurus include control over word forms, homographs and synonyms by providing cross-references from unacceptable to acceptable terms. It also provides rules and procedures for assigning terms as well as for adding new terms (Tenopir & Lundeen 1988:80).

The principle that has been followed in this study has been to use library practice and conventions as much as possible. Therefore the Library of Congress Subject Headings (LCSH), which are used by Helderberg College Library, will be used as the basis for the construction of the thesaurus. A brief example of how this will be accomplished in practice later is given here. Terms indicated as relevant to and descriptive of the rational therapy approach (see Annexure 2) will be checked against LCSH and those found to relate to those specified by the users will

be incorporated in the thesaurus. Terms that do not appear in LCSH will have to be checked against the literature, by subject experts and other tools such as bibliographies, glossaries, et cetera as described above.

Some examples of terms that users indicated and found by the researcher to be in LCSH include:

- Alternative medicine (May Subd Geog)
  UF Complementary medicine
  Healing systems
  Medicine, Alternative
  Systems, Healing
  Systems, Therapeutic
  BT Medicine
  NT Holistic medicine
  Homeopathy
  Naturopathy

- Hydrotherapy (May Subd Geog)
  UF Hydropathy
  Water cure
  Water – Therapeutic use
  BT Physical Therapy

- Holistic medicine (May Subd Geog)
  UF Holistic health
  Wholistic medicine
  BT Alternative medicine
  Holism
  RT Health
  Mind and body
  NT Holistic veterinary medicine
  Self-care, Health

- Exercise (May Subd Geog)
  UF Warm-up
  Workouts (Exercise)
  BT Health
  RT Physical education and training
  NT Abdominal exercises
  Aerobic exercises

- Sunlight
  USE Sunshine

- Sunshine (May Subd Geog)
  UF Sunlight
  BT Meteorology
  --Physiological effect
  USE Solar radiation—Physiological effect

- Temperance (May Subd Geog)
  UF Abstinence
  Drunkenness
  Intemperance
  Intoxication
  Total abstinence
  RT Controlled drinking
  Drinking of alcoholic beverages
  Prohibition
  NT Alcohol—Physiological effect
  Alcoholism
  Narcotic habit

The abbreviations used above in the examples of subject terms to be included in the thesaurus for rational therapy include RT (related topic), BT (broader topic), NT (narrower topic), UF (used for).

5.5.1.4 Media type

The user requirements collected and analysed from the user study indicated user preference for a variety of media types. These media types share common characteristics yet have characteristics which are unique to a particular media type. It was decided by the researcher to use a generalisation hierarchy (see Figure 5.16) which was defined in section 5.4.1. Hereby Mediatype is identified as a supertype entity with each individual media type identified as a subtype entity. The Mediatype entity (see Table 5.10) contains common attributes to all subtypes. The relationship between the Mediatype entity and the individual subtype entities, such as Book, Computer, Graphic, Audiovisual et cetera is 1:1.

The use of a supertype entity containing common attributes to all subtypes reduces the number of empty fields in a record , eliminates redundancy and saves space in the database. The accession number (AccNo) for each individual entity will be the link between the supertype and subtype entity. The accession number, chosen as the authorised identifier, will be assigned according to the policy for each individual entity, for example Book entity, accession number will be B1, et cetera.

5.5.1.5 Book

Particularly for those books located in the Helderberg College Library, a call number field has been added to the Book entity for retrieval purposes (see Table 5.11).

5.5.1.6 Print

The Print entity (Table 5.12) includes articles indexed from periodicals, newspapers and other materials such as papers presented at conferences. This entity is related to the Source entity Table 5.20) which lists the source of the indexed entities, such as periodicals and newspapers. It was decided by the researcher to include the separate entity Source for easy input into the database and to deal with the problem of standardisation of Source titles. With the relational approach these two entities can be linked.

5.5.1.7 Graphic

The term graphic was chosen to cater for those entities which are of a graphic nature such as charts, photographs, filmstrips, slides, posters (Table 5.13).

5.5.1.8 Computer

The term Computer was chosen to describe that entity which deals with computer files, including CD-ROM (Table 5.14). Users indicated the need for resources such as CD-ROM and documents saved on disk.

5.5.1.9 URL

The entity URL was included to list Internet sites or web pages which could be of use and/or interest to the various user groups (Table 5.15). The results of the user survey indicated that

the different user groups felt that this could be a valuable resource. Sites would be added to the database by the information professional responsible for the updating of the database and sites would also be included based on recommendation from individuals and after evaluation by the information professional.

5.5.1.10 Audiovisual

The entity Audiovisual describes both audio entities such as audiocassette tapes and audiovisual entities such as video cassette recordings (Table 5.16).

5.5.1.11 Directory

The user survey indicated that networking was an important source of obtaining information or expert advice. Therefore the researcher has included the entity termed Directory (see Table 5.17) to build up a referral type resource which refers to those individuals or organisations with specialisation or expert knowledge in a particular subject field. Specificity is required to describe the subject area the individual or organisation has knowledge of or expertise in. Therefore it was decided to limit each directory entry to one subject descriptor.

5.5.1.12 Author

The user requirements indicated that author would be used as an access point. To facilitate easy input, searching and retrieval, the researcher decided to establish an authority list for author and therefore include it as a separate entity. This will ensure standardisation in entry of each individual author. AACR2 rules for author entry will be followed. The entry of an author in only one place and only once will also minimise errors, discrepancies and allow for the choice of the correct author from an authority list. The AuthorID will be the authorised identifier for the author entity. Author details such as address, telephone number, fax number, e-mail address et cetera will allow the user to contact these individuals for further elucidation, more information, to

verify facts, among other things. For the purpose of the database for rational therapy the author is defined as any person, whether it be an individual or a corporate body who is intellectually responsible for the content of any resource. This definition includes directors, speakers, illustrators, compilers, organisations, photographers, et cetera. If no author is available for a resource then the appropriate AuthID indicating anonymous will be chosen.

5.5.1.13 Publisher

As for the Author entity, Publisher was included as a separate entity to act as an authority list for publishers (Table 5. 19). Just as for the Author entity, the publisher will only have to be entered once and only in one place. This will minimise input time, keying errors and will standardise publisher details. AACR2 rules will be followed with regards to publisher details.

5.5.1.14 Source

As stated earlier, when discussing the Print entity (see section 5.5.1.13), the entity Source has been included, just as in the case with the Author and Publisher entities, to form an authority list of Source entities which is connected with the Print entity (Table 5.20). The entities to be included in the Source entity include indexed articles from periodicals, articles from newspapers, et cetera. The inclusion of this entity will limit redundancy, ensure standardisation, minimise input time and error.

The entities listed and described above are associated with each other and connected by relationships. These must be established and specified in the conceptual schema, specifically because this is a relational database.

5.5.2 Relationships

The concept of relationships was discussed in section 5.4.3. The relationships among the entities listed above in section 5.5.1 must be defined and will be shown graphically. M:N relationships are problematic in a relational database. Therefore when M:N relationships occur they must be changed into 1:M relationships. Composite entities are formed to change these M:N relationships into 1:M relationships.

Figure 5.1 Relationship between Source and Print

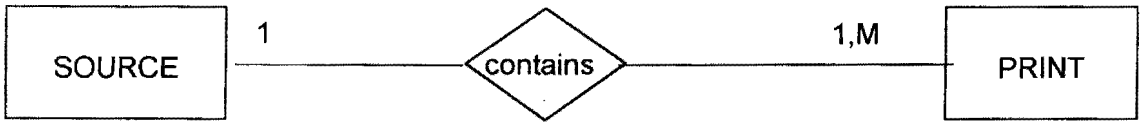


Figure 5.2 Relationship between Publisher and Mediatype

Figure 5.3 Relationship between Publisher and Source

Figure 5.4 Relationship between Directory and Subject

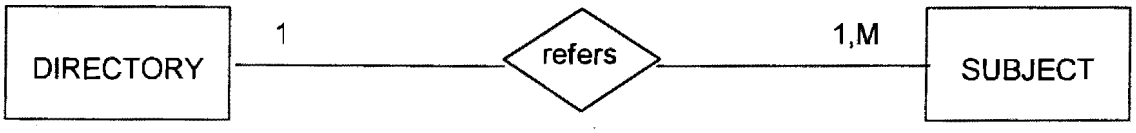


Figure 5.5 Relationship between User and Subject

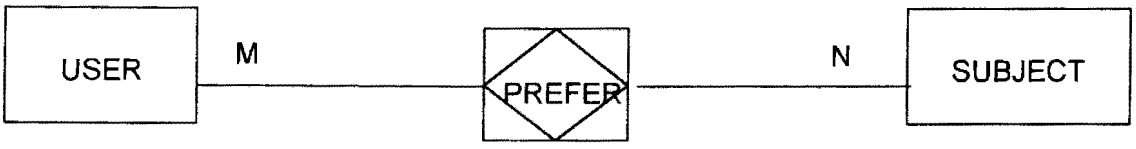


Figure 5.6 Relationship between Mediatype and Location

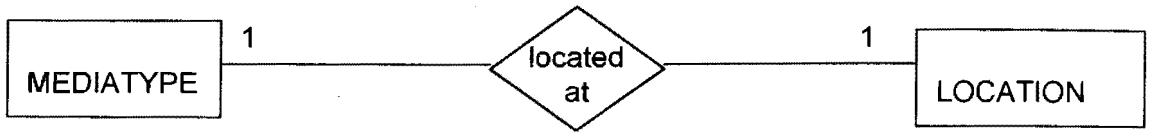


Figure 5.7 Relationship between Author and Location

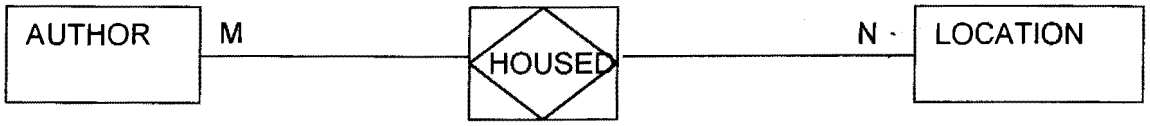


Figure 5.8 Relationship between Subject and Location

Figure 5.9 Relationship between Subject and Related

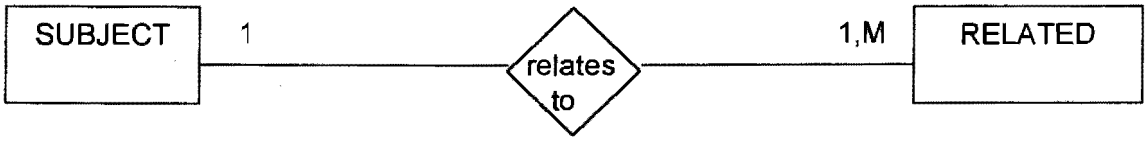


Figure 5.10 Relationship between Subject and Broad

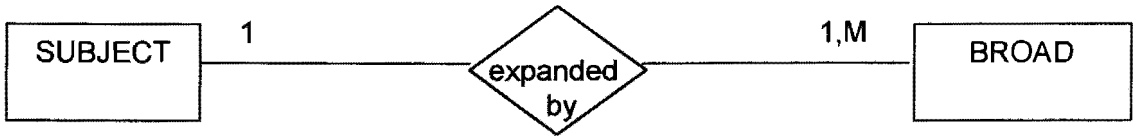


Figure 5.11 Relationship between Subject and Narrow

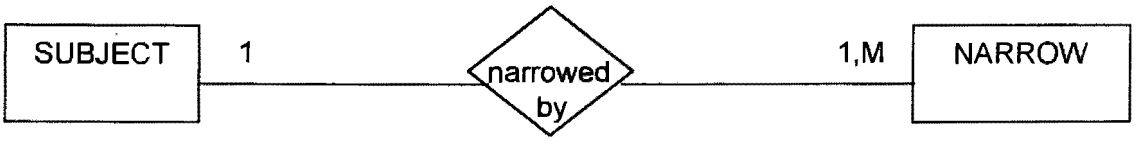


Figure 5.12 Relationship between Subject and Unauthorised

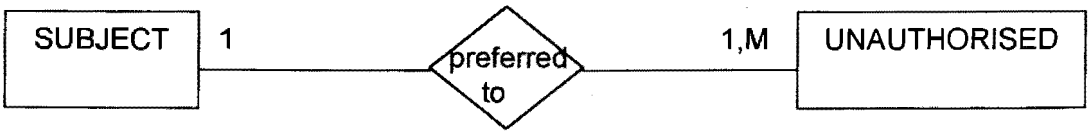


Figure 5.13 Relationship between Author and Mediatype

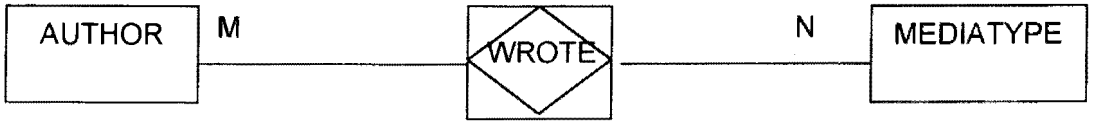


Figure 5.14 Relationship between Subject and Mediatype

Figure 5.15 Relationship between Author and Subject

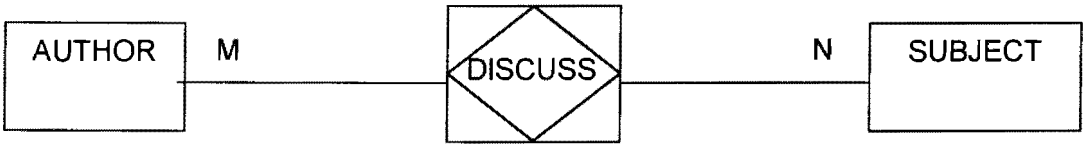
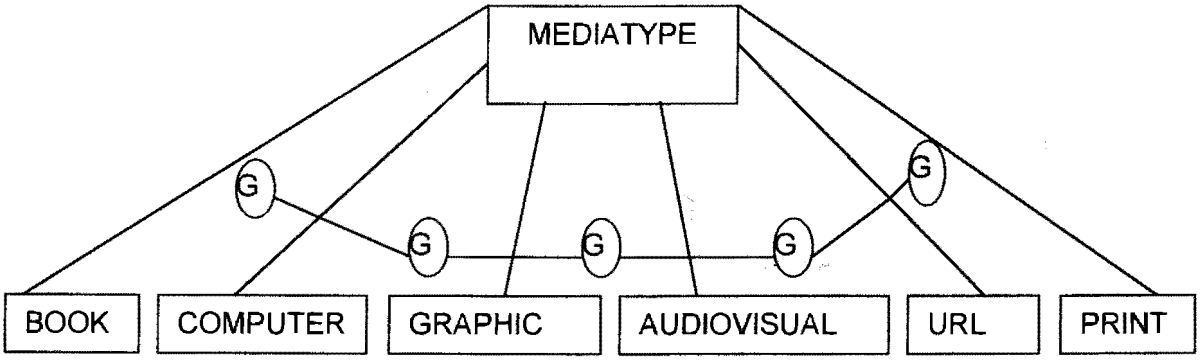


Figure 5.16 Mediatype generalisation hierarchy



The relational aspects of the generalisation hierarchy were discussed in section 5.4.3. A 1:1 relationship exists between the supertype entity, in this case Mediatype and the subtype entities, Book, Computer, Graphic, Audiovisual, URL and Print. The symbol G in the circles indicates the unique and disjoint (non-overlapping) subtype entity sets.

The relationships indicated below then are integrated to form the E-R diagram which is a graphic representation of the conceptual schema. The E-R diagram will be formulated from these single relationships in section 5.6.

The entity Wrote is a composite entity of the Author and Mediatype entities (see Figure 5.13). Many authors wrote many mediatypes (M:N). The authorised identifiers from both the Author and Mediatype entities then form the attributes of this new entity (Table 5.21).

The entity Stored is a composite entity of the Subject and Location entities (see Figure 5.8). Many subjects are stored at many locations (M:N) and many locations store many subjects. The authorised identifiers from both the Subject and Location entities then form the attributes of this new entity (Table 5.22).

The entity Discuss is a composite entity of the Author and Subject entities (see Figure 5.15). To deal with the M:N nature of the relationship between the Author and Subject the authorised identifiers from each of these tables are included as attributes of a new entity. Many authors discuss many subjects (Table 5.23).

Many subjects describe many mediatypes (Table 5.24). Therefore, because of the M:N relationship between these entities the composite entity Describes is formed by including the authorised identifiers from each of these tables as attributes (see Figure 5.14).

Many users prefer many subjects. The composite entity Prefers caters for the M:N relationship between these entities (see Figure 5.5). The authorised identifiers from both the Subject and User entities form the attributes of this new entity (Table 5.25).

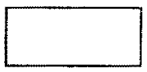
Many authors are housed at many locations (Table 5.26). The composite entity Housed describes the relationship between these two entities and includes the authorised identifiers from each of these two entities as attributes in the new entity (see Figure 5.7).

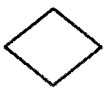
These new composite entities which were formed to deal with the M:N nature of the relationships amongst several of the entities are included in the E-R diagram.

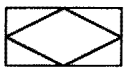
5.6 ENTITY-RELATIONSHIP (E-R) MODEL

The purpose of the E-R model is to provide a simplified representation of the relationship among entities (Rob & Coronel 1993:62). Once the data and operations dictionaries are established the database's enterprise can be formally represented. The E-R model, a diagram with supporting documentation (the data dictionary) pictures the world in terms of entities that have attributes and participate in relationships and illustrates these (Halpin 1995:5). To transform the list of discrete entries to an integrated diagram designers use their knowledge concerning relationships among entities and their capacity to distinguish between entities and attributes (Fidel 1987:91).

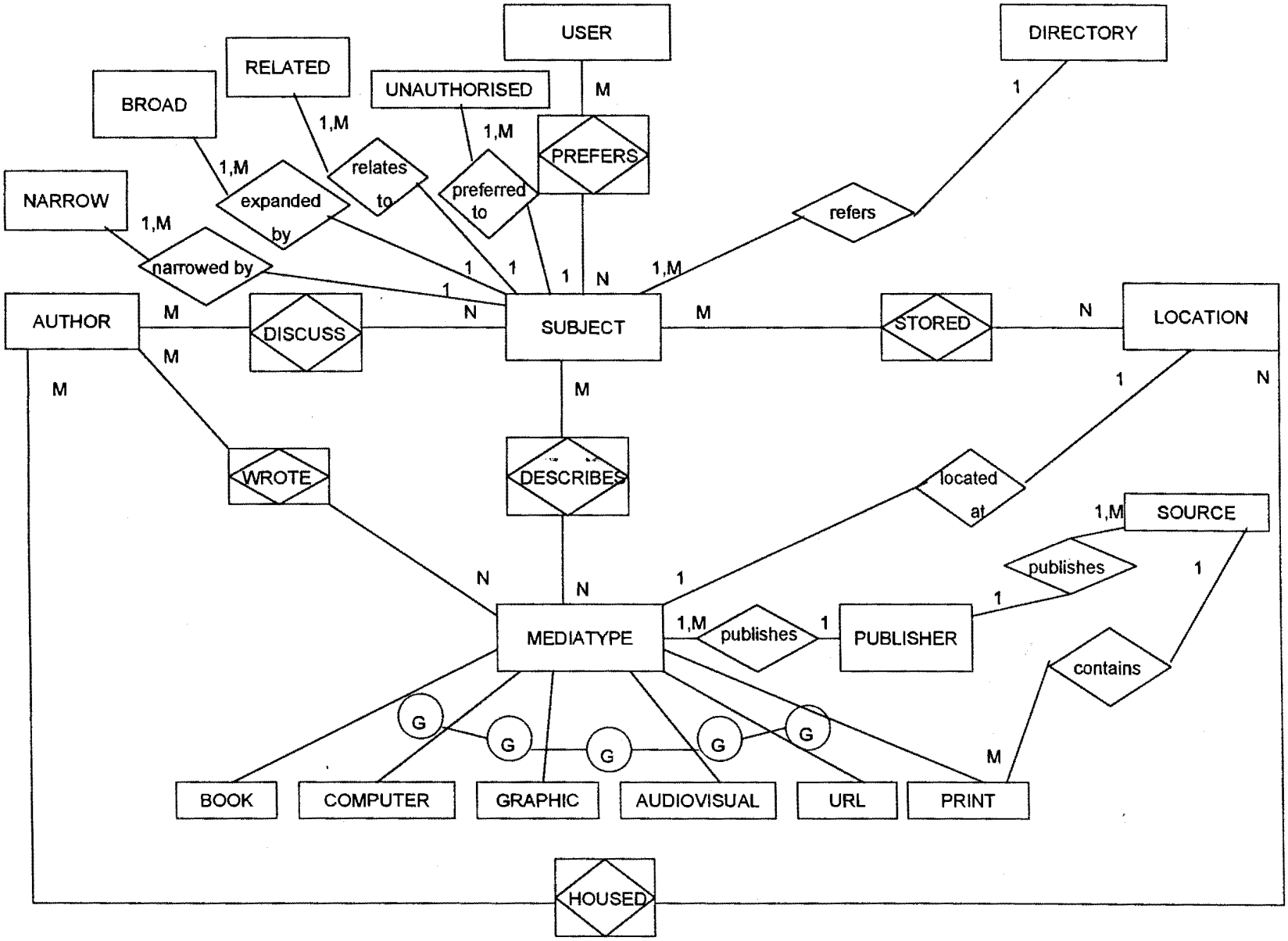
The E-R diagram for the database of resources for rational therapy is outlined in Figure 5.17. It is a composite representation of all of the relationships among entities that were outlined in this chapter. Entities, relationships and composite entities are represented as follows:


= entities


= relationships


= composite entities

The E-R diagram (see Figure 5.17) together with Tables 5.1-5.26 and Figures 5.1-5.16 and the associated policies and rules constitute the conceptual schema. This is the blueprint for the database of resources for rational therapy which could be printed in a separate blueprint document for the following stage which is beyond the scope of this project.


USER
DIRECTORY
RELATED
BROAD
UNAUTHORISED
M
1
1,M
1,M
PREFERS
NARROW
1,M
expanded by
relates to
preferred to
refers
narrowed by
1
1
1
N
1,M
AUTHOR
M
DISCUSS
N
SUBJECT
M
STORED
N
LOCATION
M
M
M
1
N
WROTE
DESCRIBES
located at
1,M
SOURCE
publishes
1
1
N
N
1
MEDIATYPE
1,M
publishes
1
PUBLISHER
contains
G
G
G
G
G
M
BOOK
COMPUTER
GRAPHIC
AUDIOVISUAL
URL
PRINT
HOUSED

5.7 CONCLUSION

The intention of this chapter was to design the conceptual schema for the database of resources for rational therapy. The findings of the user study reported in Chapter four were used to inform this conceptual design process. The user requirements summarised in Table 5.1 laid the foundation for the determination of entities, attributes, relationships among entities, rules, policies and guidelines. The entities, their attributes, authorised identifiers and the policies and rules guiding input and output were outlined in Tables 5.1-5.26 and constitute the data dictionary. The relationships among entities were graphically shown in Figures 5.1-5.16 and constitute the operations dictionary. The E-R diagram incorporated the entities, their attributes and the relationships among entities to visually represent the database. This diagram can be used to communicate with the users to determine whether the database will meet their requirements. Library practice and policy were followed as closely as possible to design the conceptual schema for the reference database that will include information and information about entities for rational therapy.

Table 5.1 Summary of user requirements for database

USER REQUIREMENTS FOR DATABASE	
INPUT	User-friendly system, ease of use, menu-driven, provide help, guide the user through processes, a choice of access points for input and facilitate output. Cater both for intermediary and end-user searching.
OUTPUT	Input must facilitate output, ie retrieval of information to satisfy requirements. Print out, save to disk, on-screen options for viewing information. Information or information about entities on a subject specified by the user. Information or information about entities by a particular author. Information or information about entities by a particular author on a particular subject. Information on an individual or organisation specialising in a specific subject area. Information on a particular subject in a particular format (media type). Information on the location of a particular entity.
ENTITIES	User. Location. Directory. Media type which includes videotapes, periodical articles, books, pamphlets, periodicals, audiotapes, CD-ROM, posters, contact people, experts, Internet URLs, newspaper clippings, subject files, research papers, databases and visiting speakers. Author. Subject.
ACCESS POINTS	Subject, author, media type, combinations.
DATABASE	Provide answers to questions and enable the fulfilment of tasks and functions of the various user groups. Allow each user access to the information contained in the database. Centralise information about entities, even if entities are not centrally located.
RESOURCES	Selection policy with regard to resources is discussed in Table 5.2. The location of each resource must be indicated for accessibility. Wide variety of resources used to satisfy information requirements.

Table 5.2 User requirements and selection policy

USER REQUIREMENT	SELECTION POLICY
1. Credible information	Identify relevant resources. Continuously evaluate potential resources including bio-medical literature for information which reflects the rational therapy approach. Use a combination of academic (eg correct use of reference techniques, bibliographies, citations, abstracts) and scientific criteria (reference to empirical studies) to evaluate information, facts, statistics, case studies as well as the skills of the trained information scientist to establish credibility of resources. Use citation indexes to trace cited and original authors writing in the area of rational therapy, lifestyle medicine, natural remedies, etc.
2. Scientifically proven information	Use of scientific method including use of empirical method and acceptable method of presentation of information to disseminate information. Check credentials of authors. Acceptability in scientific circles.
Information needed for different groups a) lecturers, b) health professionals, c) students, d) librarians and e) laypersons	Select resources relevant to the requirements of the various user groups to ensure that all needs are met.
4. Information needed for different tasks and functions relative to user group	Select resources that reflect a variety of information so that the tasks and functions specific to each user group may be met. Resources must reflect a range from academically based information to consumer and self-help information.
5. Resources must be available and accessible	Avoid duplication of resources wherever possible but ensure that information about available resources is centralised in the database. Location of entities must be clearly indicated in the database for accessibility. Loan policies are dictated by the relevant holding organisations but the information about the entities must be available.
6. Current information on a broad wholistic view of HP including lifestyle, health problems and patterns of disease	Information selected must reflect the rational therapy approach and include a variety of current, relevant resources. To ensure a balanced collection resources that question both the bio-medical and alternative approaches must be included. The database must be continuously updated to include the most recent research findings on rational therapy.
7. 'Anything' that supports the rational therapy approach	The information professional is expected to have expertise in the rational therapy approach and to continuously scan the literature for the inclusion of current research findings.
8. Include material recommended by user	The database will accommodate resources recommended by various user groups. Inclusion of such sources will be subject to criteria as stated in the selection policy and administered by the information professional.
9. PHC in the South African context	Resources must include a First and Third World approach to lifestyle, health and disease.

Table 5.3 Entity – User

USER ENTITY (A person, whether it be an individual or an organisation, who has used the database at least once)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
UserID	Authorised identifier	S (Student), L (Lecturer), HP (Health Professional), LIB (Librarian), LAY (Layperson), O (potential user group) followed by a numerical number.
UserSname	Surname of the user	Follow AACR2 rules.
UserFname	First name of the user	Follow AACR2 rules.
UserAddr	Postal address of the user	Use postal address for posting materials.
UserTel	Telephone number of the user	Preface with national or international dialing code.
UserFax	Fax number of the user	Preface with national or international dialing code.
UserEmail	E-mail address of the user	Use e-mail address as specified by user in case of more than one e-mail address.
UserOcc	Occupation of the user	Short description of user occupation, eg doctor.
UserPassw	Password supplied by the database administrator	Supply user password for access as determined by database administrator.

Table 5.4 Entity – Location

LOCATION ENTITY (The physical whereabouts of an entity (its location))		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
LocID	Authorised identifier	Each location will have a unique location ID, numbered sequentially. Not null.
LocName	Named location eg HP department	Each location will have a unique, standardised name by which it will be known and included in the database.
LocAddr	Street address of location	Each location will be entered by street address for physical access to the resource collection housed there.
LocTel	Telephone number of location	Telephone number will be that of the location itself or the contact person.
LocFax	Fax number of location	Fax number will be that of the location itself or the contact person.
LocEmail	E-mail address of location	E-mail address will be that of the location itself or that of the contact person.
LocContact	Contact person for location	The person responsible for the resource collection uniquely identified in the database.

Table 5.5 Entity – Subject

SUBJECT ENTITY (Describes the descriptors which are included in the subject thesaurus)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
SubjID	Authorised identifier	Enter a unique number to indicate each subject descriptor included in the subject thesaurus. Not null.
SubjDesc	Subject descriptor	Enter subject descriptor as determined for inclusion in thesaurus. Not null.
SubjUse	Preferred subject descriptor	Indicate when preferred descriptor should be used instead of subject descriptor listed in SubjDesc.
SubjNote	Note about subject	Enter notes about subject as applicable.

Table 5.6 Entity – Related

RELATED ENTITY (Indicates descriptor related to subject descriptor entered in Subject entity)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
RelID	Authorised identifier	Enter a unique number for a related descriptor. Not null.
RelDesc	Related descriptor	Enter related descriptor to a subject descriptor specified in the Subject entity and determined in establishment of subject thesaurus.
SubjID	Subject identifier	Enter SubjID for subject descriptor related descriptor is related to.

Table 5.7 Entity – Broad

BROAD ENTITY (Lists broader subject descriptors for subject descriptors as specified in the subject thesaurus)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
BroID	Authorised identifier	Enter a unique number for the broader descriptor. Not null.
BroDesc	Broader descriptor	Enter broader descriptor for a subject descriptor as specified in the establishment of the subject thesaurus.
SubjID	Subject identifier	Enter SubjID for narrower subject descriptor broader descriptor describes.

Table 5.8 Entity - Narrow

NARROW ENTITY (Lists the narrower descriptor for a subject descriptor as specified in the establishment of the subject thesaurus)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
NarID	Authorised identifier	Enter a unique number to identify narrower descriptor.
NarDesc	Narrower descriptor	Enter narrower subject descriptor for a subject descriptor as specified in the establishment of the subject thesaurus.
SubjID	Subject identifier	Enter SubjID of broader descriptor narrower descriptor is related to.

Table 5.9 Entity – Unauthorised

UNAUTHORISED ENTITY (Consists of those subjects that are not authorised subjects)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
UnauthID	Authorised identifier	Enter a unique number to indicate each unauthorised descriptor. Not null.
UnauthDesc	Unauthorised descriptor	Enter unauthorised descriptor.
SubjID	Subject identifier	Enter SubjID for subject descriptor used instead of unauthorised descriptor.

Table 5.10 Entity – Mediatype

MEDIATYPE ENTITY (Supertype entity consisting of subtype entities containing common attributes to all subtypes)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AccNo	Authorised identifier	Use unique accession number as determined in individual subtype mediatypes, eg. B1 for BOOK entity. Not null.
AuthID	Author identifier	Choose appropriate author identifier indicating author of entity from Author entity.
Title	Title of mediatype	Follow AACR2 rules. Not null.
Date	Date of publication	Follow AACR2 rules.
PubID	Publisher identifier	Include publisher details from publisher authority list, ie List PubID for specific publisher.
Note	Notes area	Follow AACR2 rules.
LocID	Location identifier	Use location identifier as uniquely determined in LOCATION entity.

Table 5.11 Entity – Book

BOOK ENTITY (Describes monographs)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AccNo	Authorised identifier	Enter a unique accession number prefixed by the symbol B followed by a numeral.
BookEd	Edition statement	Follow AACR2 rules for edition statement.
BookSer	Series statement	Follow AACR2 rules for series.
BookPhy	Physical description	Follow AACR2 rules for physical description.
BookISBN	10 digit International Standard Book Number	Enter ISBN if available as 10 digits. If only 9 digits, add X to end of number.
BookCallno	Classification number	Enter allocated call number if known.

Table 5.12 Entity – Print

PRINT ENTITY (Indexed articles from periodicals, newspapers and other materials)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AccNo	Authorised identifier	Enter a unique accession number prefixed by the symbol P followed by a numeral. Not null.
PrintVol	Volume of the print material	Transcribe volume number as appears in source entity.
PrintNo	Issue number of the print material	Transcribe number of issue as appears in source entity.
PrintMo	Month/season of the print material	Transcribe month or season as appears in source entity when available or to indicate individual issue.
PrintPg	Page numbers the article appears on	Indicate the page numbers the article appears on in the source entity.
SourceID	Source identifier	Use the SourceID from the Source entity for a standardised source title.

Table 5.13 Entity – Graphic

GRAPHIC ENTITY (Describes graphic materials of all kinds, eg charts, photographs, filmstrips, slides)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AccNo	Authorised identifier	Enter a unique accession number prefixed by the symbol G followed by a numeral, eg G1. Not null.
GraphEd	Edition statement of the graphic entity	Follow AACR2 rules.
GraphPhy	Physical description of the graphic entity	Follow AACR2 rules.
GraphSer	Series graphic entity belongs to	Follow AACR2 rules.

Table 5.14 Entity – Computer

COMPUTER ENTITY (Describes encoded files for manipulation by computer, including CD-ROM (AACR2))		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AccNo	Authorised identifier	Enter a unique accession number by symbol C followed by a numeral, eg C1. Not null.
ComEd	Edition of the computer file	Follow AACR2 rules.
ComChar	Characteristics of the computer file	Follow AACR2 rules.
ComPhy	Physical description details	Follow AACR2 rules.
ComSer	Series description	Follow AACR2 rules.

Table 5.15 Entity – URL

URL ENTITY (Describes uniform resource location (URL) for Internet web pages)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AccNo	Authorised identifier	Enter a unique accession number by symbol U followed by a numeral, eg U1. Not null.
URLAddr	Internet address of web page	Transcribe URL exactly in http://www. format.

Table 5.16 Entity – Audiovisual

AUDIOVISUAL ENTITY (Describes both audio material such as audiocassette tapes and audiovisual materials such as video cassette recordings)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AccNo	Authorised identifier	Enter a unique accession number prefixed by symbols AUD followed by a numeral, eg AUD1 plus an A or a B indicating side A or side B if necessary, eg. AUD1B (indicating side B of an audiocassette where the speaker is different to side A).
AudTime	Running time/Length	Include the running time or length of the audio or video recording.
AudSer	Series material belongs to	Follow AACR2 rules.
AudPhy	Physical description of the material	Follow AACR2 rules.

Table 5.17 Entity – Directory

DIRECTORY ENTITY (Refers to those individuals or organisations who specialise in, or have knowledge of a particular subject area)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
DirID	Authorised identifier	Enter a unique accession number prefixed by symbol R followed by a numeral, eg R1. Not null.
DirOrg	Organisation	Enter the name of the organisation used for referral purposes. If an individual within an organisation is used in networking include the name of the employing organisation.
DirPerson	Contact person	Enter the name of the contact person who has expertise in a particular field. Enter surname first, followed by a comma and firstname, eg Thrash, Agatha.
DirPos	Position held, eg Managing Director	Enter the title that the individual holds within the organisation or title earned through qualifications, eg Nurse.
DirAddr	Address of person or organisation	List the postal address for the individual or organisation.
DirTel	Telephone number	List the telephone number for the organisation or individual within the organisation.
DirFax	Fax number	List the fax number of the organisation or individual within an organisation if they have their own fax number.
DirEmail	E-mail address or organisation or individual	List the e-mail address of the organisation or an individual within an organisation.
DirWeb	Web page of individual or organisation	List the web page address of the organisation. In the case of an individual within an organisation having their own web page list their address if they are the contact person.
DirNote	Notes area	Include any notes which provide more information.
SubjID	Authorised identifier for Subject entity	List the main subject the individual or organisation specialises in.

Table 5.18 Entity – Author

AUTHOR ENTITY (Any person, whether it be an individual or a corporate body, who is intellectually responsible for the content of a work)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AuthID	Authorised identifier	Each author to have a unique identifier - numerical. Not null.
AuthSname	Author surname	Follow AACR2 rules.
AuthFname	Author firstname	Follow AACR2 rules.
AuthIni	Author middle and other initials	Follow AACR2 rules.
AuthAddr	Author postal address	Enter author postal address if available or if it can be established for contact purposes.
AuthTel	Author telephone number	Enter author telephone number if available or if it can be established for contact purposes. Can be null.
AuthFax	Author fax number	Enter author fax number if available or if it can be established for contact purposes. Can be null.
AuthEmail	Author e-mail address	Enter author e-mail address if available or if it can be established for contact purposes. Can be null.
AuthWeb	Author web page	Enter authorised author web page if available. Do not enter unauthorised sites which merely mention or refer to the author. Can be null.

Table 5.19 Entity – Publisher

PUBLISHER ENTITY (That individual or organisation responsible for the publication of any entity)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
PubID	Authorised identifier	Each publisher to have its own unique identifier - numerical number. Not null.
PubPlace	Place where entity published	Follow AACR2 rules.
PubName	Name of publisher or distributor	Follow AACR2 rules.
PubAddr	Address of publisher or distributor	Follow AACR2 rules, enter if available.
PubTel	Telephone number of publisher	Enter if available.
PubFax	Fax number of publisher	Enter if available.
PubEmail	E-mail address of publisher	Enter if available.

Table 5.20 Entity – Source

SOURCE ENTITY (Describes source material such as periodicals and newspapers which are related to indexed articles)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
SourceID	Authorised identifier	Each source title to have a unique identifier – numerical number. Not null.
SourceTitle	Recognised title of the source	Follow AACR2 rules.
SourceFreq	Frequency of the source entity	Follow AACR2 rules.
SourceISSN	ISSN of the source entity	Enter ISSN if available.
SourceAddr	Address of the individual, organisation or publisher responsible for the periodical	Enter this information if available to aid in research and content verification.
SourceNote	Any other relevant information associated with the source entity	Enter title changes, any other information which could aid in the retrieval of the title.
SourceWeb	Web address of source entity	Enter the web address of source. Enter web details when a title is available electronically, free or on a subscription basis. Does not necessarily mean that it will be available but indicates its location.
PubID	Publication details	Enter publication details as listed in the publisher authority list indicated by PubID.

Table 5.21 Entity – Wrote

WROTE ENTITY (Composite entity of AUTHOR and MEDIATYPE)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AuthorID	Authorised identifier from AUTHOR entity	Not null.
AccNo	Authorised identifier from MEDIATYPE entity	Not null.

Table 5.22 Entity – Stored

STORED ENTITY (Composite entity of SUBJECT and LOCATION entities)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
SubjID	Authorised identifier from SUBJECT entity	Not null.
LocID	Authorised identifier from LOCATION entity	Not null.

Table 5.23 Entity – Discuss

DISCUSS ENTITY (Composite entity for AUTHOR and SUBJECT entities)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AuthorID	Authorised identifier for AUTHOR entity	Not null.
SubjID	Authorised identifier for SUBJECT entity	Not null.

Table 5.24 Entity – Describes

DESCRIBES ENTITY (Composite entity of SUBJECT and MEDIATYPE)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
SubjID	Authorised identifier for SUBJECT entity	Not null.
AccNo	Authorised identifier for MEDIATYPE entity	Not null.

Table 5.25 Entity – Prefers

PREFERS ENTITY (Composite entity of USER and SUBJECT entities)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
UserID	Authorised identifier for USER entity	Not null.
SubjID	Authorised identifier for SUBJECT entity	Not null.

Table 5.26 Entity – Housed

HOUSED ENTITY (Composite entity of AUTHOR and LOCATION entities)		
ATTRIBUTE	**DESCRIPTION**	**POLICY**
AuthorID	Authorised identifier for AUTHOR entity	Not null.
LocID	Authorised identifier for LOCATION entity	Not null.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

This concluding chapter summarises the findings of this research project which were intended to solve the problems and corresponding subproblems raised in the problem statement (see section 1.4). Problems and complexities that emerged during the study are explained and the solutions to these suggested in this chapter. The problem statement is put into context. The methodology to be used in this study, as proposed in Chapter one, is briefly reviewed. The findings of the literature and empirical study of the user will be interpreted and the implications of these findings for the design of a database of resources for rational therapy will be discussed. Recommendations will be made for further study which includes the extension of the model proposed for the database design in Chapter three (see Figure 3.3). The chapter concludes with proposed areas for further research.

6.2 PROBLEM AND ITS CONTEXT

An intention of this research project was to investigate the current situation in the health initiative in South Africa so that the role of rational therapy information in an information infrastructure could be established. The Ministry of Health Department of Health Promotion (HP) is responsible for orchestrating this transition towards a primary health care (PHC) approach. The purpose of a database is to organise, make available and accessible, information and information about entities. The design of a database has been shown to be valuable in its potential contribution to the health information infrastructure in South Africa by organising resources which reflect a specific approach to PHC, that is rational therapy. The information provided in a database will support the initiatives of the Ministry of Health in South Africa with regards to HP and PHC. In addition information on the rational therapy approach will

support training and research and will assist health providers in their task. The level of health of a society reflects the choices made on an individual and community basis. Information is required to make these choices.

In the problem statement (section 1.4) the following questions believed to be relevant and therefore forming the basis for this study were asked:

- Assuming that rational therapy has a role in PHC in South Africa, what should a database comprise in order to organise the existing body of knowledge relevant to a rational therapy approach within PHC?
- How can these resources best be made available so as to meet the users' information requirements in order to contribute to the reorientation towards PHC in South Africa?

The following sub-problems were identified:

- What is the relevant body of knowledge concerned with PHC and more specifically the information which undergirds the rational therapy approach (ie what is the information infrastructure)?
- What are the information requirements of users and potential users?
- What should a database comprise to answer to the needs of the relevant body of knowledge and the potential users?
- How can a database contribute to the credibility of the rational therapy approach?

The intent of this chapter is to therefore discuss and summarise the findings of the preceding five chapters which attempted to answer the questions raised in the problem statement. However, it is important to firstly clarify the methodology used in this research project to ensure its credibility and the validity of the findings.

6.3 METHODOLOGY

The following methods were used in this study:

- *Extensive literature survey*

  The literature was firstly surveyed to determine whether there were related research projects to establish the justification for this research project. In addition there were many concepts that had to be clarified by researching the relevant literature. These included PHC, rational therapy, information infrastructure, information systems, database, database design and user studies. The literature was also surveyed to identify the steps to be followed in the design of the database. From this a model for database design was developed (see section 3.5).

  Based on a literature survey of user studies an empirical research study was designed so that data could be collected and analysed both quantitatively and qualitatively to establish user requirements which then informed the development of the conceptual schema.

- *Development of model for database design*

  In order that the database design process could proceed in a logical and meaningful way a model for database design had to be developed. The model developed reflects a combination of steps (detailed by various authors) that the researcher identified as essential for the design of the database.

- *User study*

  The research methodology used for the user study (see section 4.4), in which data was collected from both populations and samples of users categorised into user groups, included a questionnaire and structured interview. The questionnaire had to be developed and was used as the basis for the interview. Appointments were set up with the users and data collected.

- *Analysis of data collected*

  A combination of qualitative and quantitative research methods was then used to analyse the data collected to establish the user requirements.

- *Use of user requirements*

  The findings of the empirical study, that is user requirements were then used to inform the design of the conceptual schema.

- *Conceptual schema*

  The conceptual schema was designed. This consisted of the data dictionary, operations dictionary and the Entity-Relationship (E-R) diagram. The conceptual schema functions as the blueprint of the database.

The following discussion deals with the issues raised in the problem statement and subproblems.

6.4 FINDINGS

In this section answers to the questions raised in the problem statement and sub-problems (see section 1.4) and restated in section 6.2, will be discussed.

6.4.1 Health crisis and need for information

Firstly, the issue of the role of rational therapy in the current reorientation towards PHC must be discussed:

- Assuming that rational therapy has a role in PHC in South Africa, what should a database comprise in order to organise the existing body of knowledge relevant to a rational therapy approach within PHC and what is the relevant body of knowledge concerned with PHC and more specifically the information which undergirds the rational therapy approach.

It was identified in section 1.2.1 that there is a health crisis in South Africa, which necessitated the State initiative of a transformation towards a PHC approach in which individual and social

responsibility by communities for their well-being is assumed. Information about health care, by which wise health choices can be made, is an essential ingredient of ensuring the success of the PHC approach. No longer can people solely depend on someone else's knowledge for maintenance of their health. The onus is on personal responsibility which includes making rational choices about one's health.

Although there is a general information explosion, there is a general information crisis and a consequent ignorance explosion especially when it comes to information for a self-help, preventative approach to health and healing. There is a growing body of knowledge in the 'untraditional', alternative approach to health and healing. In the bio-medical journals there is also a move towards the recognition of the relationship between lifestyle, choices of lifestyle and patterns of disease. The problem is that this information has not been selected and organised in such a way that it can be of use in the PHC approach. It has been highlighted in this study that an information professional with expertise in the rational therapy approach must be responsible to implement the database designed in this study.

Following the implementation of a Health Promotion course at Helderberg College, the researcher in her daily contact with the students, lecturers, librarians, interested laypersons and health professionals, became increasingly aware of the need for information to complete their tasks and functions. The focus of this information need is the rational therapy approach. The need for this specific focus with regard to information was reinforced by Dr Perez, Director of Health Promotion in the Ministry of Health, in a visit to Helderberg College, when she affirmed the researcher's concern about the lack of an health information system in South Africa and the relevance of information for individuals to make informed choices about their health and the prevention of disease.

A significant problem identified was the lack of clarity about the concept 'rational therapy' which is ironically self-explanatory but fraught with the potential of misunderstanding because of the current bias towards the bio-medical approach. This approach permeates the literature and is

acknowledged as the orthodox, scientifically proven basis of medical science. Rational therapy has to do with a knowledge of the physiology of the body and its relationship to health and healing. It is a rational approach to living in such a way that disease is prevented rather than fostering a dependence on the curative approach. Knowledge of the immune system and the maintenance of its well being are a personal responsibility and evidence a rational approach to life. The laws of health can not be disregarded and optimum health merely expected. Norman Cousins (1983:50-51) has made a significant contribution to the importance of accepting personal responsibility for both health and healing. Cousins has credibility in scientific circles and explained his ideas in *Anatomy of an illness* (1979). He emphasises that "what we think, what we believe, what we eat and what we do with our bodies" are basic laws of life and that we need to regain control over the totality of ourselves as the battle is uniquely ours (Cousins 1983:230).

Limitations of and problems in the current bio-medical model have led to the upsurge of various other approaches to health and healing. Key issues identified included ignorance and neglect in general by the bio-medical approach of the rising concern about health and healing as an 'alternative' approach. This reflects a concern which challenges the preoccupation with invasive techniques, drug therapy and the erroneous belief that everything hostile comes from outside the body and has to be dealt with by outside forces instead of the view that the human body is not a machine comprised of parts but rather a holistic organism that is governed by laws which include the ability to restore health.

However not only is there confusion in terminology, for example in the use of terms such as 'alternative', 'complementary', 'holistic', 'unorthodox', 'untraditional' et cetera, but these various approaches to health and healing could represent both scientific and unscientific bases for health and healing practices. The question is whether these practices are helpful or harmful. The problem that was faced by the researcher was what constituted credible information. In the user study the users expressed concern about the credibility of information and the expectation that the information professional would have the expertise and experience to select scientifically

proven information. This impacted on a selection policy as well as the construction of a subject thesaurus. The term 'rational therapy' is not used as such in the literature but will be used here as it reflects the personal responsibility for health and is considered a generic term which eliminates the confusion surrounding the terms mentioned above. In the user study, users identified terms they thought were relevant and significant to the rational therapy approach (see Annexure 2). Together with the terms identified in the user study, a literature survey can aid in the process of the compilation of a thesaurus for rational therapy and tools such as glossaries, indexes and the Library of Congress Subject Headings (LCSH) will facilitate the selection of terms to be used in the database for subject searching and describing entities (see section 5.5.1). The information professional is expected to have a background in both rational therapy and library practice to be able to survey literature in order to extract relevant information and research findings to be included in the database.

PHC should include a rational course of action in which a personal responsibility for one's health is assumed. The emphasis should be on what is health and how to keep well (prevention) rather than what to do when one is sick. When people have access to information on how to prevent disease the first step is made in the move towards PHC. PHC should not only be curative but also should promote an understanding of health and healthier lifestyles and address the root cause of ill health. PHC services should be promotive, preventive, curative and rehabilitative but the more the preventive aspect is emphasised the more the possibility of a quality of health and community wellbeing becomes a reality. This was emphasised in the definition of HP in the Department of Health journal *Masiphile* (What is health promotion? 997:15) where health is viewed as a balance of the physical, mental and social well-being. The level of human dignity is increased as people are empowered to care for themselves and their families. This requires information that can be shared too by health professionals who also require this information for their own reorientation towards a PHC approach.

In a literature study it was noted that there is a growing body of knowledge that supports the rational therapy approach but that there was no organised collection of this body of knowledge

nor a mechanism for organising it. It was necessary to define and delineate the scope of the rational therapy approach and then design a database which would make resources for rational therapy available and position it within the information infrastructure.

The purpose of the study was therefore to support the reorientation towards a PHC approach by the current National Health initiative with the design of a database that would make resources on the rational therapy approach available and accessible.

Secondly, the composition of the database, its function and contribution to the reorientation of PHC must be discussed.

6.4.2 Database and its design

The problem statement and subproblem involving the composition of the database is restated as follows:

- How can these resources best be made available so as to meet the users' information requirements in order to contribute to the reorientation towards PHC in South Africa? What are the information requirements of users? What should the database comprise and how can the database contribute to the credibility of the rational therapy approach?

The inadequacy of available, credible information, centralised and made available in a database, was identified as a potential problem by the users surveyed. To facilitate the organisation of this existing, but rapidly growing body of relevant information, a database which is a store of related data or information representing some aspect of the real world, logically organised to solve problems and answer queries, was developed. The most suitable type of database identified from the literature is the bibliographic database that will store information and information about entities. In conclusion the database to be implemented will consist of entities, their attributes and the relationships between the entities which will be described

consistently and will use the facilities of computer hardware and software to enhance the retrieval and storage of information.

Some of the difficulties encountered included the terminology used in the literature, the confusion of concepts, for example data and information, authors' explanations of the design process in various groupings of the steps involved, for example, some authors incorporated logical with conceptual design, while others separated these. A balance had to be struck between an information science perspective and a computer science orientation. This required clear definition of terms.

The field of study for the research project had to be delimited. Database design is a complex, step-by-step process that begins with a need and eventually results in a database which has to be implemented, maintained, evaluated and continuously updated. The researcher therefore concentrated on the conceptual design of a database for rational therapy and the steps involved in this process. An effective and efficient design process is user-centred taking into consideration the problems they experience in fulfilling their tasks. Therefore it was necessary to collect user requirements for this purpose and this in itself was a major task. The user groups interviewed for the user study were delimited to the population of students and lecturers in the HP department at Helderberg College and a representative sample of health professionals, librarians and laypersons.

Firstly, the role of a database in an information system and the information storage and retrieval (ISAR) system had to be established. Secondly, a clear definition of the database had to be formulated. Although a computerised database is the goal, as it is believed that it will serve the needs of the users in the most effective and efficient way, the development of the database had to be independent of the software. This is to ensure that the database will meet user requirements and therefore function in an optimal way. But this required from the researcher a level of computer literacy to be able to research literature on database design much of which was oriented towards computer science rather than information science. To maximise the

expertise in rational therapy as well as to design the database to meet the information and information about entities requirements of the users the researcher had to become informed in areas beyond her discipline.

Thirdly, the steps in the design of a database had to be determined and a model of the design process created by integrating various models identified in the literature survey. This was done to ensure that the database design process would follow a logical sequence of steps which would result in the conceptual design of a database of resources for rational therapy. It was essential to include each vital step in the process so that the preliminary activities which included awareness of the problem, setting boundaries and an analysis of the existing situation, were incorporated. Therefore a model was developed to provide a framework in which every aspect of the design process, including actual database design, was achieved. The heart of this process was the requirements collection and analysis step in which the user study provided the data for use in the design of the conceptual schema.

An important aspect of database design identified by the researcher in the literature survey was the knowledge of the user group for which the database is to be designed. Therefore various aspects of the user were investigated, such as the user as an information seeker, a profile of the users, user tasks, the role of the information professional in developing the set of user requirements and user requirements for database design as stated in the literature. A model of the user was then presented which outlined the research questions (see Figure 4.1) to be answered in the user study.

To develop the list of user requirements that would inform the design process the researcher then developed a structured questionnaire which was used in an interview situation to collect the data. The interview facilitated clarification by the researcher when needed.

The data collected was then analysed quantitatively and qualitatively to determine the user requirements for the database. This determined what the database would consist of. The

purpose of identifying these user requirements is to develop descriptions, rules, conventions and policies as guidelines to inform the conceptual design (see section 4.5). The researcher, in the interview with the users, became aware of the fact that the user can contribute to the development of requirements but is also often unaware of what is actually needed. The user perceives it as a problem; for example, the problem is stated as 'information is unavailable'. It became apparent that although the information was available the user did not have the necessary skills, or even the patience, to search for relevant information. Often the user expressed an expectation that the library should make the information available. The researcher realised that the Helderberg College Library has a role to play and therefore this fact again reinforced the need for a database of resources for rational therapy.

Users' expression of the fact that resources were not available left the researcher with a choice between developing a special collection in the Helderberg College Library or developing a database with information about entities that could include resources in personal collections and the resources located in the HP department office. Having a special collection housed in the library would limit the use of these resources to those who frequented the library whereas a database could contribute to the information infrastructure in South Africa by becoming a part of the national health information system (NHIS) and hereby assist in the reorientation toward PHC by making resources on the rational therapy approach more widely available and accessible.

The literature emphasised the fact that the user is often unaware of the information actually required (see section 4.2.3). This therefore presents a problem to them. In order for a solution to be found the user should be assisted in the information-seeking process. The database can facilitate this process. But this requires the identification of a comprehensive set of information requirements which are accounted for in the development of ISAR systems to ensure the successful satisfaction of information needs (see section 4.2.1). The researcher needed to understand the information-seeking behaviour of the user from the perspective of user profile and as the performer of tasks and roles, as well as their stated requirements and preferences. A literature survey facilitated this understanding.

The following user requirements were established:

- an ISAR system to manage rational therapy resources so that user tasks can be fulfilled
- availability and accessibility of credible, scientifically proven resources for retrieval to answer query statements
- computerised system that could be used by users having a limited level of computer literacy and knowledge about database searching
- selection of resources identified by an information professional with expertise in the rational therapy approach using criteria verified by user groups
- database of resources which will facilitate the research process and allow for searches undertaken both by end-users and intermediaries
- subject access to information with subject vocabulary control of prime importance
- a variety of entities linked through relationships so that multiple access points may be utilised thus enhancing the search process
- input must be facilitated through the use of a user-friendly system so that output will satisfy queries
- library policies and procedures are acceptable as a basis for developing the policies and rules as detailed in the conceptual schema.

Based on the user requirements the conceptual design process was undertaken to establish a conceptual schema. The conceptual schema is the complete and accurate representation of the data requirements and is the heart of the database. It is the blueprint for collecting and organising the information to be included in the database. The conceptual schema represents the entities, their attributes and relationships among them together with the policies and rules that govern these. The data dictionary records the rules for each entity, relationship and attribute. Related to the data dictionary is the operations dictionary which defines the functions or operations to be undertaken. The E-R diagram represents the data dictionary. This was the subject of Chapter five. It is the task of the information professional to identify and describe the entities, determine the attributes of each entity, identify the authorised entity identifier and state

the policies that will govern each entity. For this task the researcher decided to follow bibliographic practice as far as possible. The various entities, their attributes and the policy or rule was stated in tabular form.

By implication the user requires that a relational database (see section 4.4.2.3) should be designed rather than a hierarchical or network database. The users' defined a user-friendly system as one that links entities, for example authors with subjects, subjects with mediatypes, et cetera.

Relationships of a many-to-many (M:N) form had to be expressed in one-to-many relationships. Therefore composite entities were formed to deal with this issue (see section 5.5.1). Supertype entities and subtype entities were expressed in a generalisation hierarchy. This was the case of the supertype entity, Mediatype and the subtype entities Book, Computer, Graphic, Audiovisual, Print and URL. Relationships among the supertype entity and subtype entities are expressed as one-to-one relationships.

It was determined that subject searching would form an important access point. Therefore subject vocabulary control was an important aspect to consider. The researcher decided on the use of a thesaurus which would standardise the use of subject descriptors to describe resources for the rational therapy approach. A combination of methods would be used to compile this thesaurus. These would include subject terms recommended by and familiar to the users, scanning of relevant literature and the use of LCSH together with glossaries, indexes and bibliographies. This compilation of a thesaurus is an on-going, essential aspect of a dynamic database. Guidelines for the compilation of the thesaurus were discussed in Chapter five.

This research project has reinforced the positioning of the database not only for user groups at Helderberg College but in the larger information infrastructure in South Africa. Rational therapy as a specific focus within PHC was shown to be a relevant and useful approach to health and healing in the rapidly changing and expanding world of health information. It was shown that a

database of resources for rational therapy would centralise this collection of information and information about entities and hereby make these resources available and accessible. Resources will be included in the database based on a selection policy of stated criteria for inclusion and exclusion of resources. The selection policy was established so as to include only those resources which meet the stated criteria, that is, only credible, scientifically proven resources. A model for the database design was established to include only those steps relevant and necessary for the design of this database. This model was then followed step by step to establish the boundaries of the research study, to collect the user requirements and analyse these to inform the design of the conceptual schema. User requirements were collected using the questionnaire and structured interview method and the data analysis was undertaken using a combination of qualitative and quantitative research methods. From the findings of the user study the conceptual schema was developed which consisted of the establishment of a data dictionary, an operations dictionary and an E-R diagram. These three components of the conceptual schema constitute the blueprint for the database.

6.5 RECOMMENDATIONS FOR FURTHER STUDY

Recommendations for further study includes the extension of the model of database design, thesaurus compilation, test database and user evaluation of the database.

6.5.1 Extended model of database design

A model for the design of a database of resources for rational therapy was proposed in Chapter three (see Figure 3.3). This model outlined the steps to be followed in this study, but in order to implement the database the model must be extended to include the steps in design, which follow on from the conceptual schema upon which the database can be implemented.

It is recommended that the extended model outlined in Figure 6.1 be the focus of a further study. The steps of the model up to and including the conceptual schema are independent of

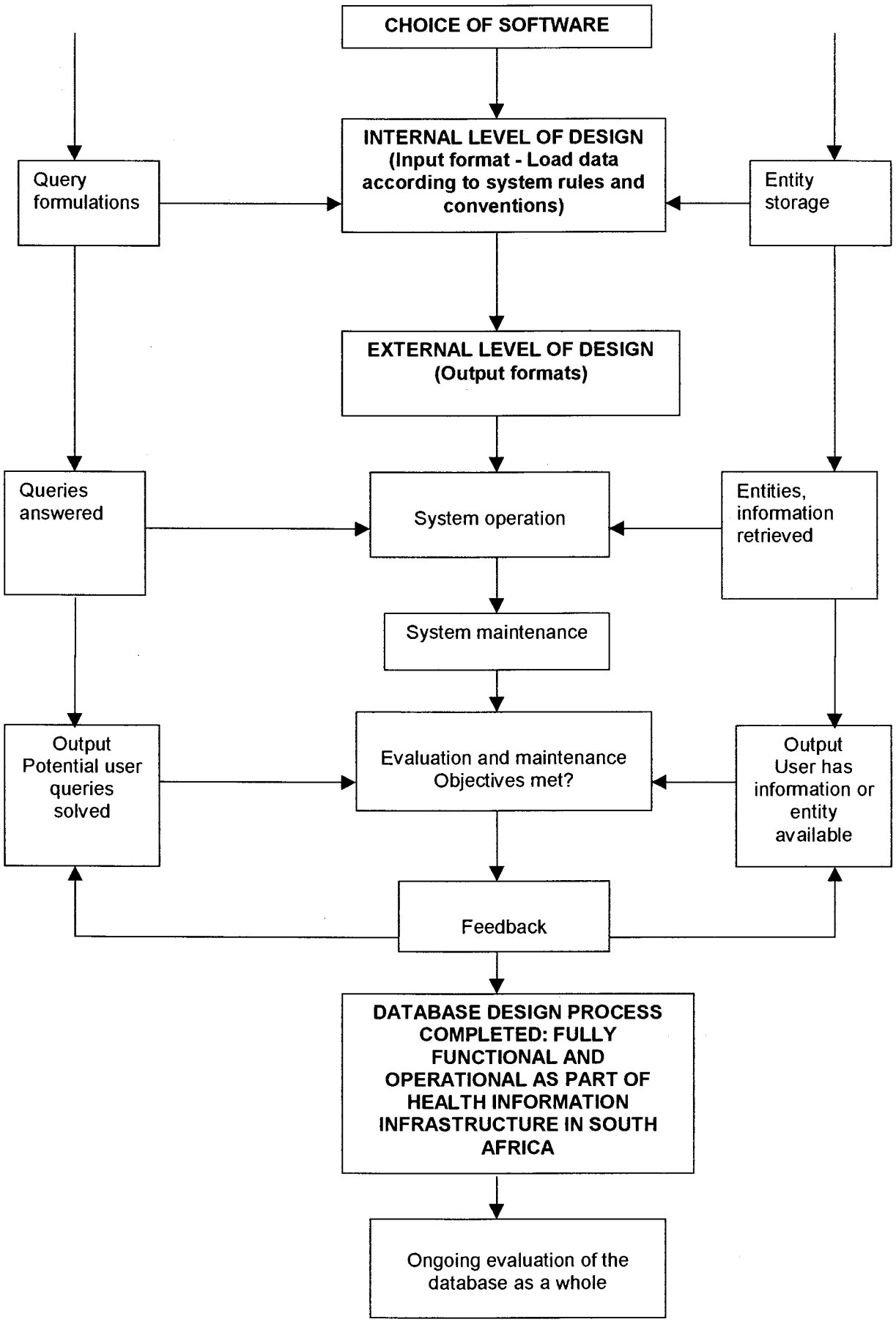
the software. Therefore it is recommended that the choice of software be made on the basis of an evaluation of the advantages and disadvantages of available software in the context of the computer literacy of the users, whether the software will support a relational database and whether it will provide a user interface which will meet user requirements. It is recommended that a thorough investigation of suitable software be undertaken both theoretically and practically so that suitable software is selected. If software is selected with which the user is not familiar, then emphasis must be on enabling the user to use the system by means of help manuals, online tutorials, et cetera. If it is concluded that there is no suitable software then it is recommended that the design of suitable software becomes an integral part of further research.

According to the extended model the internal level of design refers to the mapping of the conceptual schema onto the medium used for storing data, the format in which the data are stored, methods used to provide access to the data, indexes, the amount of information provided with each entry, form of entries and internal organisation of entries (Fidel 1987:10).

The external level of design is concerned with issues such as a means to express a request, to ask questions in a language understood by the computer (interface language), a picture of the arrangement of the data and the possible manipulation of data and formats for display of answers (Fidel 1987:11). Decisions made on the internal and external levels are software dependent.

It is recommended that user requirements collected and analysed in Chapter four be used to determine the input and output formats required for query formulation and answer to queries so that Output 1 results in potential user queries that are solved. Once the input and output formats have been determined and refined the system becomes operational. The relevant resources must be selected according to the selection policy established in Chapter five (see Table 5.2). Once these have been selected the information and information about these entities must be input and stored. The database must then be maintained and evaluated to establish whether the objectives are being met. This is done through the process of feedback to

Figure 6.1 Extended model for implementation of database



determine whether the potential user queries are solved by means of retrieved information or entities made available. Output identifies whether Input 1 and 2 is being achieved and that the potential user queries are solved.

It is recommended that the steps of the extended model be followed so that the design process can be completed. This would ensure that a fully functional and operational database of resources for rational therapy could become an integral part of the health information infrastructure in South Africa. This would ensure the credibility of the rational therapy approach while simultaneously supporting the transition to a PHC approach.

6.5.2 Thesaurus compilation

It is recommended that the guidelines established in Chapter five (see section 5.5.1) for subject vocabulary control be used in the compilation of a thesaurus for rational therapy. This would detail the subject descriptors to be used in the description of entities in the database. The subject thesaurus can only be further developed and possible modification undertaken as the input and outputs in record format are tested.

6.5.3 Test database

It is recommended that a test database be used to test the implemented conceptual schema and to redefine this where necessary according to user requirements.

6.5.4 User evaluation of database

It is recommended that the user groups identified in Chapter four (see section 4.4.1.1) be consulted for the purpose of evaluation of the implemented database. It is imperative that the user is able to find information relevant to rational therapy to answer his/her queries.

6.6 PROPOSED AREAS FOR FUTURE RESEARCH

The following areas for future research must be addressed:

- *Fee-based service*

  The use of a fee-based service to extend the potential usefulness of the database to other user groups in the information infrastructure and for the generation of funds to be utilised in updating, expanding and maintaining the database and the resources included in the database must be researched. Further research on the use of funds generated from the fee-based service to collect resources is needed.

- *Current awareness service*

  Investigate the possibility of the provision of a current awareness service to users on the rational therapy approach according to established user profiles.

- *Availability on Internet*

  A user requirement derived from the user survey was for the database to be made available on a wider scale on the Internet. This aspect of use and availability deserves study.

- *Expansion from a reference database to a source database*

  The possibility of expansion of the database from a reference database to a source database deserves further research. The choice of the type of database for this study was made in the context of the current situation in the Helderberg College Library. The potential of the provision of a source database requires attention and should be taken into cognisance in the choice of software and corresponding hardware required.

This research project was limited to the conceptual design of a database. However this is not the completed design process as, in order for the database to operate effectively and efficiently according to user requirements, the steps detailed in the extended model (see Figure 6.1) must

be implemented and continuous evaluation done. It is recommended that this be the goal and focus of a doctoral study.

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ANNEXURE 1

USER SURVEY

PLEASE TICK THE APPROPRIATE ANSWER.

1. Please indicate whether you are:

Lecturer ☐ Student ☐ Health professional ☐ Layperson ☐ Librarian ☐

Other ☐ Specify _____

2. Where do you currently find information to satisfy your information requirements with regard to rational therapy? (Tick any appropriate block)

Library ☐ Private collection ☐ Health Promotion Department ☐ Lecturer ☐

Friend ☐ Other ☐

If other please specify: _____

3. What are your information requirements with regard to health promotion and rational therapy?

_____

_____

_____

4. What methods do you use to find information on health promotion and rational therapy?

_____

_____

_____

5. When using the library as an information source which tools do you use to locate information?

Catalogue ☐ Periodical indexes ☐ Ask librarian ☐ Browse method ☐

Sabinet ☐ Internet ☐ Dewey Decimal Classification ☐

Subject bibliographies ☐ Other ☐

If other please specify _____

6. What media types (eg books, periodicals, etc.) would you like to see included in a collection of resources for rational therapy?

Books ☐ Periodical articles ☐ Periodicals ☐ CD-ROM ☐ Posters ☐

Pamphlets ☐ Audiotapes ☐ Videos ☐

Please specify any other: _____

_____

7. Do you feel that your need for information on rational therapy is being met? Is information readily accessible and available to you?

Yes ☐ No ☐

If no please specify reasons: _____

_____

8. What subjects do you feel are most relevant to rational therapy? List the 10 most important to you.

1. _____ 6. _____

2. _____ 7. _____

3 _____ 8. _____

4 _____ 9. _____

5. _____ 10. _____

9. What would you term the NEWSTART principles other than rational therapy?

Complementary ☐ Alternative ☐ Preventive ☐ Wholistic ☐

Natural remedies ☐ Lifestyle medicine ☐

Other: _____

10. If a database of resources for rational therapy was available how would you search for information?

Author ☐ Media type ☐ Subject ☐ Title ☐ Combination ☐

Other please specify _____

11. Please rank in order of importance (1 - most important) the options in question 10:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

12. What combinations of searches (eg author/title) would you like to use when searching for rational therapy resources?

_____

_____

_____

13. When searching by subject would you prefer:

an alphabetical list from which to choose the appropriate subject heading ☐

to be referred to the appropriate subject heading in a message box ☐

have the use of "see", "see also", "related term", "narrower term", "use", "broader term" references ☐

14. What does the term "user-friendliness" mean to you when you think of database searching?

_____

_____

15. How would you like to search a database? By the use of menus, commands, icons? Please specify.

_____

16. Are you computer literate?

Yes ☐ No ☐

17. Do you have access to a computer?

Yes ☐ No ☐

18. Name any software packages you are familiar with or use:

_____

19. Are you familiar with database searching?

Yes ☐ No ☐

If so, what databases have you searched and in which particular subject area/s? _____

_____

20. Do you have access to Internet?

Yes ☐ No ☐

21. Have you ever used the Internet?

Yes ☐ No ☐

If so, what subject areas have you searched? _____

_____

22. Please state whether a database of resources for rational therapy would benefit you and if so, why?

_____

_____

23. If you feel that a database of resources for rational therapy would benefit you, what expectations would you have of the database?

_____

_____

_____

24. Do you feel that all resources included in this collection should be loaned or some restricted to use in the resource centre? If use of some should be restricted, please state why you think so.

_____

_____

25. Do you think that once you have left Helderberg College this database of resources could still be of use to you? If so, why and what for?

_____

_____

_____

26. Are there any other comments you would like to make with regard to the availability and use of a database of resources for rational therapy? Any suggestions?

_____

_____

_____

ANNEXURE 2

SUBJECT PREFERENCES FOR SEARCHING

LECTURERS

Air
Balance
Cancer
Candida albicans
Colourants, preservatives
Depression
Diabetes
Diet
Exercise
Facilitation
Food/nutrition
Health
Herbs
Hydrotherapy
Hypoglycaemia
Immune system
Lifeskill techniques
Lifestyle disease
Lifestyle disease causes
Lifestyle disease management
Marriage
Micronutrients and health
Natural remedies
NEWSTART
Organic agriculture
PHC
Physical therapies
Regularity
Rest
Toxins
Water
Wellbeing

STUDENTS

Air
Alternative approach
Anatomy and physiology
Back alignment
Backpacking
Balance
Birth control
Blood pressure
Candida albicans

Charcoal
Child guidance
Community health
Cooking schools
Diabetes
Diet
Disease prevention
Disease reversal
Environment and health
Exercise
Family
First aid
Habits
Health promotion
Herbs
Home nursing
Household remedies
Hydrotherapy
Immune system
Introduction to human behaviour
Lifestyle
Malnutrition
Marriage
Mind-set health
Minerals
Natural medicine
Natural remedies
NEWSTART
Nutrition
Obesity
Obstetrics
Organic gardening
PHC
Physical fitness
Prevention
Prevention degenerative diseases
Psycho-socio-environmental medicine
Psychological counselling for sickness
Regularity
Relationships
Religious topics
Rest
Stress
Sunlight
Temperance
Third World
Trace elements
Trust in God
Tuberculosis
Vegan food

Vegetarianism
Vitamins
Water
Wholistic health
Work opportunities

LAYPERSON

Alcohol - effects
Allergies
Botany
Deterioration of the body
Diet
Disease prevention
Drugs - effects
Exercise
Health promotion
Herbs
Hydrotherapy
Hygiene
Medication
Natural remedies
Nutrition
Physiology
Physiotherapy
Psychology
Recipes
Tobacco - effects
Treatment
Vitamin supplements
Wholistic health

HEALTH PROFESSIONAL

Air
Back problems
Behaviour changes, motivation
Bio-medical
Bowel disease
Cancer
Colourants and preservatives
Decision-making
Exercise
Experts
Facilitation
Herbs
Home care giving
Hydrotherapy
Lifeskill techniques
Lifestyle choices

Lifestyle disease
Lifestyle disease management techniques
Massage
Medical science trends
Microbusiness management
Mind-set health
Natural alternatives to drug medication
Natural remedies
NEWSTART
Nutrition & diet
Physiotherapy
Poultices
Prevention
Problem-based learning
Psycho-socio-environmental health
Psycho-somatic illness
Rest
Sociological
Stress
Sunshine
Temperance
Trust in God
Water
Wellness

LIBRARIANS

Disease
Drug abuse
Exercise
Health education
Herbs
Medication
Minerals
Nutrition
Physiotherapy
Vitamins