Patterns of use of web-based library e-resources among students on the Howard College Campus of the University of KwaZulu-Natal.

Avenal Jane Finlayson
Student Number: 761767626

A thesis submitted as partial fulfilment of the requirements for the degree of Master of Arts (Digital Media)

UNIVERSITY OF KWAZULU-NATAL

Supervisor: Ms Kathy Murrell

2010

Declaration

Submitted in partial fulfilment of the requirements for the degree of Masters of Arts (Digital Media), in the Graduate Programme in Culture and Media Studies, University of KwaZulu-Natal, South Africa.

I declare that this dissertation is my own unaided work. All citations, references and borrowed ideas have been duly acknowledged. I confirm that an external editor was not used and that my Supervisor was advised accordingly. It is being submitted for the degree of Masters of Arts in the Faculty of Humanities, Development and Social Sciences, University of KwaZulu-Natal, South Africa. None of the present work has been submitted previously for any degree or examination in any other University.

.....

Avenal Jane Finlayson

20 October 2010

Acknowledgements

I would like to thank the following for support and assistance during the course of this research study:

- UKZN Libraries for support and access to the resources and data necessary to enable this research;
- Kathy Murrell for guidance, advice and support during the research process;
- Damian Finlayson for his patience and assistance with the statistical analysis of data; and
- Other members of my family for their valuable support and input.

Abstract

This study explores the use of electronic information services (EIS) by students at the Howard College (HC) campus of the University of KwaZulu-Natal (UKZN) in the faculties of Engineering and the Humanities, Development and Social Sciences (HDSS). The objectives were to establish usage among students; identify determinants of usage and to make recommendations. To achieve these objectives, the study concentrated on answering these research questions:

- Do UKZN students use library e-resources?
- Which e-resources are UKZN students using?
- Where do UKZN students access library e-resources?
- Why do UKZN students use library e-resources?
- What characterises non-users of library e-resources?
- What barriers exist to the use of electronic information services (EIS)?

A review of the literature identified a mix of quantitative, qualitative and combined methods used to investigate EIS usage. In various research studies, the variables considered to be determinants of use included age, status, discipline of study, subject content, computer proficiency, ease of use, availability and print formats in academic environments. The barriers experienced when using EIS formats, the adoption of technology and the usability characteristics of EIS were also important aspects evident in the literature.

The methodology adopted was based on a pragmatic philosophical approach and sought to establish baseline data. A quantitative research design was used which set out to achieve the research objectives through data collection on two fronts. Firstly, the overall usage environment at UKZN was established by reviewing vendor usage statistics. The COUNTER compliant statistics for selected databases and e-journals were collected and analysed. As COUNTER statistics were not available for e-books, the statistics available from the vendors were used. Secondly, a stratified, random sample of students on the HC campus was surveyed by means of an online questionnaire. A response rate of 22.5% was achieved. Data collected established the characteristics of users; whether they made use of e-books, e-journals and databases; where they used them and how often; why they made use of them; and what barriers and problems they experienced when using them. Data from non-users was also solicited. Data is presented in graphs and frequency tables. The Chi-square test was applied to establish significant associations between variables and these results are produced in contingency tables.

The findings established that EIS are used by students and usage fluctuates during the course of the academic year with peaks occurring in each semester and low points during the vacation periods. e-Journals and databases are used more than e-books, while postgraduate students use EIS most. Non-users made up almost a third

of the sample; while habitual, frequent and infrequent users were reflected in almost equal numbers among those who use EIS. Age, gender or discipline of study were not in evidence as determinants of use. Students undertake searches mainly from computers in the LANs but off-campus computers are also used, which highlights the importance of remote access. The library website is most often the starting point for navigation, although search engines are also popular as a virtual starting point. Locating information was the prime motivation to use EIS, and students largely rated the EIS they used as good or excellent. Barriers were experienced by as many as 37% of users who reported that the non-availability of EIS was the main problem, although they experienced other difficulties.

In concluding, issues of library service delivery and recommendations regarding usage are made.

List of acronyms

AWS	African Writers Series
BISAC	Book Industry Standards Advisory Committee
CLIR	Council on Library and Information Resources
COUNTER	Counting Online Usage of Networked Electronic Resources
CORSALL	Collaboration in Research Support by Academic Libraries in Leicestershire
DoI	Diffusion of Innovation
e-JUST	e-Journal Users Study (Stanford)
EIS	Electronic Information Services
HC	Howard College
HCI	Human Computer Interaction
HDSS	Humanities, Development and Social Sciences
HTML	Hypertext Mark-up Language
ICTs	Information and Communication Technologies
IP	Information Protocol
JISC	Joint Information Systems Committee
LAN	Local Area Network
LIS	Library and Information Services
LOCKSS	Lots Of Copies Keep Stuff Safe
OhioLINK	Ohio Library and Information Network
OPAC	Online Public Access Catalogue
PDF	Portable Document Format
STM	Science Technology and Medicine
TOCs	Tables of Contents
UK	United Kingdom
UKZN	University of KwaZulu-Natal
URL	Universal Resource Locator

Conventions Used

University	University of KwaZulu-Natal

Table of contents

Table of figures

Table of tables

Chapter One: Introduction

1.1 Introduction

Technological developments and the ease with which information resources can now be accessed via the Internet, have shifted the focus of collection development in academic libraries from print resources to their electronic counterparts. Together with this shift have come changes in student attitudes and behaviours regarding information searching and use. The general availability of computers and faster Internet connections has made online resources a convenient and accessible source of information for many students. To improve our understanding of the needs of these students and collect data to inform the realignment of library services, it is necessary to investigate their attitudes, motivation and behaviour when using information sources.

The University of KwaZulu-Natal (UKZN) Libraries make available a rapidly growing collection of electronic journals, online databases and e-books. Access to these electronic information services (EIS) by students, staff and researchers is facilitated by the library catalogue (iLink OPAC) which catalogues and provides active hyperlinks to these resources. The library webpages and Internet browsers, such as Google Scholar, also make easy navigation possible. Databases are searchable aggregations of journal articles, often subject specific and which draw information from journals particular to a discipline. This means that certain databases would be used more frequently by Humanities students rather than Engineering students because of their subject content, and vice versa.

Many information vendors and publishers track usage on the online products they supply by generating statistics on how these resources are accessed and used on the Internet by subscribers. This statistical information includes the number of search sessions, number of searches conducted, abstracts and full-text articles viewed. Monitoring activity is specific to an Information Protocol (IP) address or range of IP addresses. For the UKZN IP range, these statistics reflect usage by students and researchers on all the UKZN campuses and it is not possible to isolate the statistics for only the Howard College Campus. However despite this, interrogating these statistics makes it possible to identify overall those resources most often accessed, those least used and, over a given time period, general trends in the institution's usage can be observed.

This research study aimed to research patterns of use. Patterns, as representative samples of the whole, offer a means to establish some sort of coherent order on the behaviour of users and so improve our understanding. As recurrent phenomena, patterns allow a part to be examined within the context of the whole. To this end, a sample of the student population on the Howard College Campus was surveyed by questionnaire for the purpose of collecting information on EIS usage, student

preferences, purpose and characteristics. Vendor usage statistics over a two year period were collected from selected engineering and humanities databases to provide the general institutional landscape outlining the usage trends. e-Book usage statistics were also collected for the same time period.

1.2 Objectives of the study

In establishing patterns of use, the objectives of the study were focussed primarily on the user and undertook to:

- Establish e-resource usage among UKZN students;
- Identify determinants of e-resource usage; and
- Make recommendations with respect to e-resource usage.

In order to achieve these objectives a number of key research questions were formulated. These questions asked:

- Do UKZN students use library e-resources?
- Which e-resources are UKZN students using?
- Where do UKZN students access library e-resources?
- Why do UKZN students use library e-resources?
- What characterises non-users of library e-resources?
- What barriers exist to the use of electronic information services (EIS)?

1.3 Background

As UKZN Library resources are increasingly being made available online, the amount expended has also increased. According to the 2007 *UKZN Libraries Materials Budget*, 20% of the budget was committed to electronic resources, while in 2008 this figure had increased to 25%. A shift from print to electronic format became evident earlier in 2005 when for the first time certain journal titles were subscribed to in the electronic version only and the print subscriptions were cancelled. Many other e-journals were also made available in almost 100 databases to which UKZN Libraries have annual site-licenses.

The number of e-books provided to students was also steadily increasing. Over 4000 e-books comprising the *African Digital Library* (a collection of e-books freely available to residents in Africa) had been available via the netLibrary since 2000. In 2003 and 2005, a further 105 e-books were purchased and added to the titles already available at the netLibrary. The purchased titles were mostly science and engineering texts. UKZN Libraries had also purchased the *African Writers Series* (AWS) and reference e-books from various publishers. These titles were made available online at the publishers' websites and are accessible via active hyperlinks from the library catalogue and the library website.

In 2004, the draft Acquisitions Policy of the UKZN Libraries expressed the preference for online journal subscriptions when developing the collection. This approach would ensure that journals were made equally available to users situated on the geographically distributed campuses of the University and so maximise the benefit of these subscribed resources.

The availability of convenient access to e-resources in the form of databases, e-journals and e-books serves end-users well in their search for information. Access from multiple points, well beyond the walls of the library, mean that monitoring usage cannot rely on the established methods of tabulating statistics from library issues and renewals of library materials. In the online environment the vendors, publishers and aggregators have now become responsible for measuring usage and providing usage statistics. In order to provide some standardisation, initiatives such as COUNTER have laid the ground rules for measuring and presenting usage which allows meaningful comparative and quantitative analysis. This is possible as information providers and vendors restrict online access to their products by providing subscribers with a unique password for access or by requiring IP address authentication at institutions. When a user attempts to gain access to subscribed resources, the system checks whether the IP address or password being used falls within the specified IP range or matches the password allocated to the institutional subscriber. To facilitate access to remote users, often proxy servers are used which provide an institutional IP address to remote users, thus allowing them remote access.

However, the usage statistics provide only part of the picture. To understand usage more fully, it is important to examine user behaviour too. The characteristics of users in terms of age, gender, the field or discipline of study and computer literacy affect how they identify and use EIS. Likewise variables affecting user attitudes, their preferences and the purpose for which they use EIS, need investigation in order to present a more comprehensive picture and provide guidelines for future acquisitions.

1.4 Rationale and significance

Banwell et al. (2004) maintain that there is a “substantial gap in the evidence surrounding student user behaviour concerning electronic information services” (p. 304). This is certainly the situation in South African research regarding the use of web-based EIS. Although local academic institutions may have collected useful data from LibQual™ Surveys, the purpose of which is to define and measure library service quality by measuring library users’ perceptions of services, and thus identify gaps between desired and minimum expectations of service (Franklin & Plum, 2002). No published data could be located on the subject.

By investigating e-resource usage and identifying trends it becomes possible to use this information to improve, enhance and expand the delivery of information services by the UKZN Libraries. Anticipated interventions to this end can be effected by:

- Better presentation of resources through effective web design and the Human Computer Interface (HCI) (Bannon, 2000);
- Providing useful information about student behaviour which can inform the development and design of suitable library skills programmes (Dillon & Morris, 1996);
- Identifying suitable areas in which to expand library collections with e-resources (Rusch-Feja & Siebeky, 1999);
- Reviewing usage which will allow the impact of e-resources to be assessed;
- Marketing e-resources more effectively (Ramirez & Gyeszly, 2001)
- Enhancing the learning experience for students and opening doors to accessing information more effectively;
- Recognising the need for librarians to develop and expand their skills (Serotkin, Fitzgerald & Balough, 2005).

1.5 Limitations of the study

This research study was limited to two faculties based on the Howard College campus. Distance students and students based on other campuses of the UKZN were excluded. Given the disparity that existed prior to the merger of the University of Natal and the University of Durban-Westville in 2004 and the feasibility that trends may be faculty based, further research is required to investigate whether trends identified in this study are applicable across all five campuses of the University.

The scope of this study does not encompass how students search information; what search strategies students use; or analyse whether student information needs are satisfied. The e-resources available to users via non-web based means e.g. CD-Rom sources accessible on the Howard College Campus intranet are likewise not taken into account.

1.6 Definitions and terminology

Firstly it is important to clarify the meaning of **user** and **use studies**.

Use and user studies are concerned with user behaviour (van Lill, 2001). At the individual level these studies focus on the behaviour of **users** (and non-users) of information and information systems (Sridhar, 1995). Characteristics of information behaviour have been described as “how people need, seek, manage, give, and use information in different contexts” (Pettigrew et al., 2001 quoted in Fisher, Erdelez & McKechnie, 2005, p. xix). Sridhar (1995) describes user studies as concerning people and behaviour, with attitudes, priorities and preferences having a bearing on

the nature of the behaviour. Similarities and differences in the backgrounds of users need to be explored to identify the role which is played by age, status, experience, education, the field of research and other determinants in shaping information behaviour. According to van Lill (2001), who reviews the work of a number of authors on the subject, the interaction in user studies occurs between two environments. These environments are the basis of her proposed model and involve the user environment, the information system environment and interactions between the two.

At the institutional level, **use studies** explore the differences in the nature of organizations (Sridhar, 1995) and the patterns of user activity. User environments might constitute specific domains based on subject; institutional subsets like university schools and campuses, or the institution as a whole (Talja, 2005). Studies targeted at this level constitute use studies and provide insights into how a specific environment might influence online use (Tenopir & Read, 2000).

In terms of the COUNTER guidelines, a **user** is defined as an "individual with the right to access the online resource, usually provided by their institution, and conduct a session" (COUNTER, 2008, p. 9). This use is quantified in terms of the full content units which are accessed. For the different formats of EIS these are described below with usage activity constituting viewing, downloading, printing and emailing full content units:

- Journals - full-text article;
- Books – the minimum 'requestable' unit, which may be the entire book or just a section thereof;
- Reference Works - content unit appropriate to resource e.g. dictionary definitions, encyclopaedia articles, biographies (COUNTER, 2008, p. 6).

Secondly, it is important to identify what is meant by the terms electronic resources and publications.

Resources delivered online may be books, journals or other documents which have been digitised and are in a suitable format. These information artefacts have been referred to using a number of different terms. Terminology preferences see the extensive use of the term 'electronic journal' (Borrego, Anglada, Barrios & Comellas, 2007; Davis, 2002; Eason, Richardson & Yu, 2000; Liew, Foo & Chennupati, 2000; Sanville, 2001) and 'electronic books' (Gunter, 2005; Levine-Clark, 2007; Lonsdale & Armstrong, 2001), but they are also described as online or digital resources (Tenopir, Hitchcock & Pillow, 2003a). The abbreviated form of e-journal (Cochenour & Moothart, 2003; Lock, Cornell & Colling, 2001), e-book (Connaway, 2001; Dillon & Morris, 1996; Langston, 2003), ebook (Gibbons, 2001) and e-publication are also commonly used to describe these types of resources.

e-Journals and e-books refer to a number of variations in online publishing. These resources may be online replicas of the print versions where the print pages are

meticulously reproduced in scanned images which are true to the pagination and layout. These images may be viewed as PDF (Portable Document Format) documents which make them suitable for efficient downloading, storage and printing. A well-prepared PDF document is an “electronic snapshot” which stays true to the font, images and graphics of the original but is not a text image (Webopedia, 2005). In contrast, electronic resources may also be formatted using HTML which provides the advantages of added features such as improved searching, colour graphics, hypermedia and animation (Tenopir et al., 2003a). In terms of content, e-journals may have more content than their print counterparts and in some cases less content (Cochenour & Moothart, 2003). Delivery of these resources on the Internet increases their availability to potential users particularly those in an academic or higher learning environment where there is reasonable access and levels of computer proficiency. Often they are made available in a database. This constitutes a “collection of electronically stored data or unit records (facts, bibliographic data, texts) with a common user interface and software for the retrieval and manipulation of data” (COUNTER, 2008, p. 6).

Collectively the products of online publishing are termed electronic information services or EIS (Banwell, et al, 2004; Tenopir et al., 2003a). More generally, they may be referred to as digital, online, web-based or electronic resources (Franklin & Plum, 2002).

Confusion with regard to terminology arises from the fact that users are often “extremely naïve about formal descriptions of types of EIS” (Banwell et al., 2004, p. 309). This highlights the importance, when conducting research, to define and clarify what terms mean so as to minimize misunderstanding. Although, in his study of e-books, Levine-Clark (2007) deliberately chose not to define e-books. This was so as to determine whether the term was widely understood by respondents. Preferred terms adopted for use in this document are electronic information services (EIS) to refer to digital resources generally and the widely used terms e-journals and e-books for these specific formats.

1.7 Structure of the study

The research objectives and purpose of this study are outlined in the introduction. The following chapter reviews the literature on the subject, while Chapter Three describes the methodology adopted to investigate EIS use. The research findings are presented in Chapter Four, and Chapter Five analyses and interprets the findings. Chapter Six concludes the study and makes recommendations. The list of works cited is then followed by relevant appendices.

1.8 Summary

The introduction has outlined the purpose, relevance, terminology and the limitations of the research investigation. Use studies have been defined. The next chapter reviews literature on use studies conducted in academic settings where electronic resources were the focus of attention.

Chapter Two: Review of the literature

2.1 Introduction

The research reported in this chapter is informed by three broad areas of study: bibliographic research into the use of web based electronic material, Human Computer Interaction as it applies to the use and retrieval of online material and Innovation Diffusion Theory which explores how new innovations are accepted by their user community.

It is neither possible nor appropriate to review literature on all forms of electronic publishing as the field is too large and many have no relevance to this study. Literature reviewed here has been selected on the basis of the following criteria:

- studies must be relevant to academic and research settings;
- research must investigate electronic publications including e-books, e-journals and online databases;
- resources studied must be web-based and accessible via an Internet browser such as Internet Explorer or Firefox.

Excluded from review are:

- user studies not conducted in higher learning institutions or research environments;
- those targeting EIS which are not web-based but on CD-ROM and other formats, or delivered via local intranets;
- those studies which are not reported in English.

As web-based electronic publishing is a fairly recent development, it has a history spanning little more than a decade. The increased availability of e-journals is generally regarded as having an impact on library processes since 1998 (Cooper, 2007). Tenopir, who has conducted a number of authoritative studies in this area, has proposed an evolutionary approach to the subject matter (Tenopir et al., 2003b) which sees the development and adoption of electronic information resources progressing through a series of phases. This explains developments against a changing landscape of rapid advances in technology and the electronic publishing environment. Other authors have also adopted this approach (Mahe, 2004) which acknowledges the constantly evolving nature of technology and the increasingly sophisticated computer skills of users. Contextualising research studies in this way means that baseline data is established (Bishop, 1998; Bar-Ilan, Peritz & Wolman, 2003) which can be used in benchmarking trends and patterns. This allows worthwhile comparisons to be made with data from similar contexts and chronologies. The central focus in all studies is understanding usage: what constitutes use or non-use, how it should be measured and how best to interpret it.

The questions asked in research studies seek to explore user behaviour by finding out:

- what EIS are used;
- what users' preferences are when using EIS. Preferences manifested might be for a particular format like e-journals rather than e-books; PDF rather than HTML or favouring certain subjects rather than others;
- the feelings of users regarding electronic media;
- whether there are barriers to the use of EIS; and
- who is using EIS.

Conclusions drawn from the data generated by these questions are often context specific and local (Hewins quoted in van Lill, 2001), which has raised concerns about the wider application of the research findings regarding user behaviour.

This review will describe and examine some of the key issues in the journal literature. A brief descriptive overview of the main research projects provides a basis for appraising the findings and conclusions reached by these studies. Applying theoretical frameworks and the use of appropriate methods is an area of debate, so it is appropriate to consider the methodologies and methods used in the main research studies.

2.2 Theoretical approaches

In order to gain a clear overview of the research in this field, it is important to establish the perspective and theoretical approach of researchers; understand the methods and methodologies employed; and the unique conditions which prevail in their research.

The complexities of measuring and interpreting the usage of EIS in academic institutions (Bishop, 1998) have been demonstrated by research studies undertaken during the past ten years. The question of how to measure and interpret usage in digital libraries is central to understanding this phenomenon. What constitutes "acceptable" usage is likewise difficult to define and establish. Banwell et al. (2004) propose digital library equivalents to the traditional library use measures. This means the number of library users can be equated to the number of registered online system users, library visits become equated with the number of hits logged on a digital library's home page, use of library materials may be understood as documents viewed online and/or printed. It is suggested that these equivalents can be adopted across all electronic resources offered by libraries. Davis (2002) cautions that although it is "tempting" to adopt such an approach, results are difficult to compare because of how use is measured, particularly with regard to journals. Usage of print journals in libraries is usually undercounted. This is often so, because it is not possible to establish how many articles have been consulted by a user in each print

volume but in the online environment all such requests are logged. Higher online statistics may be skewed by factors such as:

- double clicking on article requests;
- the use of the refresh, back and forward buttons on the web browser;and
- the perceived inaccuracy and unreliability of vendor generated usage statistics (Davis, 2002; Atakan, Atilgan, Bayram & Arslantekin, 2008).

Another of the difficulties with conducting user studies has been that no dominant paradigm or theoretical framework is apparent (van Lill, 2001) from the literature. The lack of a common conceptual framework to provide a vernacular for researchers means that there is nothing which serves to "pull projects together and provide the basis for cumulative research" (Wilson, 2006, p. 683). The lack of theoretical guidelines has led many authors to conclude that too often research findings in user studies are fragmented, being too "site-specific, system-specific and service-specific" (Hewins quoted in van Lill, 2001, para. 2) to contribute in a meaningful way to the body of knowledge on the subject. "Practitioners are performing local, empirical studies" states van Lill (2001, para. 5) which make little contribution to developing the wider theoretical constructs of research in this field. Eason et al. (2000) caution that the results of the SuperJournal study into the experimental use of e-journals at institutions in the United Kingdom (UK) which was started in 1995 may well be generalisable. Nevertheless, these results should be understood within the context of the study because of limitations in the coverage of journals used in the study and the nature of the participating institutions. Dillon and Morris (1996) also recognise that there is scope for a unifying framework, particularly with regard to the acceptance and adoption of information technology by users and potential users.

A number of theories and models in support of positivist and interpretivist methodologies have been applied in library use and user research (Bates, 2005). Qualitative techniques which are associated with an interpretivist approach have become more common in investigating information seeking and use (Bawden, 2006). Such studies are concerned with individual and unique facts; and utilise processes where the researcher's role is subjective and involved. In contrast, quantitative methods of data analysis support a positivist approach where the researcher is objective and removed from the research process; and phenomena are understood in terms of numerical values (Bates, 2005).

2.3 Research methods in user studies

The literature on the investigation of EIS use reveals that many different research methods have been employed and studies have focused on different factors and variables. Of these, quantitative methods have embraced studies using system generated usage statistics, transaction logs and questionnaires; while qualitative methods have employed questionnaires; focus groups; observation studies and both structured and unstructured interviews (Tenopir et al., 2003a). Some studies have

used multiple data collection methods to generate in-depth profiles of users (Eason et al., 2000; Mahe, Andrys & Chartron, 2000). A definitive report on user studies was published by Tenopir et al. (2003a), which described and analysed the projects undertaken prior to 2003; and grouped them into two categories according to their size and significance.

Some of the larger or more interesting use studies targeting e-resources are described to provide insight into the research methods and methodologies which were found to be appropriate. South African studies (Pather & Stilwell, 2008; Mitha, 2009) have used mixed methods and quantitative approaches. In both studies, questionnaires (both print and online) were used for the data collection on use behaviour.

2.3.1 Quantitative research examples

Some of the research utilising quantitative methods is detailed in this section.

A European study at Max Planck libraries and information retrieval units set up an Information Provision Project in 1998 which was tasked with investigating the feasibility and usability of EIS for research purposes. e-Journals from four major publishers were made available and an online questionnaire used to evaluate their use and acceptance by all participants. The scope of this study in terms of the large number of users involved and the multidisciplinary nature of the subject content of the resources used, made it unique (Rusch-Feja & Siebeky, 1999).

The Ohio Library and Information Network (OhioLINK) is a consortium of Ohio's college and university libraries and the State Library of Ohio. This consortium serves more than half a million students, faculty, and staff at over 80 higher education institutions. The OhioLINK's Electronic Journal Center makes electronic articles and journals available to these members. The use of transaction log analysis tracked the articles downloaded from the Electronic Journal Center. This project began in 1998 and was ongoing for a number of years (Tenopir et al., 2003a).

A study of usage at four US academic Health Sciences libraries is reported by Franklin and Plum (2002) which used usage statistics and an online questionnaire survey which targeted randomly selected users when they accessed the networks library EIS. Care was taken by the researchers to create a "statistically robust methodology for examining the use of electronic services" (p. 1) which was replicable and which could be used as a model for similar studies. The findings documented why patrons use electronic resources in academic health sciences libraries and examined differences between in-house and web usage, comparing status and location of users and purpose of use.

Of the e-book studies conducted, many survey the use of a digital collection of netLibrary e-books compared to a print collection of books in a library. These comparative studies of electronic titles and their print counterparts use quantitative analysis of the usage statistics generated by the netLibrary system and the library system concerned (Fernandez, 2003; Gibbons, 2001). In her study at the University of Rochester Libraries, Gibbons (2001) comments on the shortcomings of the usage statistics supplied by netLibrary. She points out that the lack of detail provided in these statistics means it is not possible to examine in-depth how e-books were used. Information which would help determine how e-books are used could be obtained if data was available for:

- the length of time an e-book was accessed; and
- who was using a title.

Such data is not available from the netLibrary system usage statistics.

2.3.2 Qualitative research examples

Qualitative methods have been used in many studies, some of which are described here.

The Joint Information Systems Committee (JISC) established a User Behaviour Monitoring and Evaluation Framework to investigate the use of EIS in UK higher education during 1999-2002. The purpose of the framework was to identify barriers and facilitators to the use of EIS in learning and research over a period of time. In the first three years of this project, a general survey of end-users of EIS and EIS provision, and longitudinal monitoring of EIS use was conducted. Data collection was by means of critical incident interviews and questionnaires to evaluate use, awareness, attitudes and searching strategies. The project focused on students but other stakeholders were also interviewed (Banwell et al., 2004).

In 2001/2002 a survey of information use for the US Digital Library Federation and Council on Library and Information Resources (CLIR) was conducted. Over 3200 faculty, graduate students, and undergraduate students participated in telephone interviews. Participants came from private and public doctoral research universities and leading liberal arts colleges. The EIS assessed covered seven subject disciplines. Interviews were conducted and participants were asked about the use and preferences of users regarding the print and electronic resources provided by the library (Tenopir et al., 2003a).

French research scientists' use of e-journals in their work was measured by a qualitative study at the Jussieu Campus in Paris. This project was conducted under the auspices of a national programme for document digitisation in higher education and research. The main disciplines covered were physics, chemistry and biology, but it also covered mathematics, computer science and earth sciences to a lesser extent.

Users were surveyed by means of qualitative interviews conducted in the workplace and the findings generated a typology of user profiles (Mahe et al., 2000).

The Collaboration in Research Support by Academic Libraries in Leicestershire (CORSALL) project was set up to look at ways in which three UK universities could collaborate in the services they provided to researchers. Part of the project involved a survey of researchers at the institutions. The survey conducted in 2000 focused on researchers' use and satisfaction with e-resources, and any barriers which impeded their use (Lock et al., 2001).

2.3.3 Combined research examples

The use of a number of research methods has been evident in use studies. Some of these are described below.

The UK SuperJournal project involved a number of e-journal users and a variety of research methods were employed which included transaction log analysis, surveys, interviews and focus groups. The purpose of the study was to assess how academic users (comprising both scientists and social scientists; students and faculty) interact with e-journals and to identify the features they value in this electronic medium (Tenopir et al., 2003a).

The Stanford e-Journal Users Study (e-JUSt), conducted between 2000 and 2002, used a variety of methods to explore the use of electronic journals. Methods used included qualitative user surveys, transaction log analysis, and also an ethnographic study. The qualitative user surveys were conducted online. Participants included graduate students, faculty members, and clinicians from universities, hospitals, and government and academic research institutes from 99 countries (Tenopir et al., 2003a).

Tenopir and King undertook a number of research studies where critical incident, demographic, and usage questions were asked in surveys of over 16 000 university and research scientists, engineers, medical professionals, and social scientists. Information-seeking behaviour and the purpose, source and amount of reading materials were measured. Later studies focused on changes in users' reading patterns particularly as a result of the adoption of e-journals by libraries (Tenopir et al., 2003a).

2.4 Findings and recommendations

The findings of studies in the United States, United Kingdom (Tenopir et al., 2003a) and Europe (Mahe, 2004; Rusch-Feja & Siebeky, 1999) contribute to an understanding of what characterises users, user preferences, user attitudes and the barriers to the use of EIS. Local published studies which could contribute a South

African perspective were difficult to identify. A study by Pather and Stilwell (2008) highlights the preferences of Science researchers at the University of Natal with regard to e-journals; and medical researchers' usage behaviour at UKZN is investigated by Mitha (2009) in her study into information seeking behaviour and needs. A recent unpublished thesis on electronic usage statistics (Dean, 2008) highlights the South African experience in this regard. Further afield in Africa, Mawindo and Hoskins (2008) report on the use of print and online resources at the University of Malawi College of Education. This study provides the context of usage in a developing country.

The variables which determine user behaviour are "one of the aspects most analyzed in the studies of users" (Borrego et al., 2007, p. 68). Different user behaviours can be attributed to variables such as:

- the discipline or subject field of users;
- the content and coverage of EIS;
- age and the status or academic position of users;
- computer skills and proficiency; and
- the convenience and ease of use of EIS.

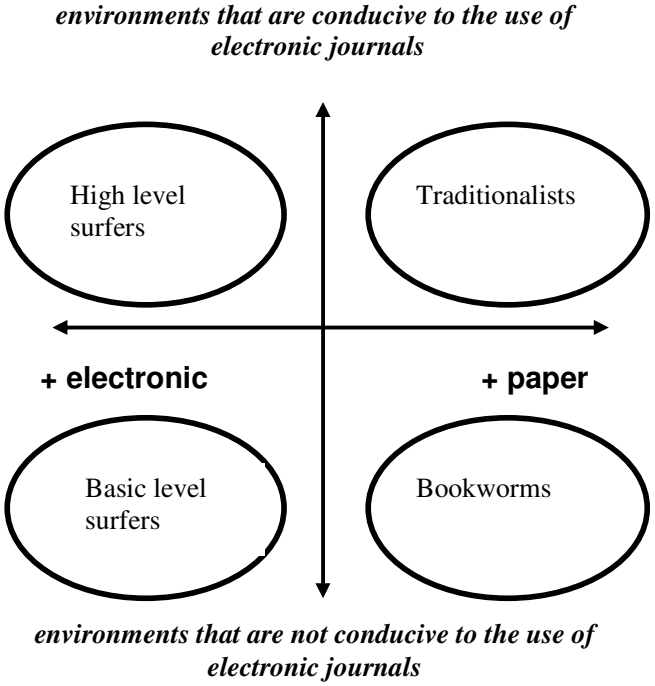
2.4.1 Discipline and subject content

Generally e-journals have been adopted fairly rapidly in academic circles, with users behaving in certain ways depending on their discipline or area of study. Some of the conclusions reached are that:

- Social scientists make more in-depth use of EIS characterised by browsing core e-journals, but scientists make more use of EIS for current awareness and staying informed on new research in their field (Eason et al., 2000);
- Engineers access and read less papers online than medical academics but they spend longer reading each paper (Tenopir et al., 2003a);
- Biology researchers are logged as avid users of e-journals compared with their counterparts in law (Tenopir et al., 2003a);
- Scientists and business faculty members (Tenopir et al., 2003a); and medical faculty (Mitha, 2009) are early adopters of e-journals and make use of a variety of full-text databases and e-journals;
- Social scientists and humanities faculty members use both EIS and print resources but they favour print books more than users in other fields of study (Tenopir et al., 2003a).

Mahe et al. (2000) maintain that discipline of study is crucially important in determining whether electronic journals are used or not. In Figure 2.1 below, the characteristics of researchers in terms of their preferences and the environments in which they conduct research are described.

Figure 2.1 Figure representing typology of users and environments



Reproduced from Mahe (2004, para 11)

High level surfers have access to computers and resources; and they prefer Internet surfing to access information. Basic level surfers are in a similar position but enjoy less access to computers and resources. The traditionalists and bookworms support paper based environments. Electronic formats were found to be used by those active in chemistry and physics.

However, other studies view the factor of discipline as less significant. Factors such as the availability of e-journals in the subject field; their content and coverage; the EIS that are promoted or made available by the academic library and competing services have been suggested as having a greater effect on use (Eason et al., 2000). Often both the content and extent of coverage of EIS have featured in studies into the use of e-journals. Many studies have limited their research into EIS to particular subject areas because of the limitations of available resources; lack of critical mass in EIS in some subjects; or because of the nature of the institution or users being surveyed. This has led to findings from which generalisations should be drawn with caution. The findings of studies report that:

- Chemists, physicists and mathematicians use older journals equally as much as more current issues. This indicates that online archival access to backcopies of journals is important to this group (Tenopir et al., 2003a);

- Most articles in e-journals are accessed and read within the first year of publication (Tenopir et al., 2003a) suggesting their importance as a current awareness tool.

Findings indicate that humanities researchers use e-books less than other groups (Levine-Clark, 2007); and that the e-books are less popular for the social sciences and humanities than other subjects (Christianson, 2005). Authors note that this might be because the "convenient electronic reference function serves some subjects better than others" (Christianson, 2005, p. 360).

2.4.2 Age and status

Both age and academic position are seen as "inversely related to the use of electronic media and journals" (Borrego et al., 2007, p.68). This indicates that older library users are less likely to make use of e-journals, as are those members of faculty holding more senior positions. Age is generally regarded as influencing usage with younger faculty members making greater use of EIS and older members relying more on print (Tenopir et al., 2003a). Nicholas, Huntington and Watkinson (2004) note that a high percentage of e-journal usage is "accounted for by intermediaries" (p. 249). Intermediaries are research assistants and postgraduate students. This would explain how members in higher age and status groups obtain their information from e-journals and databases.

Younger users adopt EIS more readily than older users and display more enthusiasm for them, with graduate students specifically identified as heavy users (Tenopir et al., 2003a). Graduate students and faculty both require print and electronic resources to cater to their research needs but undergraduate students are more accepting of using EIS only (Serotkin et al., 2005). However, this situation is changing and with the passage of time, age differences and preferences should become less apparent. Tenopir et al. (2003a) recommend further research in this area.

2.4.3 Computer proficiency

Users' perceptions of their own computer proficiency affect their preference for, and use of e-journals (Cochenour & Moothart, 2003). This also accounts for why some library users prefer to continue to use print journals. Those more likely to rate their computer proficiency highly were younger students and younger faculty members (Tenopir et al., 2003a). Regular users of EIS who had advanced computing skills were also more likely to take advantage of the additional features and functionality offered by EIS (Eason et al., 2000). However, Tenopir et al. (2003a) caution that more effective use of EIS does not automatically follow on from good computer skills, and that quality judgements made regarding online materials by younger users may not meet the standards of older users.

2.4.4 Ease of use and availability

e-Journals are used by faculty and students if they are perceived to be convenient, easy to use (Eason et al., 2000; Wolf, 2001), relevant to their studies and time-saving (Tenopir et al., 2003a). According to Borrego et al. (2007) the use of e-journals increases with time as users become familiar with them and the advantages they offer over their print counterparts. They also maintain that availability plays a significant role, with users rating desktop access and access from home an advantage. However, the use of an e-journal does not always indicate a preference for the electronic format. The situation might be such that the print format is difficult to obtain or is unavailable which forces users to make use of the electronic format. However, even those journals which are inconvenient to access are used online if they are regarded as core to a researcher's work (Tenopir et al., 2003a).

Consensus among e-book studies is that cataloguing e-books increases their use (Dillon, 2001; Gibbons, 2001).

2.4.5 Print

There is evidence that printed journals are being used less as users' preferences for the digital format grow (Borrego et al., 2007), although print is still considered important in many disciplines especially in the humanities (Tenopir et al., 2003a). Print is also the preferred medium for books but e-books such as reference works which invite "discontinuous reading" and which are "quick look-up" resources have enjoyed wider acceptance and use. For more general reading, e-book use is still in its infancy and has yet to have a significant impact on reading habits (Tenopir et al., 2003a). Users have expressed preferences for reading from paper rather than from a computer screen (Eason et al., 2000) with the majority of e-journal users preferring to print out articles rather than read them online. There is a demand for formats such as PDF which are well-suited to printing and convenient to download (Tenopir et al., 2003a).

2.4.6 Reading habits

Use of e-journals and print journals indicates that a small number of journals are responsible for most of the total use (Davis, 2002) and that users tend to regularly read a select number of core titles (Eason et al., 2000; Tenopir et al., 2003a). This suggests Trueswell's 80/20 rule, which advocates that 80% of use comes from 20% of the collection, has some validity and can be applied to reading habits (Davis, 2002) and EIS use.

2.4.7 Barriers to use

Among the main barriers to the use of EIS are:

- Researchers lack of awareness of available EIS (Lock et al., 2001) and problems navigating within the library's website to locate EIS (Serotkin et al., 2005);
- Lack of availability of relevant EIS (Lock et al., 2001) including a lack of back issues (Borrego et al., 2007);
- Lack of adequate equipment (Lock et al., 2001; Serotkin et al., 2005) and "low level technical problems" impeding the viewing of EIS (Woodward, Rowland, McKnight, Pritchett & Meadows, 1998, para. 1).
- Lack of suitable user training on how to search for information is also identified as a drawback (Lock et al., 2001) particularly given the variety of publisher interfaces on the web which deliver EIS and the speed of change (Woodward et al., 1998);
- Inconvenient and difficult to use (Lock et al., 2001);
- Problems with reading from the computer screen (Borrego et al., 2007; Woodward et al., 1998);
- Difficulty accessing EIS because of licensing or password restrictions (Serotkin et al., 2005; Tenopir et al., 2003a);
- High user expectations and disappointment that e-journals are not "just one click away" from readily accessible information (Lock et al., 2001);
- Users have an "emotional tie to paper and the library" which makes it difficult to make the move to EIS (Tenopir et al., 2003a, p. 36).

2.5 User-centred design and technology

In the information seeking relationship, the trained subject expert or information specialist in libraries has historically played the role of intermediary between the system and the user. However, more recently with the proliferation of personal computers and the development of the worldwide web, user-centred design has emerged. User-centred design accords consideration to the user and user requirements. Among theories which embrace user-centred design is Human Computer Interaction (HCI) Theory (Bannon, 2000) which focuses on understanding user behaviour and implements suitable designs for the effective online delivery of EIS (Bates, 2005). Other research approaches are concerned with the development of technology systems and devices to improve the retrieval of information (Bates, 2005).

2.5.1 Human computer interaction

The relevance of HCI is endorsed by Gerlack and Kuo who state that "the large, interdisciplinary body of research literature [on the topic] suggest[s] HCI's importance as well as its complexity" (1991, p. 527). In terms of information behaviour, Human Computer Interaction Theory is concerned with the development of user-centred

technology where human interaction with the computer interface design is the focus. Aspects covered by this theory include user requirements; the specification and design of the interface; and evaluation of the interaction in terms of the user (Bannon, 2000).

Central to interaction between user and computer is the concept of usability which has been defined by ISO 9241-11 as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (Ferreira & Pithan, 2005, p. 312). Usability guidelines established in terms of HCI aim to promote standards of design in online products which are "easy to use and learn, are satisfying to use, and [which] provide utility and functionality that are highly valued by the target population" (Bannon, 2000, section 4). Users might choose not to adopt or use an online system or resource because learning and using the system is too time-consuming and complicated (Gerlach & Kuo, 1991).

2.5.2 Usability characteristics

The following usability characteristics listed by Bannon (2000) contribute to meaningful and productive interaction between human and computer:

- Usefulness – the motivation of users to use the system and achieve their goals.
- Effectiveness – concerns "ease of use" and is often measured quantitatively as a numerical value or percentage. Aspects evaluated might include the speed of performance of tasks and the number of errors made when executing tasks.
- Learnability – the users' ability to achieve an appropriate level of competence after "a predetermined amount and period of training" (Bannon, 2000, section 4). Gerlach and Kuo (1991) emphasise that the productivity of the end-user relies not only on the functionality of the interface but also on the "ease of learning and use" of the system (p. 527). Learnability also applies to relearning the system by users who use it after an absence of some time.
- Attitude of users – also referred to as "likeability." This aspect reflects the perceptions, opinions and emotions of users of the system and interface (Bannon, 2000).

In addition to these characteristics, Maguire (2001) suggests the importance of:

- Satisfaction to cater to the users comfort and acceptability of the interface;
- Understandability which assesses whether the user understands what the system can do;
- Operability or supportiveness of the design to help the user overcome difficulties they may experience using the system;
- Attractiveness to motivate and encourage users to use the system.

2.5.3 Relevance

The relevance of HCI Theory for understanding the use of EIS lies in the user's perception of the usability of electronic formats of information sources (Dillon & Morris, 1996). If they are perceived as usable, then the benefits users will enjoy are summarised by Maguire (2001) as:

- Increased productivity and the ability to operate effectively as a "usable system will allow the user to concentrate on the *task* rather than the *tool"* (p. 587).
- Reduced errors. A poorly designed user interface accounts for much human error. By reducing inconsistencies in the interface design this can be avoided.
- Reduced training and support.
- Improved acceptance. This is an indirect outcome, but users are more likely to adopt a system which provides easily accessible and usable information.
- Enhanced reputation. Positive user acceptance enhances the reputation of the service provider e.g. the library.

To provide these advantages, the design layout of EIS and also the online navigation path to EIS via the library website (Serotkin et al., 2005) or the library Online Public Access Catalogue (OPAC), needs to embody acceptable and appropriate usability design (Bannon, 2000). Dillon and Morris (1996) point out that user-centred design and usability engineering with its focus on interface improvement has been extended by the Technology Acceptance Theory to "predictions of likely usage" (para. 6), making it relevant in use studies.

2.6 Acceptance of technology

To contribute to our understanding of how and why some technologies are more readily adopted and accepted than others, are the Diffusion of Innovations Theory (Dillon & Morris, 1996; Minishi-Majanja & Kiglang'at, 2005) and the Technology Acceptance Model (Dillon & Morris, 1996). The Diffusion of Innovations Theory (DoI) will be described and discussed here. This theory has been widely adopted by a number of different disciplines and an enormous amount of literature on the topic exists (Rogers, 2004).

2.6.1 Diffusion of innovations theory

Currently, DoI is widely used to study the adoption of innovations such as the Internet and other Information Communication Technologies (ICTs) (Minishi-Majanja & Kiplang'at, 2005). Minishi-Majanja and Kiplang'at (2005) indicate that elements of DoI Theory are specific to the culture in which it was derived and has limited applicability in developing countries, although they concede that the theory is helpful in that it can provide a platform for investigating issues in Library and Information Services (LIS) in developing environments.

The DoI Theory proposes perceivable channels and time spans for the adoption of new innovations by a social system (Rogers, 2004; Lajoie-Pacquette, 2005). A new practice, idea or product may be perceived as an innovation by an individual or group of individuals (Rogers, 2004). However, potential adopters of the innovation need first to learn about the innovation, and be convinced of its merits, before choosing to adopt and implement it.

Communication channels for innovation are the means by which messages are sent from one individual or group to another. The transmission or diffusion may be by means of the mass media, the Internet or inter-personal communication. Minishi-Majanja and Kiplang'at (2005) note that paradoxically information about new communication technologies is often by means of the technology itself.

2.6.2 Adoption characteristics

The adoption of innovations is determined by the following list of characteristics (Lajoie-Paquette, 2005; Minishi-Majanja & Kiplang'at, 2005) which may singly or collectively influence the rate at which adoption occurs:

- Relative advantage. This is the extent to which the innovation is seen as an improvement on the previous idea or practice. The improvement might be assessed in both tangible and intangible terms.
- Complexity. If the innovation is simple, then diffusion will be quicker than if it is complex, requires training and the development of new skills.
- Trialability. The extent to which the innovation can be "trialed" and experimented with before adopting it. Being able to try out an innovation incrementally contributes to a faster adoption rate as users have an opportunity to become familiar with the innovation.
- Compatibility. The extent to which the innovation accords with existing values and needs of potential adopters. Incompatibility equates with slow adoption.
- Observability. An innovation will be adopted more readily if the results are visible or apparent.

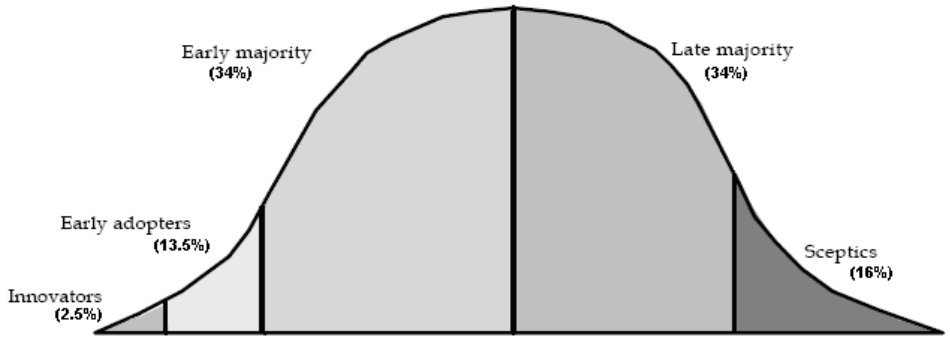
White (2001) reports on the study into the adoption of Digital Reference Services in a number of US libraries. This theory was applied to the rate of adoption of the services by users. The variables used to characterise adoption were the size and scale of the parent institution which included the enrolment, financial resources and staff resources; the degree of acceptance of computers for information access; and the demand for library services. Mitha (2009) reflects on a "fast rate of adoption of technology by South African medical academics" (p. 28) which is manifest in their usage of medical databases.

2.6.3 Profiles of adopters

The social system in the innovation diffusion model consists of a group of people or a set of interrelated units that are focused on accomplishing a common goal (Lajoie-Paquette, 2005). Within this social system, five adopter categories are evident and are categorised as:

- innovators;
- early adopters;
- early majority;
- late majority; and
- laggards or sceptics.

Figure 2.2 Everett Roger's model of adopters



Reproduced from Robinson (n.d., para 3).

The rate of adoption in terms of time taken for an innovation to diffuse is dependent on the innovation-decision process; the relative time with which an innovation is adopted by an individual or group; and the innovation's rate of adoption. Most innovations have an S-shaped rate of adoption where rapidly diffused innovations create a steep S-curve while others with a slower rate of adoption, create a more gradual slope to the S-curve (Surry, 1997 cited in Minishi-Majanja & Kiplang'at, 2005). The rate of adoption is the diffusion rate and follows a process which progresses through five stages. These five stages are awareness; interest; evaluation; trial; and then finally adoption. Innovators and early adopters readily pass through these stages while the sceptics lag.

Application of DoI is not limited to the level of the individual and in White's study (2001) she reports that the diffusion of Digital Reference Services (DRS) at US academic libraries focused on adoption by the institution (or library) and not by the individual (or user). Minishi-Majanja and Kiplang'at (2005) maintain that LIS services in higher education are "early adopters since in most cases it was LIS services that first adopted computerization" (p. 213). However, they also point out that the Higher

Education social system is based on bureaucracies which by their nature, stifle and impede the adoption of innovations.

2.6.4 Significance of DoI theory

Understanding those users of EIS who are likely to be reluctant or slow adopters of e-publishing innovations is important. Intervention strategies such as training and skills development can be specially designed with them in mind (Dillon & Morris, 1996). Likewise the role of innovators or leaders in this field can be helpful in promoting the use of EIS by exerting an influence on potential audiences through personal contact and other communication channels. A better understanding of the role of intermediaries or gatekeepers in the diffusion process would be helpful to marketing and publicising the library EIS more effectively and could also inform the role of librarians in this process. However, Minishi-Majanja and Kiplang'at (2005) caution that the theory "does not adequately provide a basis for predicting outcomes or for providing guidance for accelerating adoption rates" (p. 211). Its value should be seen in that it is a useful tool for descriptive research.

2.7 Conclusions with relevance to proposed research

The research goals of this study are in keeping with many of the studies which have been reported in the literature. However, the focus of the UKZN study is more limited as only students were surveyed and not academic or faculty staff. By including e-journals, databases and e-books in the study, a comprehensive survey of EIS provided by the library was conducted. Many studies reported in the literature have focused on a particular format.

User studies have employed both quantitative and qualitative methods to reach their objectives, but as the study undertaken at UKZN is a baseline study, it is appropriate that there is quantitative data collection and analysis. The methodology and data collection instruments are described in the following chapter.

2.8 Summary

Literature on the subject of EIS use was reviewed. Theoretical approaches, the research methods employed, variables and barriers to use were identified in various research studies. Aspects of user-centred design as evident in human computer interaction and Diffusion of Innovation theory were considered.

Chapter Three: Research methodology

3.1 Introduction

Use studies are conducted to achieve an understanding of how resources are used and to shed light on the behaviour of users. A variety of quantitative and qualitative methods have been employed to investigate usage, depending on the theoretical or philosophical framework adopted by the researcher.

3.2 Research philosophy – pragmatic research

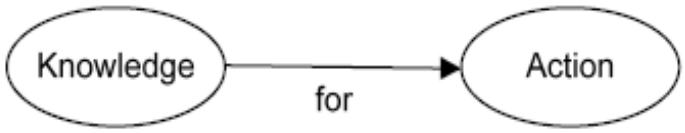
Information theory and social theory both provide frameworks within which to develop studies in information science (Burke, 2007). As LIS research is often applied research directed at problem solving within the profession (Sundin & Johannisson, 2005, p. 24), it exhibits a strong emphasis on the practical. This makes it incumbent on the researcher to expand on the abstract theoretical foundation underlying research in order to attain a better understanding of the issues under investigation (Burke, 2007). Considering that "methodological approaches vary, depending on the philosophical stance taken and the particular emphasis of the project" (Banwell et al., 2004, p. 304), it follows that the data collection instruments and methods used in research are informed by the theoretical approach adopted.

Adopting a paradigm assists in the research process as a paradigm provides a viewpoint or lens through which ideas and actions are perceived and understood (Burke, 2007). A paradigm also allows the researcher to interpret research findings from a standpoint based on certain articulated underlying assumptions and norms. In information use studies, human behaviour and technology are both important dimensions of research because such studies deal with the interaction between people and information; and also the interaction between people and the technology used to access information. Burke (2007, p. 476) emphasises that this interaction process occurs within an environment of change, competition and developing communication technologies.

This study takes a pragmatic approach. Pragmatism as a philosophical method is primarily concerned with the practical results of actions. In pragmatist terms, to judge the truth of an idea is to evaluate the extent to which it makes a difference to practice (Sundin & Johannisson, 2005, p. 27). All values, beliefs and actions are acknowledged as instrumental to human actions and are often expressed in terms of the 'tool metaphor'. Pragmatism is a strong advocate of democracy and consensus. In the knowledge environment of academic libraries, this can be applied and understood as supportive of domain analysis, where professional information results from collaboration rather than endeavours at the individual level (Sundin & Johannisson, 2005).

In his investigation of information systems, Goldkuhl (2008) proposes three approaches in pragmatic research, namely functional pragmatism; referential pragmatism; and methodological pragmatism. These approaches are all based on the interaction between the central concepts identified as Knowledge and Action (p. 2). Of particular interest is the functional approach which embodies the idea that "knowledge should [be] useful and applicable in action". Functional pragmatism is expressed as "Knowledge for Action" and is displayed diagrammatically thus:

Figure 3.1 The knowledge – action relation in functional pragmatism



Reproduced from Goldkuhl (2008, p. 2).

The rationale for investigating EIS use at UKZN expressed in Chapter One, suggests that the findings would provide information to improve, enhance and expand the delivery of information services to students by the UKZN Libraries. This is a pragmatic approach which views knowledge as a functional resource, giving "humans guidance in their practical endeavours" (Goldkuhl, 2008) and in formulating proposed types of actions.

A functional approach provides a useful lens which emphasises the benefit of a 'working point of view'. In this research study, a pragmatic approach is both suitable and relevant as the focus on the practical consequences of beliefs, ideas and actions of pragmatism accords well with the applied nature of LIS research. The pragmatic view is also appropriate in a baseline study whose purpose is establishing foundational data. Baseline studies provide an analysis of the current situation and establish the base data needed for assessing change. It is a starting point which gives a measure of conditions at the outset, and which makes it possible to relate measurements taken later to this baseline data. In this way the extent of change can be clearly determined. Baseline data may be collected on any number of factors – social, economic, population characteristics – in order to benchmark and understand the current situation.

3.3 Methods and methodology

This section describes the quantitative research approach adopted and the issues related to using the Internet to collect research data.

3.3.1 The research design

The pragmatic approach of this research study is in keeping with the ethos of much of the research reported in the literature where a motivating factor is the efficient delivery of EIS by libraries. The emphasis on measurement means that data collection methods used are essentially quantitative.

3.3.2 Quantitative approach

A quantitative research approach emphasises measurement and allows the relationships between facts to be quantified and analysed. Given that the nature of a baseline study is to provide a yardstick, quantities must constitute the type of data collected. It also follows that the role of the researcher is an objective one, removed from involvement with the respondents.

Two data sources were targeted for data collection. A web-based questionnaire was administered to collect data from students; while the schedules of usage statistics from selected EIS vendors provided data on the online usage of both general and selected databases, e-journals and e-books. These statistics were downloaded from vendor websites and from ScholarlyStats™. The latter is a service available to subscribers for the management of EIS usage statistics. Through the combined use of data from the questionnaires and the vendor usage statistics, this research study aims to present a picture of the general patterns of use within the University and to interrogate the usage behaviour of two defined sectors of the student population. The two sectors comprise students from the faculties of Engineering and Humanities, Development and Social Sciences (HDSS) who are based at the specific geographic location of the Howard College campus, Durban.

The cross-sectional aspect of this research required a strategy which involved the study of many cases. When many cases are investigated it is difficult to do so in-depth, and, it is more appropriate to focus on a limited number of features or variables in each case (Bryman, 2004). Questionnaires are suitable instruments for obtaining information from many respondents about their opinions, attitudes and behaviours. They are also suitable for the collection of descriptive data, like the personal and background characteristics of respondents. Therefore, to collect data on a limited number of variables across a broad population, it was appropriate in this research study to employ a questionnaire.

However, “a study of individuals’ use of mediating tools should be complemented with a study of how these tools have developed together with that of the institutional context that they are used within” (Sundin & Johannisson, 2005, p. 38). So as to place the data from the questionnaire within context, the usage statistics from the selected EIS vendors were plotted over a given time period to reveal any trends. The extended time series of this data provides a longitudinal perspective against which the cross-sectional nature of the findings of the questionnaire could be superimposed. Both sources of data supported the research objectives of this study and together, captured an evolutionary perspective of EIS use which many researchers (Tenopir et al, 2003b; Mahe, 2004) observe is germane to research on EIS in a continually changing online environment.

3.3.3 Using the Internet to collect data

Internet research methods are increasingly popular as a means of collecting information from individuals. The online environment presents possibilities for a number of research methods (both qualitative and quantitative) which include the use of online or web-based questionnaires to conduct social surveys (Bryman, 2004). Some of the reasons for adopting an online survey method are elaborated by Van Selm and Jankowitz (2006). They emphasise that the object of the study is very significant when making this choice. “Online surveys are often employed in studies of Internet use in order to reach a population with Internet experience” (Van Selm & Jankowitz, 2006, p. 436). The characteristics of the population can also determine whether an online survey is appropriate. Certain age groups and computer proficient “restricted populations” are suitable. In environments such as the higher education sector, where computer skills are thought to be reasonably well-developed, online questionnaires are a suitable instrument for data collection. The University student cohort represents a “restricted population” which has ready access to skills, computer technology and infrastructure.

A web-based survey involves developing a questionnaire using appropriate survey software or HTML coding; and then making it available on the Internet. The questionnaire can be presented in a visually attractive way and by exploiting the added functionality that survey software offers, can guide respondents seamlessly through the questions on the questionnaire. Features such as radio buttons, text boxes and multi-media can enhance the respondent’s experience. Web-based questionnaires are made available on the Internet at a specific URL. Respondents are pointed to the questionnaire in a number of ways, with email being a popular means. An alternative is to conduct an online survey via email. An email survey can be presented to respondents as either an attachment to the email message or with the questions embedded in the email message itself. Embedded questionnaires require that the respondent fill in answers on the email message and submit them by replying to the sender. Attached questionnaires require more advanced computer skills because the questionnaire needs to be opened, completed, saved and then

attached to the replying email message. Bryman (2004) cautions that it is important to consider the "distinction between web-based and communication based methods" when using online questionnaires (p. 470).

3.4 Sampling strategy

The sampling strategy addressed two different samples. The one sample targeted student respondents in the Engineering and HDSS faculties. These two faculties were selected as they are based at Howard College and represent most of the student cohort. Cluster random sampling was applied to identify the sample of students who were to complete the questionnaire. The other sample identified usage statistics of subscribed EIS. Their selection was based on COUNTER compliance and subject content.

3.4.1 Questionnaire sample

The student population on the HC campus exceeds 8 000 students in the faculties of Humanities, Development and Social Sciences (HDSS); and Engineering. As it was not feasible to survey all possible cases in this study, a sample was identified. Cluster random sampling was adopted as a practical option which allowed for some stratification and the random selection of respondents. In the sample the different levels and subjects of study had to be represented as these were outcome variables proposed by this research study. The sample size needed to be as large as possible to provide accurate results but also needed to be manageable given the limited resources available. A sample of 200 willing respondents was targeted, but because there is generally a poor response rate to online questionnaires (Van Selm & Jankowitz, 2006; Couper, 2000), a sample population of 760[1] was drawn using a combination of student class lists and by identifying suitable respondents from the Groupwise PO.3[2] address book. Using an institution's email address book as a sampling frame has been used in other studies (Couper, 2000, p. 486). UKZN student email addresses identify students by their student number and from this number it is possible to approximate the year of academic study of undergraduates. Of the sample targeted, 72 proved to be 'out of scope' (email undelivered) and were removed from the study, making the sample population size 688. From this sample 155 questionnaires were returned by respondents, constituting a response rate of 22.5%. Other studies at UKZN report slightly higher response rates at 25.2% (Mitha, 2009) and 28% (Pather & Stilwell, 2008), however, Borrego et al. (2007) argue that the response rate of 18.05% achieved in their study is adequate particularly as participation was voluntary and no incentives were offered.

[1] Initially this sample was 800 but 40 students' names were found to be duplicated and as they could only be counted once, the total sample diminished to 760.
[2] The email post box for students based on the Howard College campus.

To redress the low response rate, a reminder was sent to the sample group after three weeks encouraging participation. The time that the questionnaire was available online was extended from three to six weeks to allow respondents more time to access and complete the questionnaire.

According to Bryman (2004) a common misconception about sampling is that large samples are the best way of obtaining accurate findings. While it is true that larger samples reduce sampling error (the probability that if another sample of the same size were drawn, different results might be obtained), sampling error is the smallest of the three components of error which affect the soundness of sample designs. Two other errors — sample bias (primarily due to loss of sample units) and response bias (responses or observations which do not reflect “true” behaviour, characteristics or attitudes) — are much more likely to jeopardise validity of findings.

3.4.2 Usage statistics sample

Searching EIS in the academic environment is characterised largely by the need to either locate information on a topic or subject; or to locate a specific publication or article. The former typically involves browsing or a keyword search in a database or library catalogue. The purpose is to find (if executed successfully) references to a range of information sources germane to the topic. The latter involves searching a journal list or catalogue to locate the specific item or the journal in which the specific article appears. The sample of usage statistics collected needed to reflect usage from resources utilised in both these types of searching.

Furthermore, EIS sources needed to represent the different EIS formats and include e-journals, databases and e-books. Suitable targets needed to include resources with subject content in the HDSS and Engineering. Other important considerations were the availability of COUNTER compliant statistics for the selected sources over a suitable number of months before and after the time of the questionnaire in October / November 2008. Ideally a suitable period would span all the months in 2008 and those of 2009. This would provide monthly data over two full academic years. However, it was not always possible to get monthly statistics for the full period, thus the graphed statistics examined in this document reflect usage over variable periods. As the purpose of investigating the usage statistics is to map trends rather than to accurately measure usage, the variation in the time periods covered does not detract from the intent to portray the general usage trends at UKZN.

The EIS tabulated below in Table 3.1 were selected as representative:

Table 3.1 Sample drawn for EIS usage statistics

	General	HDSS	Engineering
Databases	TDNet and EbscoHost Academic Search	Project Muse	Compendex
e-Journals	TDNet and EbscoHost	Project Muse and Cambridge University Press Journals	Emerald Engineering Journals
e-Books	netLibrary and African Writers' Series	N/A	N/A

3.5 Data collection instruments

In order to collect data from variant sources, two different data collection instruments were used. By using more than one source of data, findings can be cross-checked (Bryman, 2004, p. 545) and in this way triangulation of data improves confidence in the resulting findings (Bryman, 2004, p. 275). The instruments employed were a questionnaire administered to students; and schedules of EIS usage statistics provided by vendors and service providers.

3.5.1 Questionnaire

Questionnaires characteristically pose a number of questions in order to collect data directly from respondents. The responses to the questions provide the data which is analysed and gives rise to the research findings. The questionnaire in this study (Appendix A) was designed to elicit responses to a number of questions on the use of EIS and to collect brief biographic information on each respondent. Questions were framed so as to avoid ambiguity or misunderstanding. Wright points out that "online survey questions are of the same type as those appearing in traditional paper/pencil questionnaires" (Wright, 2005, para. 33) and they benefit from logical sequence, clear instructions and unambiguous wording. Clear instructions were provided for completion of the questionnaire. For practical considerations, the questionnaire was designed to be self-administered and it was made available online on the Internet.

A limitation of the questionnaire as a survey instrument is that depth of understanding is restricted. The questions posed by the questionnaire would collect data which provided only a partial view of student use of EIS. To address this limitation, it was originally envisaged that a number of semi-structured interviews could be conducted as a follow-up to the questionnaire. However, due to time constraints and difficulties with contacting students, it was not possible to include this data collection method as part of the study. It is suggested as a recommendation for further research.

The questionnaire was placed online by the UKZN Information and Communication Technology department using the open source LimeSurvey software. The questions were carefully proofread and some questions had to be adjusted and reformatted because of the requirements and limitations of this software. Other limitations of the online questionnaire which should be noted were:

- Duplication of responses – the software could not track or stop respondents from answering the questionnaire more than once should they choose to do so;
- Incomplete responses – it was possible for respondents to exit the questionnaire without completing all the questions and then resume the process later. Some students did not complete the process.

The questionnaire was administered to the sample population during October and November 2008. The online URL for the questionnaire was emailed to respondents with a covering message (Appendix A) asking them to please participate by completing the questionnaire. Respondents were assured that their participation in the study was voluntary and that they were free to withdraw from the study should they choose to do so. Respondents could not proceed with completing the online questionnaire unless they first completed the declaration (Appendix A). Respondents were not offered any inducements to take part in the study and were informed that all responses would be reported anonymously

The questionnaire asked a number of closed questions with a pre-determined selection of responses (Bryman, 2004). Closed questions or limited-option questions are quicker and easier for respondents to complete. They require that the respondent select and mark an appropriate option or options on a list. In order to overcome the limitations of closed questions in that they might not allow some respondents to answer in ways that are relevant to them, many of the questions also provided opportunities for comment or explanation. This was catered for by including an “other” option with space for a written explanation or comment. A rating scale was provided in question eighteen so that respondents could rate the EIS they use.

Background information on respondents was solicited so as to establish the characteristics of the sample population. Information was requested on the qualification for which respondents were studying; the discipline and level of study; gender; age; and computer proficiency. Further, the research questions in the questionnaire focussed on:

- Awareness of e-resources;
- Levels of use of e-journals and e-books;
- Reasons for use;
- Navigation and access;
- Problems experienced when using e-resources; and
- Rating of online resources.

Responses from the questionnaires were captured in a data matrix by the LimeSurvey software. Each question was numbered and labelled as a column in the spreadsheet. Respondent's responses were tabulated in rows, with missing values represented by empty cells.

3.5.2 Usage statistics

Vendor usage statistics for EIS provide a metric which informs broad usage patterns and trends. The COUNTER initiative provides an international standard for libraries and the publishing world which is based on two codes of practice. They allow for the collection of comparable usage statistics from different information providers and services. In 2003 a Code of Practice for online journals and databases was made available and a revised edition appeared in 2008. A Code of Practice for online books and reference works was issued in 2006. These codes of practice outline the procedures to be followed by vendors in providing usage statistics and include definitions of terms, and layouts for the presentation of statistics. They require that data be tabulated in specified formats (which allow for easy importation into Excel spreadsheets) when providing monthly usage and annual totals. Separate totals are provided for the PDF and HTML (Hypertext Mark-up Language) formats accessed by subscribers.

COUNTER usage statistics provided to the UKZN libraries depend on the nature of the database – whether it is an abstracting database or whether it provides full-text articles. The relevant usage reports are collated on an annual basis providing figures for the following with regard to full-text databases:

- Journal Report 1: Number of Successful Full-Text Article Requests by Month and Journal;
- Journal Report 2: Turnaways by Month and Journal;
- Journal Report 5: Number of Successful Full-Text Article Requests by Year and Journal.

In the case of abstracting databases, these usage reports are produced:

- Database Report 1: Total Searches and Sessions by Month and Database;
- Database Report 2: Turnaways by Month and Database;
- Database Report 3: Total Searches and Sessions by Month and Service (COUNTER, 2008).

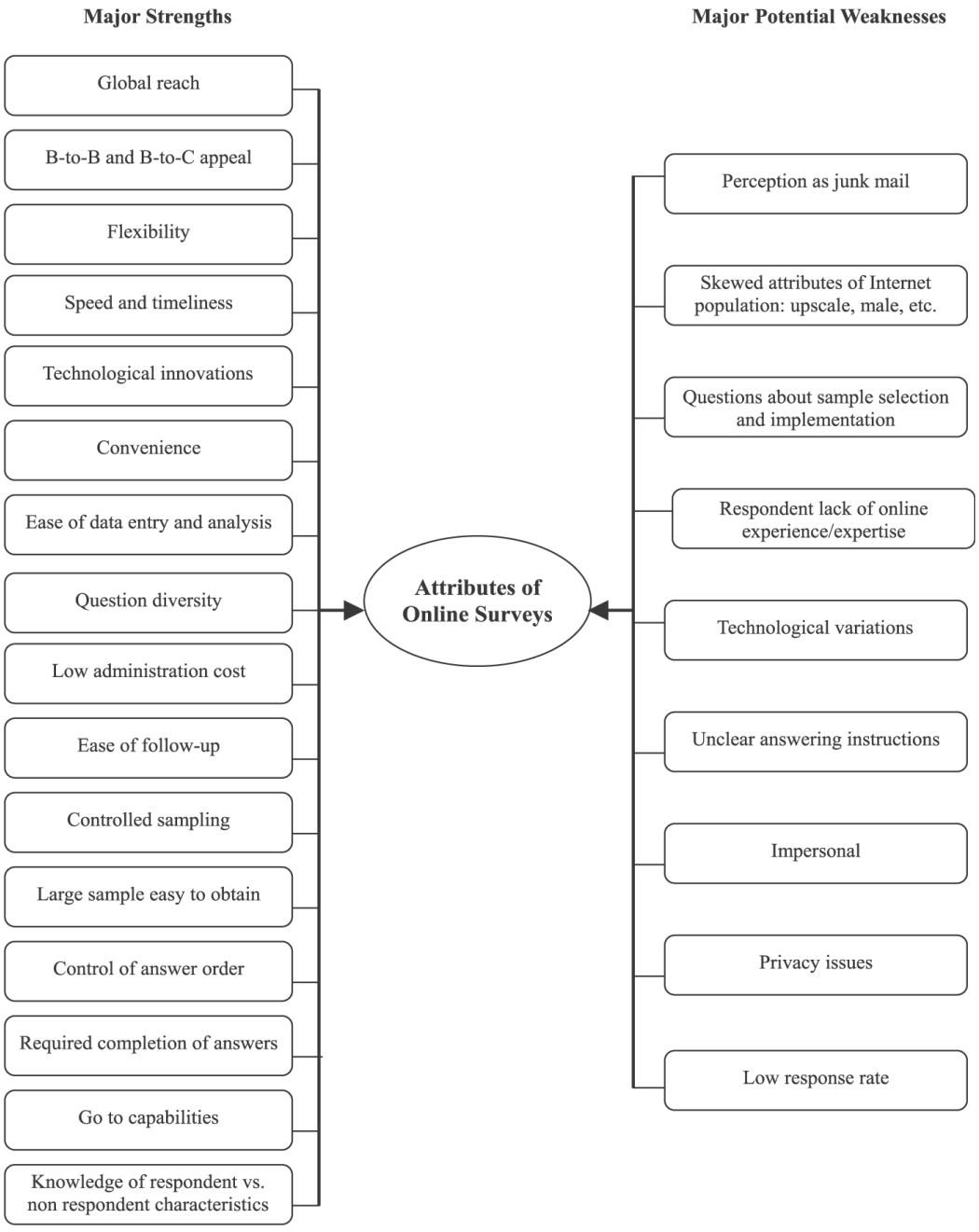
3.6 Advantages and disadvantages of these methods

Questionnaires and usage statistics present both limitations and benefits as data collection instruments in the research process. These are discussed in turn below.

3.6.1 Questionnaires

Online questionnaires have both advantages and disadvantages as a data collection instrument. Evans and Mathur (2005, p. 197) provide a comprehensive graphic representation of their strengths and weaknesses which is reproduced in Figure 3.2:

Figure 3.2 Summary of strengths and weaknesses of online surveys



Reproduced from Evans and Mathur (2005, p. 197).

From the researcher's point of view it is important to maximise the benefits and reduce the disadvantages by taking appropriate steps. Online questionnaires offer a number of advantages over print. They are relatively easy to administer, they are affordable, and they can be achieved in a short time-span. They make it possible to survey large populations and manage substantial sets of data because data can be captured and managed in spreadsheet format. This saves time when managing and storing data. Question order is more easily controlled using an online format as respondents can be routed to relevant questions or prompted to complete all the answers before proceeding to the next screen.

From the respondent's point of view, web-based questionnaires are often quicker and more convenient to complete provided they are well-designed. The quality of responses in self-administered questionnaires can be compromised by what is termed measurement error. Measurement error is defined by Couper as "the deviation of the answers of respondents from their true values on the measure" (Couper, 2000, p. 475). This could occur in instances where for some reason respondents intentionally misrepresent their responses to a question. Contributing factors listed by Couper include lack of motivation or comprehension, and intentional distortion. The design of the questionnaire is very important in limiting this kind of error particularly in terms of the layout and design; the framing of questions and terminology used; and instructions for completion. It follows that for best results, the questionnaire needs to be "easy to understand and to complete, must be designed to keep respondents motivated to provide optimal answers, and must serve to reassure respondents regarding the confidentiality of their responses" (Couper, 2000, p.475).

It can be problematic that the appearance of online questionnaires varies from respondent to respondent because of differences in the browser used for viewing. All respondents might not see the same configuration of the questionnaire. A web-based questionnaire could have potential bias in favour of the more computer proficient user. This leads to self-selection bias which means that there is a tendency for some people to respond to an online questionnaire while others do not (Wright, 2005, para. 19). Systematic bias in this case would favour those with skills and inhibits the researcher's ability to generalise the study findings. Although all students at UKZN are required to develop basic computer skills in their first year of study, this cannot be ruled out in terms of validity.

A poor response rate is generally a problem with questionnaires whether print or online (Couper, 2000; Van Selm & Jankowitz, 2006). However, there is always the danger of the emails inviting participation in a research study to be regarded as unsolicited email or spam and are thus easily deleted. This makes it important to counteract this tendency with efforts to personalise the process as much as possible and to follow up with reminders to those participants who have not completed the questionnaire.

3.6.2 Usage Statistics

With regard to the quality of vendor supplied statistics, their accuracy varies depending on the processes implemented to capture this data. The COUNTER code of practice (2008) draws attention to the potential effects of the increasing use of federated searches and Internet robots on inflating usage statistics. To minimise the tendency to over-report because of these practices, the Code stipulates that usage data from federated searches needs to be reported separately; and that activity generated by Internet robots, crawlers and Lots of Copies Keep Stuff Safe (LOCKSS) caches must be excluded from the usage data reported. In this way, accuracy is improved.

Likewise, user behaviour can skew the level of usage recorded. In this respect, Davis (2002) has drawn attention to the possibility of users double clicking on article requests; using the refresh, back and forward buttons on the web browser which can contribute to inflating the number of hits on a particular article. These concerns have been addressed to some extent by the 2008 revision of the COUNTER guidelines. The security of the institution's computer system also needs to be assured. If access is compromised in any way, unauthorised users can gain access to subscribed e-resources. This would affect the statistics generated and would reflect usage from persons not part of the university or subscriber base.

3.7 Data management

Data management involved both the construction and analysis of data collected by the questionnaire and from the vendor usage statistics.

3.7.1 Questionnaire data

The data from the web-based questionnaire was captured in a spreadsheet by the Limesurvey software. This data was entered into Stata™ version 8.2 for Windows, which is software designed for statistics and data analysis. A backup copy of the data was provided to the author's supervisor in order to comply with University regulations regarding research data. A further copy was stored on the author's F drive which is a secure space on the University computer network protected by username and password.

The responses in the spreadsheet were reviewed for unusable data caused by inconsistencies in responses. The type of data collected was nominal and descriptive; and was subjected to the following analysis:

- Univariate analysis of single variables to expose the amount of variability.

- Bivariate analysis to show the extent to which different variables were related to one another. The results of some questions were combined before cross-tabulation and in other instances the results were compared in order to answer the research questions. Here it is important to note that due to incomplete responses provided to questions on the questionnaire, the figures presented in unitary frequency tables do not always match those reflected in contingency tables where more than one variable is analysed. This has occurred when respondents have provided data pertaining to one of the variables under scrutiny but not the other.

- Basic content analysis was applied to the answers of questions where explanations and comments were provided. Content analysis involved identifying concepts expressed in the answers and then clustering these concepts into categories.

Data was presented using charts, graphs and both frequency and contingency tables.

3.7.2 Data on usage statistics

The usage statistics from the selected vendors were downloaded from the secured websites. This required the use of the UKZN library administrator's username and password. The statistics were selected for the 24 month period from 2008 to 2009. As access to these statistics depended on what was provided by the vendor, the same specific period was not always available from the different vendors. These statistics were imported into Microsoft Excel and plotted as column charts.

3.8 Reliability

Reliability of research ensures that the methods applied produce the same results if the study is replicated (Bannon, 2000). In a baseline study it is important to be able to repeat the study, and whatever methods are used need to be clearly explained and justified. This allows others to assess the suitability of the method adopted and reproduce the study in future in order to extend or review the research undertaken.

Provided the questions asked are appropriately framed and presented, a questionnaire can be a reliable means of collecting data. In this study, a logical and clear layout of questions was adopted which used a "funnel" approach i.e. arrangement from the general to the specific. Limited option questions were used to measure attitudes and behaviour. Both these features guided respondents when completing the questionnaire, making it quicker and easier to complete. The use of pre-testing provided input into the design of the questionnaire and the framing of the questions. The questions and their layout were again re-visited and edited when the questionnaire was coded and placed on the Internet.

3.9 Validity

Validity ensures that the study evaluates what it claims to be evaluating (Bannon, 2000) and is an accurate measure of the concept under investigation.

Internal validity is concerned with the appropriateness of the measuring instruments and the research design to realise the research objectives. As the specification of research goals embodied in the research questions is an important aspect of validation, they were given careful consideration when selecting data collection instruments. A questionnaire was chosen as a suitable instrument. The questions asked by the questionnaire were related to what was being measured and what was required to achieve the research goals. This involved interrogating respondents about their behaviour, attitudes and the difficulties they experienced when using electronic resources. Banwell et al. (2004) caution that “the selection of appropriate indicators” (p. 309) is pivotal in ensuring that the measures of use are valid. The identification of variables as indicators of the concepts of usage allows usage to be both observed and measured. How to establish the categories to be used for analysis is seen as a challenge. This issue was partly dealt with by reviewing prior research and basing categories on those already used. However, some consideration of local conditions was necessary. Adopting this approach went some way to establishing continuity with existing studies.

The pre-testing of the data collection instruments helped validate the research process. A pre-test of the questionnaire was administered to four volunteers during September 2008 to identify problems associated with the design of this instrument. The four volunteers were representative of undergraduates and postgraduates in Engineering and in the Humanities. The four volunteers were not included in the sample for the final questionnaire. The piloted questionnaires were administered in print format and provided important feedback. Necessary adjustments were made to the phrasing and terminology of some of the questions. However, it was an oversight to apply the questionnaire only in print format and not online as well. An opportunity was missed to gather valuable feedback on the web-based layout. This might have improved the research process and response rate.

Construct validity makes it necessary to establish that the phenomenon under study occurs in real life and that the behaviour measured as a sign of it provides an accurate representation of the concept. The design of the questionnaire was established and validated with reference to similar studies presented in the literature review. Validation was extended by incorporating electronic usage statistics in the study. However, as the reliability of usage statistics has been questioned in the literature (Atakan et al., 2008), the COUNTER compliant vendor statistics were collected and analysed for the use of e-journals. Clear standardised procedures are laid down for their collection, which means accuracy is improved and it is possible for these measures to be compared across different service providers. However, it was

found that in some cases that vendors[3] reported errors in collating the statistics. This questions the validity of these statistics. In the case of reporting statistics for e-books, it became evident that none of the e-books to which UKZN Libraries had access provided COUNTER compliant statistics. Therefore, the statistics provided by the vendors have been used as indicative of the trend of usage, but comparability is compromised.

The Chi-square test is used to establish statistical significance in the data collected from the questionnaire for this user study. The requirements for the use of this test are satisfied by the methodology and procedure used, namely the sample was randomly selected; data is of the nominal type; cell entries are independent; and expected frequencies are large enough. However, the possibility of Type I and Type II errors are still a possibility[4].

The importance of external or population validity is that it determines whether the research results can be generalised to the population and are not merely specific to the character of the research study viz. environment, measure, scope. Here the sampling procedure and response rate have bearing on whether it is possible to generalise findings to the population from which the sample is drawn. However, if the sample is representative, then a case can be made to generalise to the population from which the sample is drawn. In terms of the UKZN student population in 2008, the composition in terms of level of study (postgraduate / undergraduate); and enrolment by faculty on the Howard College Campus are presented in footnotes where relevant in the text.

3.10 Anticipated problems

Anticipated problems concerned the terminology of electronic publications, the visibility of e-books and the response rate to an online survey.

The research process recognised that the terminology used for e-publications might challenge a common understanding (Banwell et al., 2004). Respondents could misinterpret what is meant by e-journals, e-books and e-resources, so the use of a clear definition of these terms on the questionnaire helped to avoid any misunderstandings *viz*. “For the purposes of this study, e-resources are journals, books, databases and other information resources which are delivered online on the Internet”. Many e-journal and e-book websites to which the UKZN Libraries subscribe clearly acknowledge UKZN when users authenticate at the site, however not all of them do so. It is therefore not always apparent to students that the resource they are using is indeed a resource made available by the library. Confusion also arises when

[3] Correspondence from Swets Subscription agent regarding errors in reporting usage of the Elsevier online products

[4] A type I error occurs when the null hypothesis is rejected but should be confirmed. A type II error confirms the null hypothesis when it should be rejected (Bryman, 2004, p. 238).

users access e-resources via Google searches and by means other than the library webpage or the library catalogue. As it is difficult to minimise this type of confusion, respondents were asked what methods and navigation they used to find e-resources. In this way it was possible to establish what resources were used.

The visibility of e-books as a library resource is poor for many titles. Not all e-books are catalogued in the library iLink catalogue. Selected titles in the netLibrary and reference e-books appear and can be easily searched in the catalogue, but the individual titles in the African Digital Library and the African Writer's Series do not appear in the OPAC. However, both these collections are presented as databases on the library webpage. Students might not be aware in this case that these are in fact databases of e-books.

Achieving an acceptable response rate to the questionnaire to allow for generalisation of results across the student population on the Howard College (HC) campus was difficult. Planning took into account the importance of timing the questionnaire so as not to clash with undergraduate students' preparation for exams as this would impact negatively on the response rate. However, the questionnaire was administered in October 2008. Delays in both finalising the questionnaire after feedback from the pre-testing and in placing it online meant that the questionnaire was made available a month later than originally intended. In addition to this, the server hosting the questionnaire could not be accessed shortly after the questionnaire went live. Both these factors had a negative impact on the response rate.

3.11 Research ethics

Ethical principles in social research serve to protect research participants from harm by insisting that respondents are fully informed and consent to their participation in any research process. By complying with the *UKZN Research Ethics Policy* and *Code of Conduct for Research,* these principles were adhered to and suitable procedures were adopted to implement them. Clearance was formally requested and obtained from the UKZN Ethics Clearance Committee (Appendix B). As this research study involved measuring human behaviour, it involved interaction with human subjects.

The following procedures formed part of the research process and had the purpose of protecting the privacy, rights and dignity of the participants:

- Participation in the study was anonymous and voluntary by all respondents;
- Respondents were free to exercise their right to withdraw from the study at any time they chose to do so. This was clearly communicated at the beginning of the questionnaire (See Appendix A);

- The credibility of the study was established by providing pertinent information about the study, including the credentials of the researcher and supervisor, at the beginning of the questionnaire;
- The consent of respondents was secured when they agreed to answer the questions posed by the questionnaire;
- No inducements were offered to respondents to take part in this study; and
- Responses were kept confidential and the data collected was stored securely so as to guarantee the anonymity of the respondents;
- Best practice was followed and deception/misrepresentation of any kind was knowingly avoided.

3.12 Summary

The research design was based on a pragmatic approach which was appropriate in developing a baseline study. Quantitative methods were used to collect nominal descriptive data. Some qualitative data was also collected. The next chapter presents the research data and findings.

Chapter Four: Data collection and analysis

4.1 Introduction

Descriptive research concerns itself with measuring and estimating the size, quantities and frequency of variables (Kent, 2001, p. 244); and in establishing the nature of the relationships between them. It is in discovering these associations that it becomes possible to describe the patterns of activity regarding usage. The purpose of this chapter is to present the data collected.

4.2 Response rate

The response rate was determined by respondents completing or refusing to complete the questionnaire. In addition to this, an important aspect which needed to be considered was item non-response which resulted when respondents submitted incomplete questionnaires.

4.2.1 Questionnaire

Although the study aimed for a response rate of 200 questionnaires, a total of only 155 were returned. Kent (2001) suggests that a minimum of 100 cases is required for quantitative analysis and the calculation of percentages in a single variable. Applying this rule means that data gleaned in this study could be treated by univariate, descriptive analysis only. However, to redress the limitations of the small response rate, other options can be considered. Data can be adjusted by combining categories so as to create binary data. By collapsing these categories the number of respondents in each sub-category is increased, making it possible to apply the Chi-square test to analyse for statistical significance. Here it is also important to bear in mind the variability of the population characteristics from which the sample was drawn.

Non-response often denotes the probability of a high level of bias in the study. Bias indicates the likelihood that the responders in the study are systematically different from those who did not respond. Ideally this needs to be investigated to establish whether this is indeed the case. However in real terms, it is difficult to do this as the absence of data makes it impossible to establish the characteristics of non-responders.

Of the 155 questionnaires returned, some of the questions were not answered by respondents. This meant that all questionnaires in the dataset were not complete. Kent (2001) advises that researchers can employ a number of ways to deal with missing values. One method is ‘listwise’ deletion which means that all incomplete questionnaires are deleted from the sample set. In this research study, listwise deletion was not a practical option given the fact that the sample size was critical. A

less extreme option was to include all questionnaires in the dataset but exclude missing values from the tables and particular calculations where there were missing values. This approach has been adopted when analysing the data collected in this study. The nature and amount of "item non response" is reported and communicated in the findings for each variable in the frequency tables.

4.3 Data analysis

In line with the intentions of the research, results are reported under broad headings for the characteristics of the sample population and then specifically for each of the objectives of the study.

4.3.1 Unit of analysis

Many usage studies have used the individual as the unit of analysis (Sridhar, 1995) while others have favoured domain analysis (Talja, 2005). The former focuses on users in "a generalised and context independent manner" (Talja, 2005, p. 123) while domain analysis looks to the specialities and disciplines to which users collectively belong in order to explain their behaviour. Rogers (1976) points out that although the individual is the unit of response in many studies, it does not necessarily follow that the individual is the unit of analysis. By expanding analysis to the "clique, network or system of individuals" (p. 297) communication relationships are preserved. This is important for understanding diffusion research. This stance on domain analysis is supported by Sundin and Johannisson who state that:

> … an individual's information needs, ought to be studied from the collective level embodied by the knowledge domain rather than from individuals' actions or experiences. Consequently, domain analysis emphasizes that the creation of meaning, or meanings, of professional information is carried out not by single individuals but in collaboration with others within the knowledge domains where information appears (Sundin & Johannisson, 2005, p. 32).

In order to answer the research questions and fully interrogate the data in light of the stated research objectives, the unit of analysis has tended towards domain analysis; an approach supported by the pragmatic focus of this research. Domain analysis lends itself to analysing data so as to expose patterns and trends.

4.3.2 Questionnaire data analysis

The data set was copied from the XML data matrix generated by the questionnaire software and pasted into Stata™. Data generated by the limited option questions on the questionnaire was tabulated to provide frequency counts and percentages. These are presented in frequency tables and describe the characteristics of the research

population sample. Contingency tables have been used to demonstrate the association and dependence between variables and EIS usage. In order to establish the strength of such relationships, the Chi-square test was applied to the cross-tabulated variables. The purpose of the significance test is to draw meaningful conclusions about survey data. Significant differences are a statistic which indicates opportunities for further investigation; suggests relationships or associations between variables; or highlights 'cause and effect' patterns. By using the test, it was possible to establish whether the relationship between different variables was statistically significant and not due to chance. To apply the Chi-square test effectively, Kent (2001) recommends that subgroups need to have more than five cases. In order to achieve this, it was necessary in some instances to adjust data by combining categories into binary (two by two) tables e.g. age. The level of probability is calculated and represented as the P value. It provides a common means for comparison across different tests. For the purpose of establishing statistical significance in the research data of this study, the convention of $P < 0.05$ is adopted and applied. Data from the Chi-square test is noted in the contingency tables and states the Chi-square score; the degrees of freedom; and the P value[5].

The open ended questions on the questionnaire generated narrative or text comments by the respondents. This qualitative data collected by the questionnaire was subjected to content analysis. Analysis and interpretation of narrative content was done manually and involved firstly, identifying the main themes and appropriate categories of the content; and then secondly, allocating the responses to these identified categories.

4.3.3 Usage data analysis

Statistics on usage were downloaded from the vendor websites and captured in Excel spreadsheets. Statistical data recorded searches, sessions and full-text downloads from EIS. This data was collected for the relevant time period and collated so as to generate clear, explanatory graphs. The graphs were created so as to consistently (colour, layout, axes) present data and to make comparison between the different databases, journal collections and e-books possible.

4.4 Usage statistics

To understand the usage of EIS it is important to do so within the context of the extent and availability of these resources (Sundin & Johannisson, 2005, p. 38) to users. At UKZN, students have access to a comprehensive selection of STM (Science Technology Medicine), Education, Law, Social Sciences and Humanities abstracting and full-text databases (Appendix C); and over 22 000 e-journals. These

[5] For example the information on the Chi-square test is tabulated thus:
Pearson chi2(1) = 1.0170 Pr=0.313

resources are made available on an annual basis by subscription and since the 2004 merger of the Universities of Natal and Durban-Westville, e-resources have been added to the collection each year. This has seen the scope of available content from subscriptions increasing each year, which means that the context of usage is not constant but has expanded.

4.4.1 TDNet statistics

Subscribed databases are searchable via the publisher's interface but since 2008, many can also be searched using a federated search set-up by the UKZN Libraries via TDNet™. The federated search option allows cross searching of up to fifteen databases simultaneously. Federated searching is defined as a programme which "allows users to search multiple databases owned by different vendors simultaneously with a single query from a single user interface" (COUNTER, 2008, p. 6). The federated search adopts a subject-based layout which clusters like-databases into categories for efficient and seamless searching.

With respect to e-journals, the full range of subscribed content available to students is organised and listed on the TDNet™ Journal Manager. The Journal Manager was implemented in mid-2007 and provides users with a fully searchable list of both subscribed and free e-journals via the library website. Linking from article references to the full-text articles is facilitated by the use of an open URL resolver. The linking provided by this resolver means that users can navigate to full-text articles in e-journals and databases from scholarly abstract databases and from hyperlinks found via Internet search engines like Google Scholar.

The TDNet™ systems were operational for many months prior to the questionnaire survey undertaken in October / November 2008. Thus, the usage data is fairly representative of usage of the resources delivered by these means. When examining the logged usage statistics, general trends are visible, and become clearer when the data is represented on graphs. As an overview, the usage data contributes a contextual landscape against which the specific findings of the questionnaire can be understood.

A preliminary observation on Figure 4.1 is that general usage is variable for all resources. On closer inspection, it becomes apparent that the undulating pattern of usage corresponds closely with the progression of the academic year. Vacation periods show a drop in the usage of e-journals, while usage peaks during the course of the semesters. This suggests that usage fluctuations are linked to the academic year with usage peaking at some point in the first and second semesters and lower usage apparent during the December/January and July vacations.

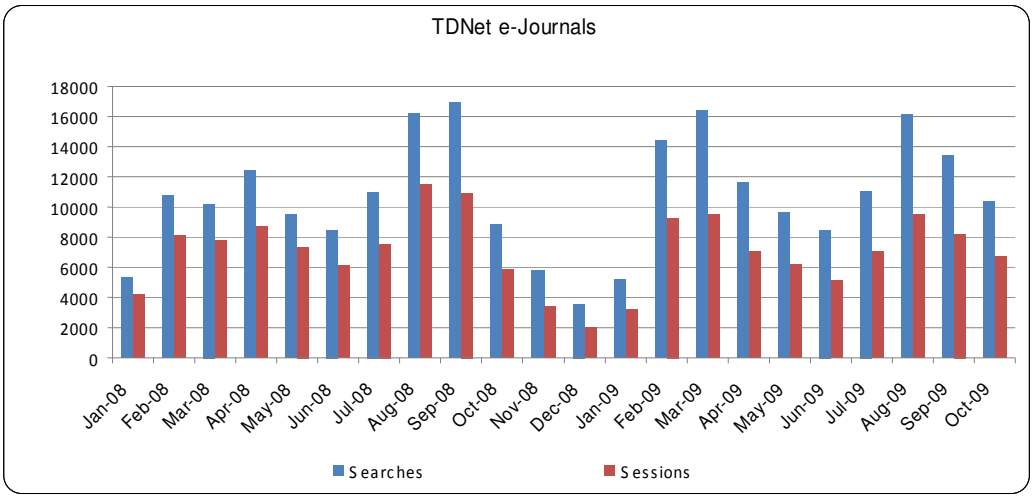
The searches and sessions of e-journals on the TDNet™ Journal Manager, show that on average, users conduct more than one search during a search session. A session is defined as:

> A successful request of an online service. It is one cycle of user activities that typically starts when a user connects to the service or database and ends by terminating activity that is either explicit (by leaving the service through exit or logout) or implicit (timeout due to user inactivity) (COUNTER, 2008, p. 8).

A search is defined as:

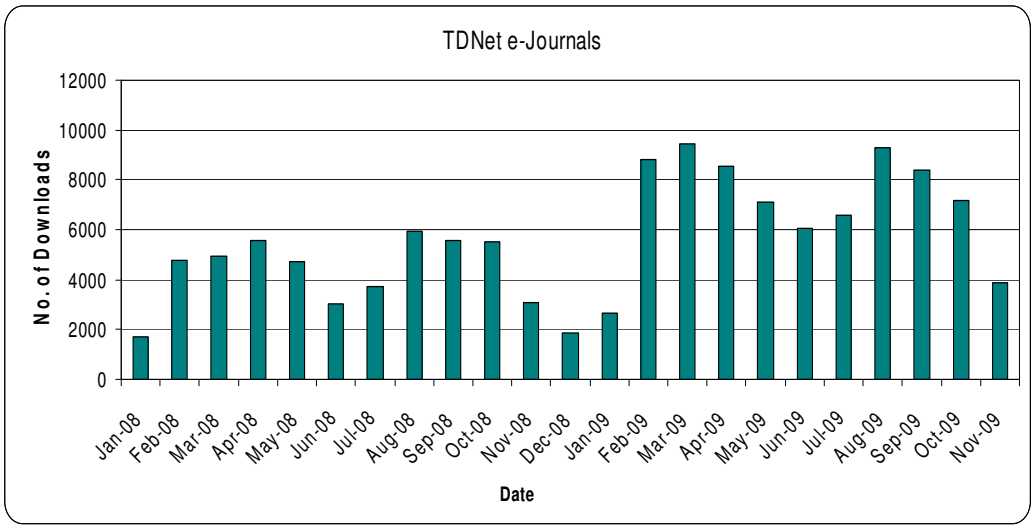
> A specific intellectual query, either equated to submitting the search form of the online service to the server or by clicking a hyperlinked word or name which executes a search for that word or name. The results of a specific intellectual query submitted by a user and executed by a server. This can typically be via a search form, or else by clicking a hyperlinked word or name which submits a search query (COUNTER, 2008, p. 8).

Figure 4.1 Searches and sessions on the TDNet Journal Manager



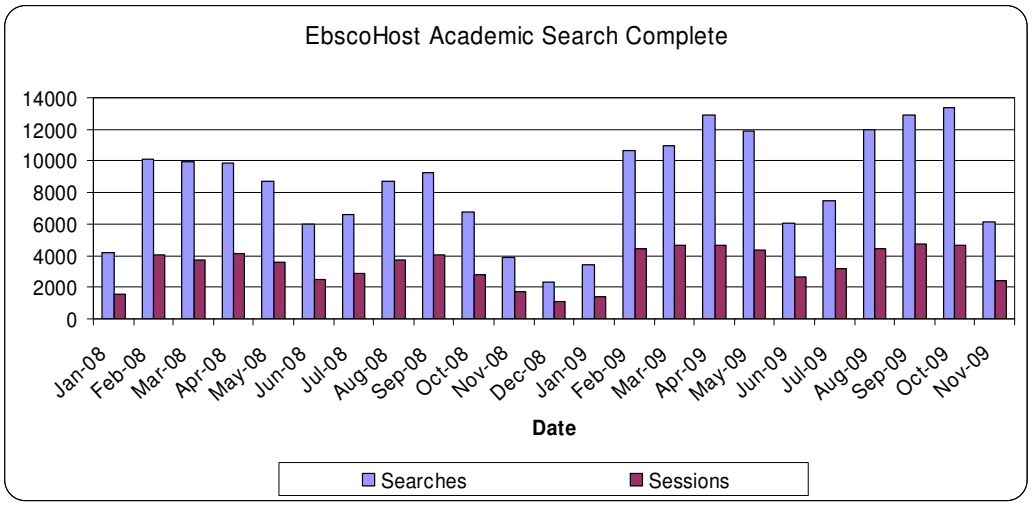
Further scrutiny of the usage data available shows that the searching activity detailed in Figure 4.1 above translates to a more specific measure consisting of full-text articles downloaded. These appear in Figure 4.2 and show that the average number of searches conducted for each full-text download is two. This suggests that users do not locate what they are looking for once off, and typically need to follow up with a second search. The preferred method of searching is by journal title, followed by article title and author.

Figure 4.2 Full-text article downloads on TDNet Journal Manager



Searches in the EbscoHost database Academic Search Complete, a popular multidisciplinary source of information, shows an undulating pattern in keeping with that which is described for the searches and use of TDNet journals above. The average number of searches per session is 2.5 which indicates that for each session there were at least two searches. The graph also reflects a rise in activity during 2009 over that in 2008.

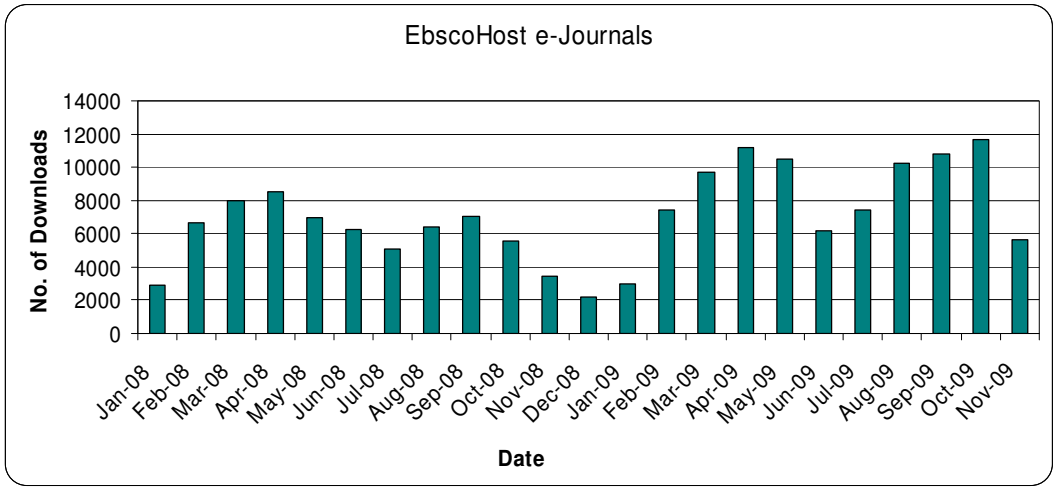
Figure 4.3 Use of Academic Search Complete



It is not possible to relate searches to journal downloads on EbscoHost as the journal data reflects use on all the EbscoHost full-text databases and not just Academic Search Complete. However, the journal download data is reproduced graphically

here to show that the pattern of use is similar to that which is generated by the journals on TDNet. The rise and fall of the graph shows a drop off in use corresponding to the vacation months, particularly in December. It is also possible to see that the usage in 2009 is slightly higher than in 2008 suggesting growth in the use of these particular resources.

Figure 4.4 Use of EbscoHost e-Journals



4.4.2 Vendor statistics for subject specific EIS

The usage statistics from the selected EIS for the Humanities and Engineering, as detailed in Table 3.1, are presented in this section.

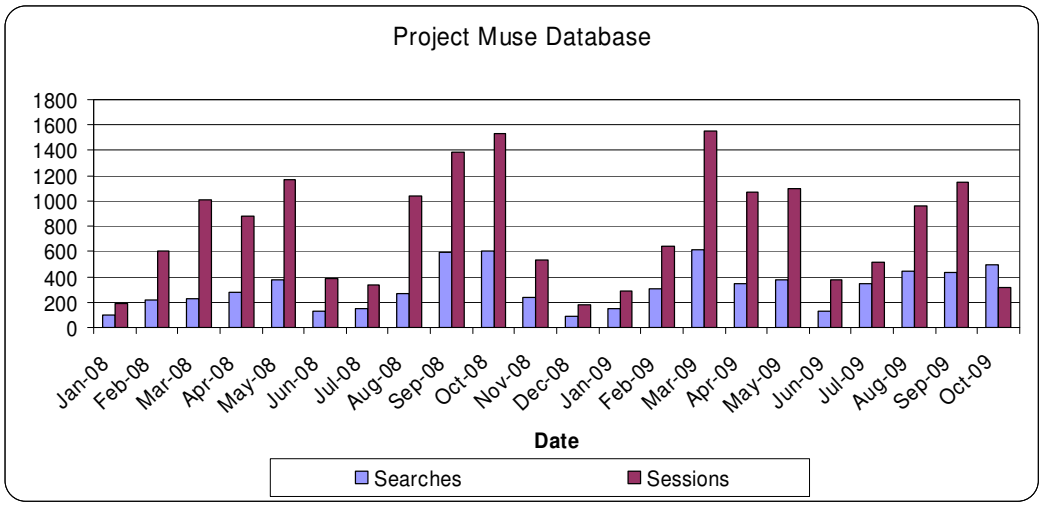
4.4.2.1 HDSS subject specific EIS

To demonstrate the usage of databases and e-journals specific to the Humanities, the usage statistics from the Project Muse database and the Cambridge University Press were selected and are represented below in Figures 4.5, 4.6 and 4.7. Given the subject content of these databases, usage would anticipate activity from largely HDSS students although this cannot be guaranteed. The Project Muse database is a product of John Hopkins University Press and the content features journals in the humanities and social sciences.

Figure 4.5 shows there are more sessions than searches on Project Muse which suggests a pattern of use at odds with that expected in databases. The pattern demonstrated by the TDNet Journal Manager and Ebscohost is characterised by more searches than sessions. Clearly users are directed to the Project Muse website, but once there find that they do not want to search the e-journals available. Possible explanations for this could be that the subject matter is not appropriate to

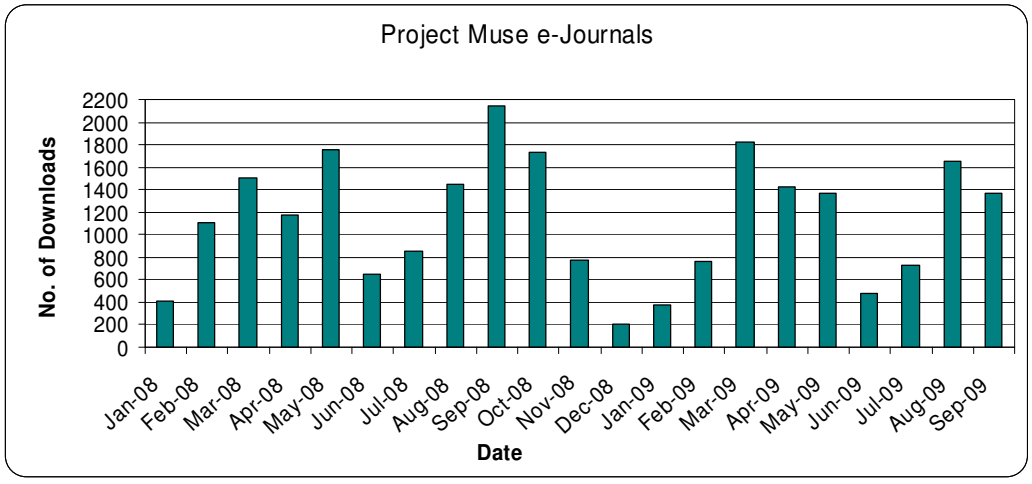
their needs; or they are misled in their expectations of the database content. It is also possible that users encounter problems when trying to access and search the Project Muse website, so they exit the site without conducting any searches.

Figure 4.5 Searches on Project Muse



The usage of Project Muse follows the seasonal rise and fall previously noted. However, indications are that usage in the second semester of 2009 is less than for the same semester during the previous year, suggesting a possible trend of decreasing usage.

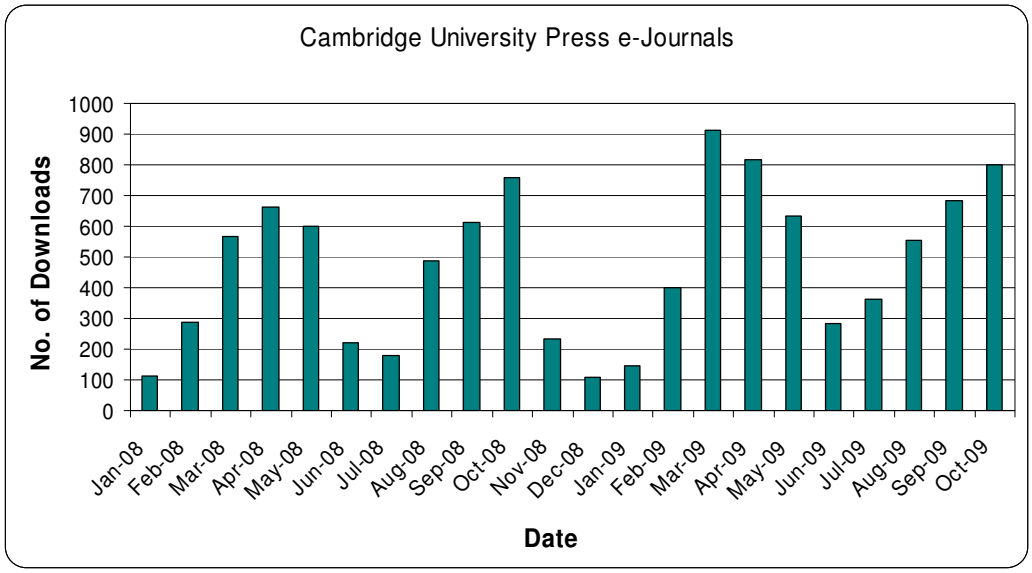
Figure 4.6 Use of Project Muse e-Journals



In one respect, the usage of the Cambridge University Press e-journals displays a similar trend to that of Project Muse. Low points of usage are recorded for January, July and December 2008, and in January and June 2009. These months correspond

to the vacations during the academic year. But in contrast to Project Muse, the usage during 2009 is higher than in 2008, showing an increasing trend in usage.

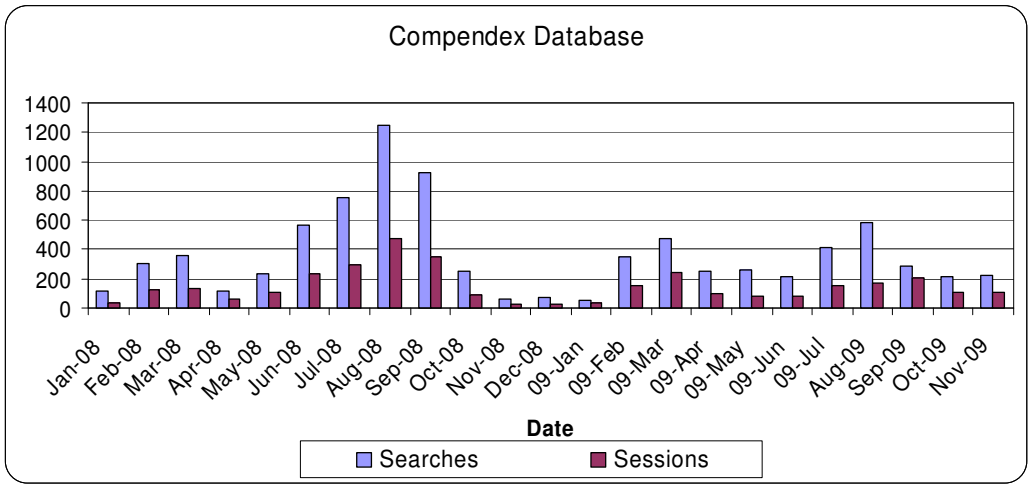
Figure 4.7 Use of Cambridge University Press e-journals



4.4.2.2 Engineering subject specific EIS

Compendex is an abstracting database covering all fields of engineering. Activity on the Compendex database hosted on the Engineering Village platform shows an average of 2.5 searches for each session. This is in accordance with that which is described for EbscoHost above. A much higher level of use is evident during the second academic semester in 2008 but this is not the case in 2009 although slightly greater usage is reflected in the second semester than in the first semester.

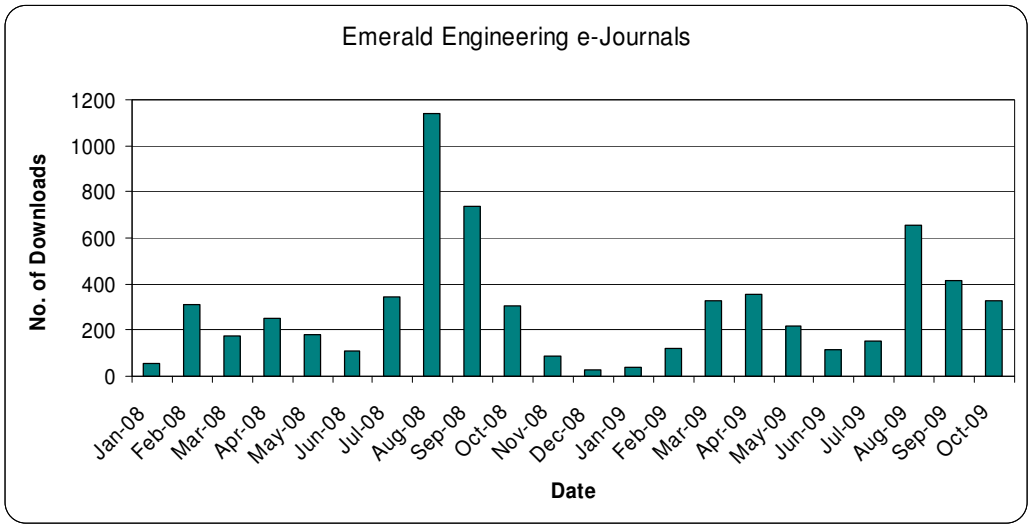
Figure 4.8 Use of Compendex



Compendex does not provide full-text content so it is not possible to relate the search activity to journal article downloads. However, by examining the use of a uniquely engineering collection of journals such as the Emerald engineering journals, it is possible to see usage trends in this subject field. The Emerald engineering journals comprise some 28 engineering journals which form a subset of the greater Emerald journal collection. In the graph below (Figure 4.9) it is apparent that usage occurs throughout the year but the least usage is during the vacation months. Also apparent is a tendency for usage in the second academic semester to be higher than at any other time of the year. This corresponds to the pattern of searches on Compendex.

A possible explanation for this peak in use is that it results from the activity of final year engineering students who are required to complete a research / design project during the second semester and make use of EIS to locate suitable information.

Figure 4.9 Use of Emerald Engineering e-Journals



4.4.3 Format of article downloads

In all the databases reviewed full-text articles may be downloaded in either the HTML format or in PDF although sometimes one format may be more evident than the other. These statistics are included below and represented in Tables 4.1 to 4.5. They are explored to see whether any pattern is evident which could shed light on the usage behaviour of EIS users.

The preferred format recorded for articles downloaded from the TDNet Journal Manager is the HTML format. Over the months reviewed during 2008 and 2009, 73.5% of downloads were in HTML whereas 26.5% were in PDF.

Table 4.1 Preferred format of TDNet Journal Manager e-journal articles

TDNet Journal Manager			
Year	**HTML**	**PDF**	**Total**
2009	57766	21787	79553
2008	37422	12974	50396
Total	95188	34761	129949
Percent	73.5	26.5	100

Access to EbscoHost e-journal articles by means of the PDF was clearly the preferred format. Table 4.2 below shows that 80.5% of articles were downloaded in PDF as opposed to only 19.5% in HTML format.

Table 4.2 Preferred format of EbscoHost e-journal articles

EbscoHost			
Year	**HTML**	**PDF**	**Total**
2009	18507	74731	93238
2008	13104	55796	68900
Total	31611	130527	162138
Percent	19.5	80.5	100

The Project Muse database shows a marked preference by users for the HTML as 63.2% of downloads are in this format, compared with 36.8% in PDF.

Table 4.3 Preferred format of Project Muse e-journal articles

Project Muse			
Year	**HTML**	**PDF**	**Total**
2009	7481	4302	11783
2008	8657	5113	13770
Total	16138	9415	25553
Percent	63.2	36.8	100

The Cambridge University Press article downloads record 99% for the PDF while just 1% is recorded for the HTML format.

Table 4.4 Preferred format of Cambridge University Press e-journal articles

Cambridge University Press			
Year	**HTML**	**PDF**	**Total**
2009	85	5510	5595
2008	42	4790	4832
Total	127	10300	10427
Percent	1	99	100

The most popular format for full-text article downloads at Emerald Engineering is PDF. This format accounted for 67.3% of article downloads while 32.7% were downloaded in HTML format.

Table 4.5 Preferred format of Emerald Engineering e-journal articles

Emerald Engineering			
Year	**HTML**	**PDF**	**Total**
2009	1216	1504	2720
2008	888	2834	3722
Total	2104	4338	6442
Percent	32.7	67.3	100

The preferred format in the TDNet e-journals and Project Muse is the antithesis of that evident in the other databases. The preference for HTML in these databases is not evident in usage of the Cambridge University Press[6], EbscoHost and Emerald e-journals where the PDF is the format selected. There is no link evident here between preference of the format for article downloads and the subject content.

4.4.4 Vendor statistics for e-books

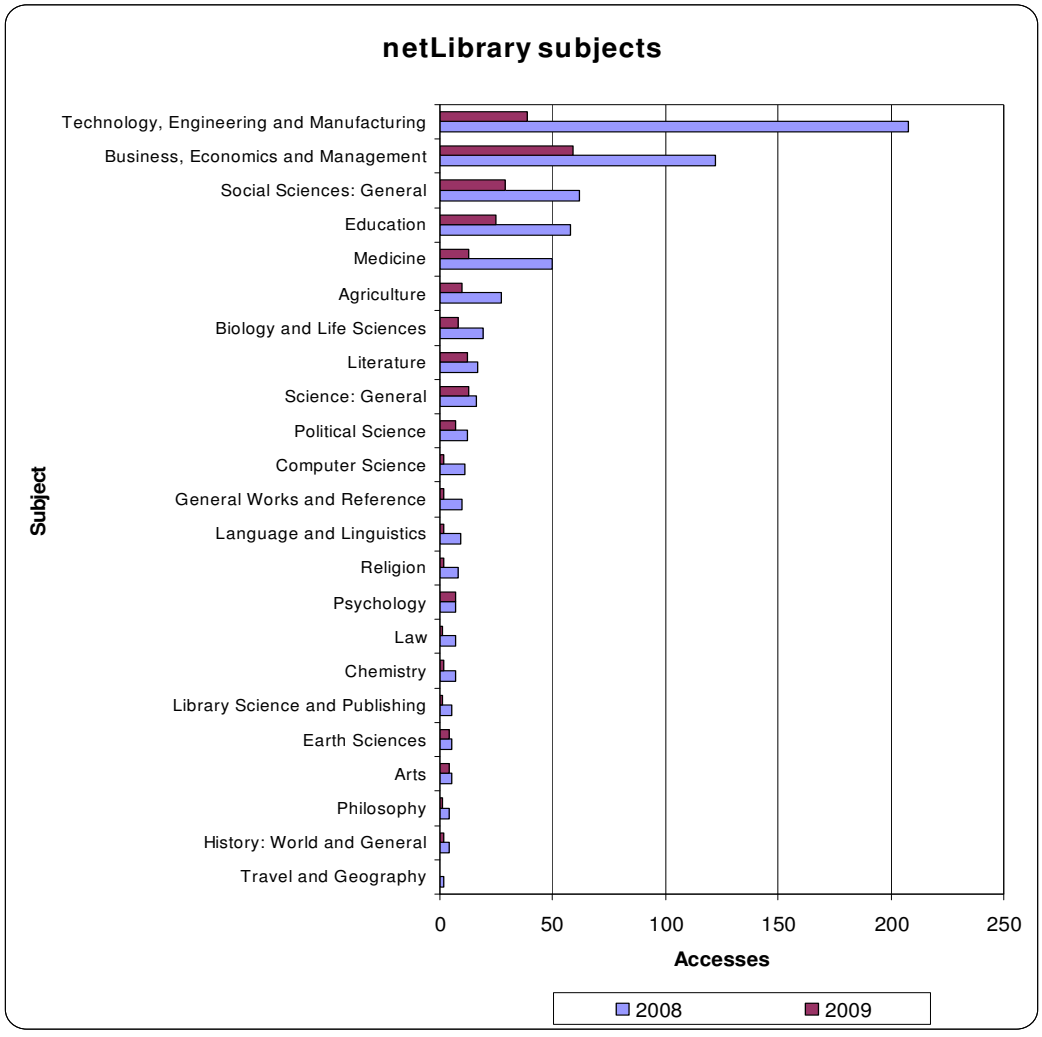
The e-book statistics presented here are from two distinct collections, namely the netLibrary and the African Writers Series (AWS). As previously stated the statistics from neither source is COUNTER compliant. netLibrary statistics provide a record of access to titles and to subjects. Subject categorisation is according to BISAC (Book Industry Standards Advisory Committee) and they appear in the bar chart represented in Figure 4.10. Excluded from the chart are those categories where accesses were one or zero. The excluded categories are:

[6] The format of Cambridge University Press articles is predominantly PDF and as very little HTML content is available, this is not surprising.

History, United States, Home Economics, Mathematics and Statistics, Networking and Telecommunications, Other, Physics, Sociology and Anthropology, Sports and Recreation.

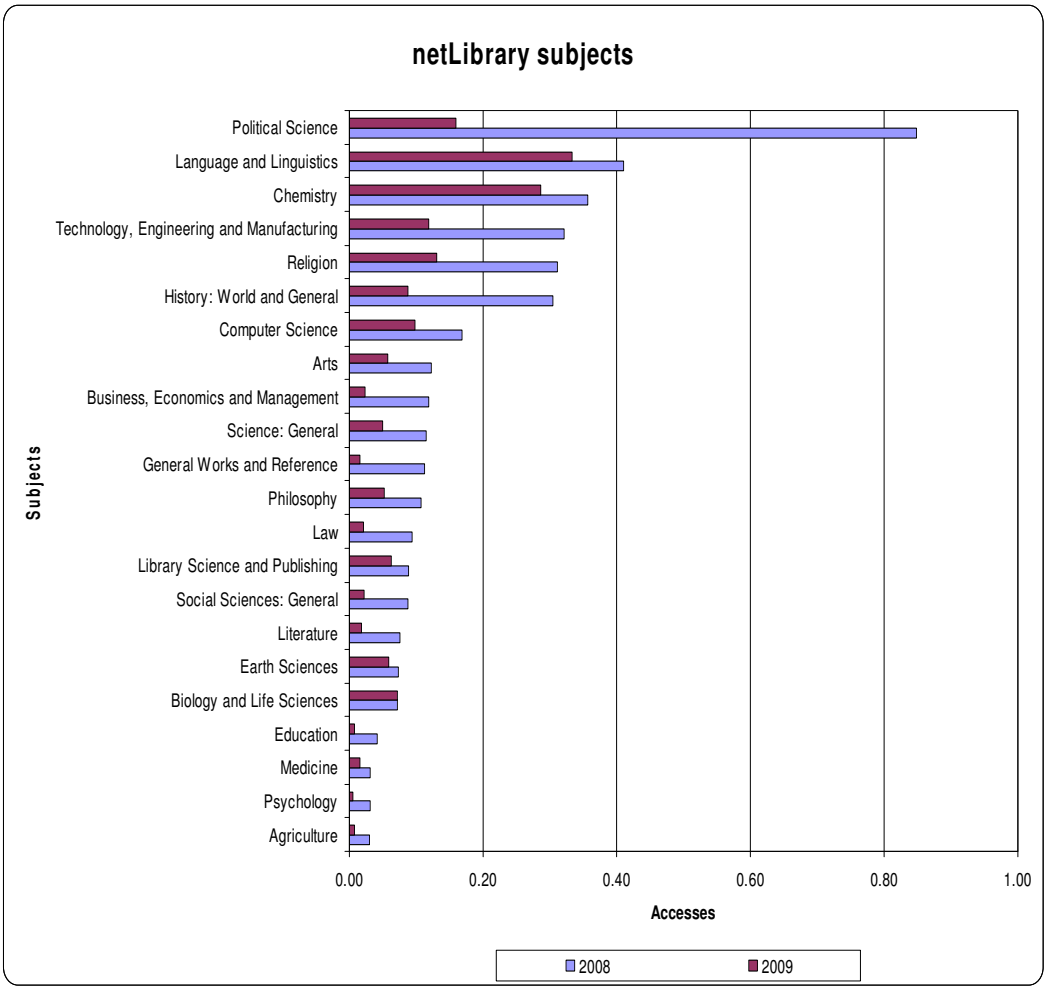
The subject categories in Figure 4.10 are arranged in the order of those most used to those least accessed. The engineering content is represented in the category of Technology Engineering and Manufacturing. The usage in this category records over 200 accesses during 2008 but less than 50 accesses during 2009. This is a dramatic drop in use. Subject categories for the HDSS include Social Sciences (General), Literature, Political Science, Language and Linguistics, Religion, Psychology, Arts, Library Science, Philosophy, and History. Access to titles in these subjects are all well below 50 except for the General Social Sciences where e-books in this category were accessed over 50 times in 2008. In 2009 there is less usage in all the HDSS categories except for Psychology which appears to maintain the same usage.

Figure 4.10 netLibrary e-book access by subject



Christianson (2005) calculated use of netLibrary e-books by taking into account the "difference of opportunity" (p. 359). This involved dividing the total use for a subject category by the total number of titles available in that subject. In this way usage was not misrepresented for categories with few titles. This calculation was applied to the figures above, and the results are represented in the chart in Figure 4.11 below.

Figure 4.11 netLibrary e-book use corrected for difference of opportunity



This interpretation provides a picture where Political Science, and Language and Linguistics record the most usage, while Technology, Engineering and Manufacturing appears fourth on the chart and reflects less use than these two HDSS categories.

Table 4.6 represents the number of accesses and the titles accessed during 2008 and 2009. Looking at these figures it is clear that a limited number of titles get most usage. This indicates there are areas of high use of 'core' titles, amid low use or no use of the bulk of the collection. This observation has been made by a number of sources in the literature (Christianson, 2005; Levine-Clark, 2007).

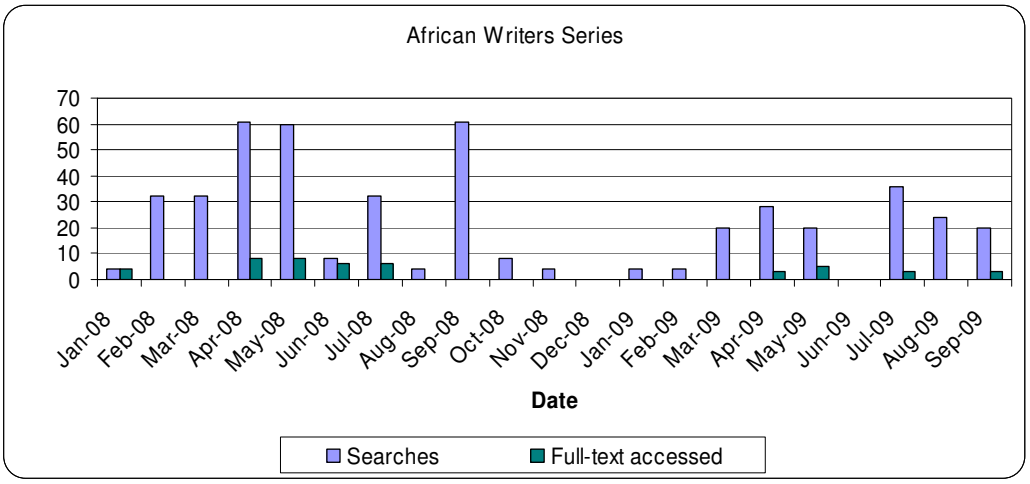
Table 4.6 netLibrary usage by subject showing accesses and titles

netLibrary usage	2009/2008	2009		2008	
Ssubject	Total Titles	Accesses	Titles	Accesses	Titles
Agriculture	84	10	5	27	10
Arts	68	4	3	5	1
Biology and Life Sciences	61	8	6	19	7
Business, Economics and Management	1141	59	44	122	52
Chemistry	23	2	2	7	3
Computer Science	356	2	2	11	6
Earth Sciences	14	4	1	5	1
Education	504	25	21	58	22
General Works and Reference	237	2	2	10	6
History: World and General	128	2	1	4	1
Language and Linguistics	96	2	2	9	1
Law	62	1	1	7	4
Library Science and Publishing	42	1	1	5	2
Literature	191	12	11	17	5
Medicine	574	13	12	50	22
Philosophy	135	1	1	4	3
Political Science	71	7	5	12	5
Psychology	97	7	6	7	0
Religion	106	2	2	8	3
Science: General	39	13	1	16	2
Social Sciences: General	507	29	23	62	27
Technology, Engineering and Manufacturing	245	39	19	208	29
Total	4781	245	171	673	212
Note: HDSS subjects are italicised and Engineering appears in bold					

The AWS, provides over 200 works of literature from many African authors. Usage statistics for this collection differ from those provided by netLibrary as they record both searches and full-text accessed. However, for almost all the months under review, data on sessions was not available from the publishers. This information has therefore been excluded in order to portray a consistent picture during the whole period.

The pattern of use shows that of the many searches conducted in this collection, few result in the full-text being accessed. Generally usage is very low. In 2008, the high points were the months of April, May and September when almost 60 searches were made. However, full-text was accessed less than 10 times during the whole of 2008 and for many months not at all. The usage in 2009 is less than that recorded in 2008, with a peak occurring in July where over 30 searches were conducted. Very little full-text was accessed during 2009.

Figure 4.12 Use of African Writers Series



It is clear from these statistics that the content in this collection receives very limited usage. This seems to be supported by the low statistics for the literature category recorded at the netLibrary. Over 2008/2009, only 29 accesses are recorded for literature on netLibrary and this applied to merely 16 titles of the 191 available.

4.5 Questionnaire results

The data collected by the questionnaire is presented in this section and describes the characteristics of the sample population, establishes EIS behaviour usage and identifies barriers to use.

4.5.1 Characteristics of the sample population

Using the questionnaire data collected, the characteristics of the sample population are described in this section and a profile compiled. To achieve this, the data for the population variables of age, computer proficiency, level of study, degree and gender have been presented univariately in frequency tables. The missing data (no response) has been included in the tables but the valid percent column reflects the actual values or responses being measured.

The gender profile shows that respondents were predominantly male (76 cases), representing 58% of the sample while 42% were female (55 cases).

Table 4.7 Gender profile of sample

Question 1: Gender				
Gender	Frequency	Percent	Valid Percent	Total
Female	55	35	42	55
Male	76	49	58	76
Total	131	85	100	131
No response	24	15		24
Total	155	100		155

The age of respondents reveals that the bulk of the population was 25 years or younger (78%) while 13% were in the age group 26-39 years of age and the balance of 9% was over 40 but younger than 55 years.

Table 4.8 Age profile of sample

Question 2: Age				
Age	Frequency	Percent	Valid Percent	Total
25 years & younger	104	67	78	104
26-39 years	17	11	13	17
40 -55 years	12	8	9	12
Total	133	86	100	133
No response	22	14		22
Total	155	100		155

As the age of students increases, the number of respondents in each category decreases. This tendency is expected in tertiary education where typically students enrol as school leavers rather than as more mature students; and where the bulk of the student population is made up of undergraduates[7].

Undergraduate students made up the bulk of the sample at 67% (89 cases). The balance of 33% consists of postgraduate students, represented by 43 cases.

[7] UKZN 2008 statistics for Howard College Campus indicate an enrolment of 85.5% undergraduates and 15.5% postgraduates.

Table 4.9 Level of study of sample

Question 4: Level of study				
Level	Frequency	Percent	Valid Percent	Total
Postgraduate	43	28	33	43
Undergraduate	89	57	67	89
Total	132	85	100	132
No response	23	15		23
Total	155	100		155

The population sample represented slightly more students studying Engineering (52%) than in the HDSS (48%).

Table 4.10 Discipline of study in sample

Question 3: Degree				
Degree	Frequency	Percent	Valid Percent	Total
Engineering	67	43	52	67
HDSS	61	39	48	61
Total	128	83	100	128
No response	27	17		27
Total	155	100		155

Most respondents rated their computer proficiency highly (82%) with 42% describing their skills as good while 40% responded that their skills were excellent. Only 21 cases (or 16%) felt their skills were adequate while just three respondents declared their computer proficiency to be poor (2%). The small number of respondents with poor computer skills suggests a possibility of self selection bias in the population sample, where those with better computer skills respond to an online survey. However, this is difficult to establish without knowing the characteristics of the whole student population with regard to computer proficiency. UKZN students are required to develop computer skills during their first year of study as undergraduates, but the more mature postgraduate students who return after some years to study at the university might not have this grounding.

Table 4.11 Computer proficiency in sample

Question 6: Computer proficiency				
Rating	Frequency	Percent	Valid Percent	Total
Excellent	53	34	40	53
Good	55	35	42	55
Adequate	21	14	16	21
Poor	3	2	2	3
Total	132	85	100	132
No response	23	15		23
Total	155	100		155

Relating computer proficiency to degree of study reveals that Engineering students rate their computer proficiency skills more highly than their fellow students in the HDSS. The cross tabulation in Table 4.12 below[8] indicates that 90% of Engineering students (59 cases) rated their skills as good or excellent compared to only 77% of HDSS students (47 cases). When the Chi-square test is applied to this data, it indicates that the relationship between the two is unlikely to have been brought about by chance and is statistically significant. From this it is possible to establish with some confidence that there is a real association between these two variables.

Table 4.12 Contingency table: relationship between computer proficiency and degree of study

Degree	Computer Proficiency				Total
	Poor	Adequate	Good	Excellent	
Engineering	0	7	21	38	66
Percent	0	11	32	58	100
HDSS	2	12	33	14	61
Percent	3	20	54	23	100
Total	2	19	54	52	127
Percent	2	15	43	41	100
Note: Pearson chi2(3) = 16.8887 Pr = 0.001					

The contingency table below (Table 4.13) displays the relationship between the variables of age and level of study. It indicates that older students tend to be at postgraduate level while younger students are more likely to be undergraduates. A direct association exists here between age and level of study among the respondents. This is to be expected in the student population and is statistically significant when the Chi-square test is applied. As recommended by Kent (2001), the age data was collapsed into two categories so as to create categories containing sufficient cases in order to analyse for significance. Age was consolidated from three

[8] Refer to Section 3.7.1 regarding analysis of data across more than one variable.

categories (25 and younger; 26-39 years; and Over 40 years) to two categories (25 years and younger; and Over 25 years).

Table 4.13 Contingency table: relationship between age and level of study

Age	Level of Study		Total	Percent
	Postgraduate	Undergraduate		
25 years or younger	16	88	104	79
Over 25	27	1	28	21
Total	43	89	132	100
Percent	33	67	100	100
Note: Pearson chi2(1) = 65.9702 Pr = 0.000				

The population sample was represented by 53% Engineering students of which more were undergraduates (47 cases) than postgraduates (20 cases). HDSS comprised 47% of the sample and also represented more undergraduates (38 cases) than postgraduates (23 cases).

With regard to the higher number of undergraduates in Engineering it needs to be borne in mind that the Engineering degree requires a four year course of study whereas most HDSS degrees span three years. Thus, a student at fourth year level in Engineering will still be an undergraduate student, while a fourth year level student in HDSS is likely to be a postgraduate student.

Table 4.14 Contingency table: relationship between level and discipline of study

Discipline	Level of Study		Total	Percent
	Postgraduate	Undergraduate		
Engineering	20	47	67	53
HDSS	23	38	61	47
Total	43	85	128	100
Percent	34	66	100	100
Note: Pearson chi2(1) = 1.0170 Pr = 0.313				

With regard to gender and course of study, it can be noted that males dominated in Engineering at 76% (51 cases), while more females represented the HDSS at 64% (39 cases). This is not unexpected, as Engineering has a tradition of being an attractive course of study for males.

Table 4.15 Contingency table: relationship between gender and discipline of study

Discipline	Gender			Total
	Female	Male	N/A	
Engineering	14	51	2	67
Percent	22	76	2	100
HDSS	39	22	0	61
Percent	64	36	0	100
Total	53	73	2	128
Percent	41	57	2	100
Note: Pearson chi2(2) = 25.0869 Pr = 0.000				

To summarise, the salient characteristics of the population sample show that respondents featured predominantly in the 25 years and under age group (78%). The sample represented both postgraduate and undergraduate students but the latter made up the bulk of the respondents (67%). A significant relationship was established between age and level of study showing that older students were likely to be postgraduates. Both HDSS (48%) and Engineering students (52%) constituted the respondents. Good to excellent computer skills were reported by 106 respondents and a strong association between computer proficiency and Engineering students was indicated. Slightly more males than females were respondents; and a significant link between male students and engineering was established.

4.5.2 Do UKZN students use library e-resources?

The questionnaire measured awareness of EIS by students, which EIS they use and how students rate these resources. Of students responding to the question of whether they were aware of EIS on the Internet, 101 (88%) indicated that they were aware of EIS (Table 4.16) although only 91 (80%) were aware that EIS were made available by UKZN Libraries (Table 4.17).

Table 4.16 Awareness of EIS on the Internet

Question 7: Are you aware of e-journals, e-books and databases on the Internet?				
Awareness of EIS	Frequency	Percent	Valid Percent	Total
Yes	101	65	88	101
No	14	9	12	14
Total	115	74	100	115
No Response	40	26		40
Total	155	100		155

Table 4.17 Awareness of EIS made available by UKZN Libraries

Question 8: Do you know that many of these online resources are made available by UKZN Libraries?				
Availability of EIS	Frequency	Percent	Valid Percent	Total
Yes	91	59	80	91
No	23	15	20	23
Total	114	74	100	114
No response	41	26		41
Total	155	100		155

Those who were aware of EIS made up 87.5% of all the responses and represented both the HDSS (45 cases) and Engineering (53 cases). Just 12.5% were not aware of EIS and these respondents were almost evenly distributed across both the faculties.

Table 4.18 Awareness of EIS and discipline of study

Question 7: Are you aware of e-journals, e-books and databases on the Internet?				
Awareness of EIS	Degree		Total	Percent
	Engineering	HDSS		
Yes	53	45	98	87.5
No	8	6	14	12.5
Total	61	51	112	100
Percent	54	46	100	100

Comments received from respondents for Question 7 on EIS awareness showed that those making use of EIS did so via Internet searches (one comment) or by interrogating specific resources such as JSTOR; TDNet; ScienceDirect; Ebsco; and Sabinet (six comments) for the specific purpose of research and essay writing. One respondent admitted that the EIS collection was vast but nevertheless still made a case for additional resources while two respondents described EIS as difficult to access. Three respondents declared they were ignorant about EIS while the need for training in how to use EIS was articulated by two respondents.

Students who use EIS reported that they have become aware of them from Library orientation sessions (21%); fellow students (23%) and the library website (25%). To a lesser degree, lecturers play a role in creating awareness of EIS (18%) and Google Scholar (7%) is instrumental in increasing visibility of these resources.

Table 4.19 How students know about EIS

Question 9: How do you know about these resources?							
Knowledge of EIS	Orientation	Lecturers	Fellow Students	Library Website	Google Scholar	Other	Total
Yes	50	41	54	59	17	14	235
Percent	21	18	23	25	7	6	100
No	105	114	101	96	138	141	695
Percent	15	16	15	14	20	20	100
Total	155	155	155	155	155	155	930
Note: Respondents could select more than one option							

Data collected on the frequency of use and presented in Table 4.20 reveals that student behaviour is variable and no clear tendency is apparent. Students make use of e-books and e-journals on a daily, weekly, fortnightly and monthly basis. The highest response on usage (32%) was for the "Other" category, indicating that frequency options not listed on the questionnaire were pertinent. Given the fact that the usage statistics from vendors indicate trends across the semesters, it is likely that students read and consult EIS on a semester basis. Comments from students like "t*wice a year I do a literature survey"* corroborate this. Likewise, use seems to be linked to a more irregular pattern determined by need. Students' comments reflect that projects and assignments which they need to complete during the academic year prompt this need:

- "*when I need information for my courses";*
- *"When necessary";*
- *"depends how often projects are given";* and
- *"Whenever we are referred to a journal article to read or when doing research for an assignment".*

Table 4.20 How often students read EIS

Question 15: How often do you use them?					
Frequency	e-books	e-journals	Percent	Valid Percent	Total
Daily	6	13	6	12	19
Weekly	14	21	11	21	35
Fortnightly	7	8	5	9	15
Monthly	22	20	14	26	42
Other	26	26	17	32	52
Total	75	88	53	100	53
No Response	80	67	47		147
Total	155	155	100		310

By collapsing the daily and weekly categories, a category of habitual users is created. Collapsing the categories of fortnightly and monthly users created a

category of frequent users and the balance of users can be viewed as infrequent users. Habitual users constitute 33% of usage; frequent users make up 35% of usage; while infrequent users contribute 32% of usage.

4.5.3 Which e-resources are UKZN students using?

Both e-books and e-journals are used by students. Sixty-six percent of those respondents using EIS reported that they consult both e-books and e-journals. Ten percent use e-books only while 24% use e-journals only.

Table 4.21 Student use of EIS

Question 10 & 13: Do you read e-books and e-journals					
Reading of EIS	e-Books	e-Journals	Percent	Valid Percent	Total
Yes	69	82	49	67	151
No	45	30	24	33	75
Total	114	112	73	100	226
No Response	41	43	27		84
Total	155	155	100		310

Table 4.22 Analysis of student use of EIS

Use of EIS	e-Books & e-Journals	e-Books only	e-Journals only	Total
Yes	60	9	22	91
Percent	66	10	24	100
No	21	24	9	54
Percent	39	44	17	100
No Response	41	0	2	43
Total	122	33	33	188

Usage by postgraduate and undergraduate students is presented in Table 4.23. Most respondents were users of both e-books and e-journals (60 cases). Significantly over 88% (38 cases) of postgraduates use some form of EIS while just 60% (53 cases) of undergraduates do so. A strong relationship between these variables is not unexpected as postgraduate studies require that students consult current research. The behaviour of postgraduates reflects the importance of EIS in meeting this need. Undergraduate students rely heavily on prescribed and recommended texts in their studies. Other sources of information are less important and this is reflected in their reported use of EIS.

Table 4.23 Contingency table: relationship between level of study and EIS use

Level of study	EIS use				No response	Total
	Both e-books & e-journals	e-Books only	e-Journals only	Neither		
Postgraduate	27	0	11	2	3	43
Percent	62.8	0	25.6	4.7	7	100
Undergraduate	33	9	11	21	15	89
Percent	37	10	12.4	23.6	17	100
Total	60	9	22	23	18	132
Note: Pearson chi2(4) = 18.4076 Pr = 0.001						

Looking across the disciplines of study, 72% of Engineering students (49 cases) and 64% of HDSS students (39 cases) consult EIS. Of the Engineering students 58% used both e-books and e-journals, whereas only 34% of HDSS students made use of both formats of EIS. Those who reported not using either e-books or e-journals will be considered in section 4.5.7 when characteristics of non-users of EIS are considered.

Table 4.24 Contingency table: relationship between discipline of study and EIS use

Discipline of study	EIS use				No response	Total
	Use both e-books & e-journals	e-Books only	e-Journals only	Neither		
Engineering	39	5	5	12	6	67
Percent	58	7	7	18	9	100
HDSS	21	3	15	11	11	61
Percent	34	5	25	18	18	100
Total	60	8	20	23	17	128
Note: Pearson chi2(4) = 13.3362 Pr = 0.010						

4.5.4 Where do UKZN students access library e-resources?

In terms of physical location, most students use the student LANs on the University campus to access e-resources (55%), while 22% use facilities situated off the campus. Only 17% used the library as a venue for accessing EIS while 6% make use of “other” locations which were not specified. With regard to accessing EIS at the libraries, one student commented that:

> *I experience problems when using [a] computer in the library. Most of the e-journals are available in PDF format, and most times it doesn't open on the computers in the library. Another*

problem is that it is time wasting as one has to wait for a long time on [sic] a queue.

Table 4.25 Locations for accessing EIS

Question 19: Where do you access online resources?					
Locations	Computer LANs	Library	Off-campus	Other	Total
Yes	92	29	37	10	168
Percent	55	17	22	6	100
No	63	126	118	145	452
Percent	14	28	26	32	100
Total	155	155	155	155	620
Note: Respondents could select more than one option					

The most popular virtual path reported for navigation to e-resources was via the library website (41%), with search engines as the next most popular means at 35%. Publishers' websites accounted for 14%. Least used are access via personal subscriptions (2%) and email alerts (6%). Email alerts are usually set up by persons doing ongoing research, and in keeping with this, nine of the eleven respondents making use of this method were postgraduate students. Distribution of responses in each category embraced both undergraduate and postgraduate students in Engineering and HDSS. However, use by navigating via Publisher websites was prevalent among Engineering students. Of those using this route, 33% were HDSS students while the bulk of 67% were studying engineering.

Table 4.26 Navigation to EIS

Question 17: How do you navigate to the resources you use?							
Navigation	Publishers Sites	Personal Subscription	Library Webpages	Search Engines	Email Alerts	Other	Total
Yes	26	3	74	63	11	5	182
Percent	14	2	41	35	6	3	100
No	129	152	81	92	144	150	748
Percent	17	20	11	12	19	20	100
Total	155	155	155	155	155	155	930
Note: Respondents could select more than one option							

4.5.5 Why do UKZN students use library e-resources?

The reasons for using e-resources showed that 32% of students agreed locating information was their prime motivation. Information for research purposes received 27% of the responses while 15% found EIS more convenient to use than the print

resources. 14% use EIS to stay current and only 10% used EIS on the recommendation of lecturers.

Table 4.27 Reasons for using EIS

Question 16: Why do you make use of these online resources?							
Reasons	Locate Information	Lecturer Recommends	More Convenient than Print	Research Purposes	Stay Current	Other	Total
Yes	86	26	42	74	37	6	271
Percent	32	10	15	27	14	2	100
No	69	129	113	81	118	149	659
Percent	10	20	17	12	18	23	100
Total	155	155	155	155	155	155	930
Note: Respondents could select more than one option							

The rating of EIS showed that 72% of the respondents (77 cases) rated the EIS they used as good (59%) or excellent (13%) while 28% (30 cases) felt these resources were merely adequate or poor. Interestingly 16 of these respondents did not use either e-journals or e-books but provided ratings. Possibly other online resources were being considered here as half of these respondents (8 cases) reported that they used Google and other search engines to navigate to the EIS they used.

Table 4.28 EIS ratings

Question 18: How do you rate the online resources you use?				
Rating	Frequency	Percent	Valid Percent	Total
Poor	2	1	2	2
Adequate	28	18	26	28
Good	63	41	59	63
Excellent	14	9	13	14
Total	107	69	100	107
No response	48	31		48
Total	155	100		155

4.5.6 What characterises non-users of library e-resources?

Non-users are characterised primarily by their ignorance of EIS with 39% stating they are unaware of these resources. A preference for print journals and books was expressed by 13% of non-users. Those who had no perceived need for e-resources made up 17%, and a further 9% were undecided. Those who found EIS too difficult or too complex to use constituted 7% and 4% just did not have the time to become users. More respondents commented on their non-use of e-books than non-use of e-journals.

Table 4.29 Non-use of e-books and e-journals

Questions 11 & 14: Comments on non-use of e-Books / e-Journals				
Category	Q11: e-book non-use	Q14: e-journal non-use	Total	Percent
Difficult to use	1	1	2	3
Ignorant	16	13	29	39
No Need	7	6	13	17
No time	2	1	3	4
Prefer Print	8	2	10	13
Too complex	4	1	5	7
Undecided	4	3	7	9
No Response	3	3	6	8
Total	45	30	75	100

Referring to non-use reported in Table 4.21, a third of students reported not using either e-books or e-journals. Of this group, more reported non-use of e-books (60%) than e-journals (40%). Non-use of EIS by postgraduate students reported in Table 4.23 shows that just 5% (two cases) admit to not using EIS, while 24% of undergraduate students (21 cases) make the same admission. Of the sample population, these figures translate into 18% of Engineering students and 18% of HDSS students who do not consult or read EIS. This suggests that postgraduates are less likely to be non-users, while distribution of non-use across the different disciplines of study is fairly evenly distributed among undergraduates.

The number of respondents reporting problems accessing EIS may shed some light on non-use. Table 4.30 provides data on barriers to EIS use and indicates that as many as 37% of respondents claim to experience some sort of problem when using e-resources.

4.5.7 What barriers exist to the use of EIS?

More than a third of respondents (37%) reported experiencing problems accessing EIS.

Table 4.30 Problems accessing EIS

Question 20: Do you experience problems accessing online resources?				
Problems	Frequency	Percent	Valid Percent	Total
Yes	40	26	37	40
No	68	44	63	68
Total	108	70	100	108
No response	47	30		47
Total	155	100		155

The problems encountered by students included difficulty with access (five comments), computer system problems (four comments), poor searching skills and difficulty in finding the information required (five comments); and two found EIS to be unreliable. However the most common barrier reported was the non availability of EIS (15 comments). In this regard, students reported that full-text articles are often not available because the library does not subscribe to the journal required and users are prompted to purchase articles they need. Although, finding legitimate sources; access to abstracts only and not full-text articles; and difficulty in using the off-campus access were all cited as problems.

A more in-depth look at those respondents reporting difficulties is tabulated in Table 4.31. Both undergraduates and postgraduates experience problems accessing EIS, and likewise both Engineering and HDSS students are represented. The level of perceived computer proficiency appears to have little influence as respondents with excellent to poor levels of computer proficiency reported problems at their level of use.

Table 4.31 Analysis of those having problems accessing EIS

Discipline	Frequency	Computer Proficiency			
		Excellent	Good	Adequate	Poor
Postgraduates					
Eng	10	3	3	4	0
HDSS	10	2	6	2	0
Undergraduates					
Eng	12	6	6	0	0
HDSS	8	1	3	1	1
Total	40	12	18	7	1

4.6 Summary

The data collected from EIS vendors on usage and from the questionnaire administered to the sample of students on the HC campus was presented and analysed. Interpretation of this data in light of the literature review will follow in the next chapter.

Chapter Five: Interpretation and discussion of results

5.1 Introduction

The objectives of the research reported in this thesis were threefold and set out to firstly, establish usage among students; secondly, to identify the determinants of usage; and thirdly, to make recommendations in this regard. This chapter will consider the first two objectives in the light of the findings described in the previous chapter and the literature reviewed in Chapter Two. The third objective will be discussed in the concluding chapter.

In the interpretation of research findings, Banwell et al. (2004) advise that "skimming to obtain a broad picture, must be accompanied with a considerable amount of 'dipping' as an aid to interpretation of any questionnaire based data" (p. 309). To respond to this and fully explore the data, a process referred to as "data dredging" has been adopted. This term is defined by Kent (2001, p. 200) as a metaphor for "the process of trawling a dataset" to explore the data fully in order to see if any patterns emerge. This ensures a thorough approach to identifying the existing patterns of activity. Bishop (1998, para. 39) also emphasises "the value of ascertaining natural rhythms of library and journal use in order to interpret digital-library use statistics" effectively.

The variables measured regarding usage and the associations in evidence are considered so as to understand usage at UKZN and to locate it within the bigger picture. Reasons and causes can be used to explain and attribute meaning to human behaviour and actions. Given the nature of the research undertaken in this study, it is not possible to impute causality, and Bryman (2004) cautions against doing this when analysing descriptive data. However, tentative "cause and effect patterns" are noted. The qualitative aspect of the research, although limited, allows some insight into the reasons why EIS are used. 'Reason giving explanations' allow actions to be assessed and expose the consistencies in behaviour. This contributes to the interpretation of relationships and associations between different variables.

5.2 Interpretation of data

Criticism of research in the area of library usage, as mentioned in section 2.2 above, has suggested that many studies are context driven and local (van Lill, 2001). By developing this research study as a baseline study, the local character of the investigation is acknowledged and provides a foundation or context from which to expand research in this area. The JISC Diagnostic Toolkit developed in the UK and reported by Banwell et al. (2004, p. 317) proposes a number of generic development stages for e-resources in academic environs. These are identified as progressing from a baseline through a number of stages to full integration of EIS within an institution. The baseline stage is the initial stage of development. The subsequent

stages offer direction for establishing and developing research in the area of EIS usage by adopting a holistic strategy and anticipating the continuum of development. Such a strategy embodies a number of different themes which are identified by the Toolkit. These themes are itemised as access; LIS / academic liaison; training users; user behaviour; and integration within the institution. They are characterised to denote incremental levels of development. Of particular relevance is the theme on user behaviour which is reproduced in Figure 5.1. Using the typology offered, it is possible to rate the level of development exhibited by EIS users by applying the characteristics described.

Figure 5.1 Figure of stages of development / characteristics of Jubilee Toolkit

Table III JUBILEE Toolkit outline

Theme	Stage of Development	Characteristics
User behaviour	1	Reliance on printed sources of information, with little use or awareness of relevant EIS and limited IT literacy
	2	Printed resource use prevalent, but with greater use and awareness of EIS among some groups of users
	3	Use of both print and EIS material, increased IT literacy, but limited awareness of EIS other than Internet search engines
	4	Increasingly integrated use of different media, and a critical awareness of EIS married with the acquisition of information-seeking skills
	5	Individual behaviour recognised and satisfied (with seamless use of the most appropriate resource, be it print or EIS)

Reproduced from Coulson and Banwell (2004, p. 157).

5.2.1 Characteristics of users and non-users

Age, discipline, gender, computer proficiency and level of study were identified as possible characteristics of HC students which might influence usage.

The findings presented in the previous chapter reveal that age as an indicator of use among members of the student population, is not in evidence as a variable for consideration. Borrego et al. (2007, p. 68) anticipated that age differences and

preferences would become less apparent as EIS use became more widespread. This would appear to be the case, but an investigation of academic staff's EIS usage would be required to establish this with any degree of certainty within the academic environment.

It was not possible to establish a significant relationship between gender and usage. Discipline specific behaviour in the use of EIS was also not readily apparent, but other differences were noted. The level of study is a strong factor in determining usage with greater e-journal usage among senior students or postgraduates than among undergraduates. Given the nature of postgraduate studies, this pattern of "cause and effect" is anticipated.

Computer proficiency was clearly evident among the student sample, particularly the Engineering students. For purposes of analysing frequency of use, Atakan et al. (2008) used the categories often, occasionally and not at all to denote usage; while Bar-Ilan and Fink (2005) classified users as habitual or non-habitual. Cochenour and Moothart (2003) identified frequent users as those who made use of EIS monthly and more often; and heavy users as those who used EIS weekly and more often. The EIS usage exhibited by UKZN students can be similarly understood by adopting a comparable approach, UKZN students can be viewed as habitual users (daily and weekly); frequent users (fortnightly and monthly); infrequent users (other); or non-users. "Other" users were those who do not use EIS on a daily, weekly, fortnightly or monthly basis, but when there is a need. It is difficult to ascertain their level of use, so they have been termed infrequent users. Most likely this group contributed to the unique highpoints in usage during the semesters which is clearly evident on the graphs of usage. Frequency of use is reported in Table 4.20 and shows an almost equal split between the three categories of habitual, frequent and infrequent users in the sample.

Non-users were identified as students with certain characteristics. These students preferred print resources (both books and journals) to their online equivalents; were largely ignorant of EIS; and declared they had no need for EIS. EIS were perceived as difficult to use and time-consuming to adopt. Non-users were more prevalent among undergraduates than among postgraduates.

5.3 Usage of EIS and determinants of usage

Determinants of usage and non-usage considered which EIS students use, why they use them; how EIS were perceived; where they were accessed (both in terms of physical venue and through online navigation). Other factors which contribute to the discussion of usage are the availability and visibility of EIS.

5.3.1 Usage of EIS

The concept of use was defined in the opening chapter and informs the discussion. In order to establish the extent of usage by students, the general level of use across the entire institution was reviewed by examining usage statistics of general and multidisciplinary EIS resources. Then usage was considered specifically in terms of resources relevant to the Engineering and HDSS students. This approach was adopted because it provided an institutional landscape regarding usage.

The general pattern represented by the usage data for e-journals and databases indicates that they are indeed used by students but at varying levels during the course of the academic year. The undulating pattern apparent in the graphs presented in the previous chapter is indicative of this and speaks to a strong association between need and usage. In Bryman's words these two features are "coherently related" (2004, p. 495). In their research, Tenopir et al. (2003a, p. 40) report "peaks and valleys" in usage which follow "the normal rhythms of the workweek and academic calendar". It was not possible to establish weekly usage at UKZN but students did corroborate a pattern of usage which reflected the course of the academic year, with unique trends in each semester.

Usage of e-books is different. Lower usage is recorded by vendors although many students reported using them. Mahe et al. (2000) draw attention to the discrepancy between users' statements regarding e-book usage and the actual use they make of them. e-Books may be used in a number of different ways, and it has been suggested that discipline and subject matter of the book plays an important role in determining how it is used. Downloads cannot be used to measure the extent of usage as the reason for consulting the publication might be met without having to download the book or a section of it. This applies particularly to reference e-books where the answer to a question or clarification of a concept is sought. Students could simply copy and paste.

Students voiced different approaches to these two EIS formats:

- *I prefer to use [print] books from the library [and] online journal articles.*

Although students did report use of e-books, the take up by users is tentative with few searches recorded and a low pattern of use. Comment from students show that they have problems with this format:

- *I haven't been able to access the E books as easily as I have the articles;*
- *Takes a long time to find the appropriate information;*
- *Prefer a hard copy; and*
- *It is a bit difficult to use.*

Yet other students expressed appreciation of the advantages e-books offer:

- *Some ebooks are better than others. It is much easier to have them, as you don't have to worry about getting them from / or returning them to the library;*
- *The best ones are with hyperlinks; and*
- *It varies with availability of what I need in e-book format. But I prefer it to hard copies if available.*

Many students reported that they did not like to read from the computer screen which impacts more directly on e-book than e-journal usage. It is not as easy or convenient to print out sections of text from e-books as it is from e-journals.

5.3.2 Where EIS are accessed

In the physical sense, student usage occurred at venues both on and off-campus (see Table 4.25). The former was the most popular with students mainly using spaces such as the student LAN. It was interesting to note that off-campus access was an important means of accessing EIS for 22% of students.

Students reported their experiences regarding off-campus access thus:

- *I use the off campus link from home;*
- *I do most of my literature and information searches off-campus and use ezproxy a lot;*
- *difficult to access on campus and off campus; and*
- *at times it is difficult to find how to log in to e-journals from off campus and then access is barred, even though you know the varsity has a subscription.*

Bonthron et al. (2003) found that off-campus access was an advantage for students in the JUSTEIS research project. This means of access appears to be important for HC students too. With growing wireless networks and the popularity of laptops, it is anticipated that the demand for remote access will grow and this makes it important for the libraries to ensure all resources are available via the ezproxy server[9].

In the virtual world, students reported that the “place” they used most to access EIS was the library website and Internet search engines (see Table 4.26). Bonthron et al. (2003) suggest that faculty users prefer using online bookmarks rather than their library website to access EIS, as their library website is seen as too complicated and difficult to navigate. Among the UKZN students on HC, the library website was the starting point for most students with 41% reporting that this was the means of navigation they used. However, search engines were also a popular means of navigating to EIS with 35% using this method. However, 14% did report accessing EIS directly from the publishers’ website.

[9] The ezproxy server allows UKZN students to authenticate using a login and password and access online resources which are IP authenticated to the university.

5.3.3 Motivation to use EIS

When examining the motivation to use EIS, Bonthron et al. (2003) found that the main influence on student use of EIS is academic staff. Recognising that the student-lecturer relationship is important in shaping academic behaviour, this option was presented as one of the choices which could be made to Question 16 on the questionnaire (Table 4.27). However, respondents did not select this option as the primary influence on their using EIS. This suggests that academic staff members are not as influential as they might be; and highlights the fact that there is scope to increase their awareness of EIS and the role they can play in influencing students' behaviour in this regard. The most popular option was the need to locate information. The two most popular combinations of reasons for using EIS reported by students were:

- To locate information; and for research purposes;
- For research purposes; and as they are more convenient than the print format.

Students' opinions of the EIS they use is contributory to their usage behaviour. Ratings of EIS were largely favourable with as many as 72% of students regarding the EIS they used as either good or excellent. It would follow then that using these resources had value to the studies and tasks in which students were engaged.

The vendor usage statistics provide data on the preferred format for viewing full-text content from e-journals and databases. In the databases and e-journal collections reviewed, no clear pattern of preference for either PDF or HTML formats came to light. Different formats were favoured in different databases. Borrego et al. (2007) report that PDF was the format preferred in their study. However, this was not evident in the EIS reviewed at UKZN although there were very clear preferences one way or the other for specific EIS. It has been suggested that PDF is more efficient to download and print. However, increasingly sophisticated HCI features and functionality offered by the HTML version may account for the variation in choice depending on the database. Reading behaviour in this regard would need to be investigated further to improve understanding of the role played by the format of e-text.

5.3.4 Barriers to usage

Both HDSS and Engineering students encountered problems when accessing EIS. This group of students exhibited varying levels of computer proficiency and was comprised of both undergraduates and postgraduates. With regard to computer proficiency, it is interesting to note that even students who rated their proficiency highly, experienced problems. This suggests that the nature of their difficulties was not related directly to a lack of computer skills and seems to be the case among the sample surveyed. In fact, it appears that the nature of many of the difficulties experienced by students can be related directly to service delivery by the UKZN

Libraries and should be addressed by taking appropriate action. This may require further research to fully understand the problems. In this regard the themes – particularly LIS / academic liaison; and training users - identified by the JISC Evaluation Toolkit provide some guidance on how to achieve this. The anticipated interventions mentioned in the introductory chapter (section 1.4) also shed light on how barriers to usage can be dealt with.

A vigorous library training and user education programme which informs all students about access (including off-campus access) and what resources are available would go some way to ameliorate the situation. Such a programme would train students to search more effectively to find the information they require; and to identify legitimate sources of academic information. Although the UKZN Libraries do have a programme in place, it needs to be active and widespread so as to reach all students at the undergraduate and postgraduate levels. Greater publicity and liaison with the schools and faculties would make known the resources available from the library and keep them constantly apprised of the situation. As the website of the library is a well-used starting point for students accessing EIS, this vehicle needs to play a pivotal role.

As a reflection on adoption of DoI, it appears that students experience barriers because they use EIS.

5.3.5 Other factors influencing usage

Availability of EIS, visibility and ease of use are all contributory to the adoption rate and level of usage.

The importance of e-resource availability in the institution as an influence on usage is emphasised by Eason et al. (2000). At UKZN, the EIS collection is constantly growing which means that the range and scope of available resources is not constant. The literature reports that the academic environment has adopted EIS fairly rapidly, and in terms of institutional adoption by the UKZN libraries, this has been part of an active process. The draft Acquisitions Policy states that with regard to journals, “the preferred medium is electronic format on a University-wide basis”. The growth in the resources made available over the past six years confirms an awareness of EIS as a technology and an acceptance of its merits through adoption and implementation. Adoption applies in particular to databases and e-journals rather than e-books. e-Book collections are less well-developed. By factoring in the “difference of opportunity” when analysing e-book usage, the importance of availability is acknowledged. The analysis and discussion offered in the previous chapter presents an interpretation of the data which places it within the context of the size and nature of the e-book collection.

With a growing collection of EIS, it is difficult to realistically peg the level of use of a specific resource over a given time period. Fluctuations in the use of a specific

resource may be as a result of a number of alternate resources being available which are similar in content but much easier to use or more convenient to access. Hence, an expectation of continually increasing usage over a series of years could be a misguided one in a changing environment which offers more and more resources. Here, the importance of a longitudinal strategy to measure usage on an ongoing basis needs to be recognised and implemented. Bonthron et al. (2003) see the "critical mass" of e-journals as the prime mover in changing users' orientation to e-access. This is difficult to define but they suggest the tipping point is reached when 60-75% of the journal collection is available online.

Students expressed their opinions on the availability of e-resources thus:

- *Very useful and convenient!*
- *They have formed a significant part of the sources I consult for my research as most of the literature on the area is in journals. I am also far from a regular library;*
- *it is easy to access and very convenient*; and
- *its always up to date and user friendly.*

In the adoption of innovations, the initial stage of adoption is one of awareness of the innovation. Measuring the degree of EIS awareness among the sample population of students found that they exhibited a high level of awareness. Not only were as many as 88% aware that these resources were available on the Internet, but also that EIS were made available by UKZN Libraries (80%). However Levine-Clark (2007) observes that greater awareness of EIS, particularly e-books "does not translate to greater use" (p. 12). Awareness of e-books was not as evident or widespread and usage differs markedly from the pattern of use evident for e-journals

In conjunction with availability, other factors contributing to levels of usage include visibility and ease of use.

Visibility refers to the profile of a resource on the Internet. This might be a result of publicity or reputation. The pattern of usage of Project Muse suggests that students are being effectively pointed to the Project Muse resource even when it not the resource they need. This speaks to high visibility of this resource on the Internet.

Ease of use relates to HCI issues and the features offered by EIS to help users manage their information experience. Research by Pather and Stilwell (2008) reports that postgraduate students in the Sciences at UKZN showed a preference for "full-text searching, browsability, [the] searching facility, availability and convenience of ejournals" while they expressed a dislike for "user authentication via an IP address most" when using these resources (p. 32). HCI as a contributing factor to usage needs to be fully explored. Some of the features offered by EIS are seamless linking from references and abstracts to full-text articles; and integration with referencing software e.g. Endnote.

5.4 Evaluation of the research study

Explanations of usage at the UKZN HC campus might be best served by constructing a profile of behaviour in this narrow field of study - the profile of the EIS user. Such a profile would be descriptive and based on the observed patterns of behaviour. As a simplifying device, the profile can highlight those features of interest and the relationships in evidence. Taylor (1970) points out that with any particular set of data it is "possible to hypothesise a variety of patterns" (p. 100) and that "any fact can be fitted into a hypothesised pattern" (p. 101). However, the measurement reported in the previous chapter allows a basic level of systematic representation on which to base a profile.

The students on the HC campus are aware of EIS particularly e-journals; report good to excellent levels of computer proficiency; and make use of search engines to locate EIS. They exhibit a need for remote access to resources; but make limited use of e-books and rely primarily on print in this regard. These characteristics match level three in Figure 5.1 above, a rating which suggests users are at a midpoint in the transition to full integration of EIS according to the JISC Evaluation Toolkit.

As an attempt to set a baseline, this user study has taken a step towards establishing usage levels and characteristics at UKZN. Given the limitations of the study, it has set a foundational position limited to HC student use of EIS by determining usage and identifying the characteristics of these users.

5.5 Summary

By examining the awareness of EIS, reported usage, frequency of use, reasons for usage and the venue students use for accessing EIS, it is possible to begin to create a picture of how Engineering and HDSS behave regarding EIS. To summarise the findings, a profile of HC students in these two faculties can be mapped. The final chapter presents conclusions and makes recommendations.

Chapter Six: Conclusions and recommendations

6.1 Introduction

Given the pragmatic slant of the research undertaken, it follows that in concluding, the findings which impact on library service delivery require some comment. Those areas highlighted by the study and which merit further research, also need to be noted. Most important, however, is the review of the research questions which were the main focus of investigation into EIS usage. It is necessary to revisit the research questions and objectives stated in the first chapter and to draw conclusions.

6.2 Conclusions

This study has produced baseline data on EIS usage and has gone some way to answering the research questions. Recognising patterns of use in the collected data has created some order by grouping like and repeating activity. The patterns which emerged could be identified and described. The "searching rhythms" (Nicholas et al, 2004, p. 269) of repeat users of EIS have been seen to contribute to generating the "regular rhythms of academic life" (Tenopir & Read, 2000, p. 238). Taken in tandem, these rhythmic patterns mirror the activity of EIS users in a succession of actions and events across the academic year. Reviewed over two academic years has provided a timeline which confirms the patterns and highlights usage trends for Engineering and HDSS students on the Howard College campus of UKZN.

Investigation of the stated research objectives, has established certain data and trends which respond directly to the research questions:

- **Do UKZN students use library e-resources?**

EIS are indeed used by both Engineering and HDSS students on the Howard College campus at varying rates for different types of EIS. The "natural rhythm" of usage creates a pattern which rises during each semester and then falls during the vacation months. This is in keeping with trends documented in other studies reported in the literature. A tentative increase in usage can be observed over the 2008/2009 period in some resources, although it is acknowledged that the expanding range and availability of these resources on the institutional landscape impacts on this as a general trend.

Of the variables investigated, the level of study or status of students was found to be significant to usage, with postgraduates using EIS more than undergraduates. However, no significant association was found between the other anticipated variables of age, gender, computer proficiency and discipline of study.

- **Which e-resources are UKZN students using?**

e-Journals and databases enjoyed increasing usage by both undergraduate and postgraduate students. Over the two years under review, usage in almost all EIS sampled exhibited a trend of increasing use. In the population sample, habitual and frequent users of EIS comprised 68%, indicating usage on a regular basis (daily, weekly and monthly).

However, adoption of e-books was low and during the period under review showed a decline in usage. In this regard it is important to bear in mind that the available e-book collection was limited and factoring in the "difference of opportunity" was an important aspect of calculating usage.

- **Where do UKZN students access library e-resources?**

The student LANs on the university campus were the most popular venue for accessing and navigating to EIS. However, off-campus or remote access was also important with as many as 22% of the sample making use of these online resources from computers off-campus.

In the virtual sense, the library website and Internet search engines were the preferred place from which to navigate to the subscribed e-resources provided by UKZN Libraries.

- **Why do UKZN students use library e-resources?**

A direct relationship between need and usage was evident, with students primarily motivated to use EIS to locate information and for research purposes. The convenience of EIS compared to the print format was also articulated. Favourable ratings of EIS by users indicated that they are regarded as valuable resources.

- **What characterises non-users of library e-resources?**

This group found no advantage to using EIS, perceiving them to be time-consuming and difficult to use. They were largely ignorant of EIS and expressed an unwillingness to adopt them. Non-users expressed a preference for the print format of both books and journals.

In terms of user behaviour on the JUBILEE Toolkit, non-users matched the characteristics of stage one on the development scale (see Figure 5.1).

- **What barriers exist to the use of electronic information services (EIS)?**

Barriers to the use of EIS were identified and experienced by many students in both Engineering and the HDSS. In particular, students reported problems of access to EIS where the UKZN Libraries do not have subscribed access. Also voiced was a reluctance to read from the computer screen which was seen as a problem when using e-books.

Of interest is that students who rated their computer proficiency highly, also reported difficulties when accessing EIS. This suggests a more active role needs to be played by the Libraries in educating students in using EIS. Likewise issues of HCI at the searching interface (publisher's website, database or federated search screens) need to be investigated and addressed.

6.3 Library service delivery

Banwell et al. (2004) map seven key areas which impact on service delivery. These key areas comprise the wider environment, the institutional context, strategic management within the institution, library service issues, user needs, communication, quality, and resources. These key areas highlight the possibilities for improved service delivery regarding EIS, their complete integration within the institution and in the student's learning experience.

Within the pragmatic framework, Goldkuhl's maxim of "knowledge for action" can be applied to information brought to light by the questionnaire. Briefly summarised the findings have bearing on:

- The importance of off-campus access to EIS as a means of expanding access and availability. Eason et al. (2000) document the importance that availability and access from anywhere at anytime would aid in maximising usage.
- The improved visibility and increased use prompted by co-ordinated federated searching and searchable journal management software. The impact of a common search interface across a number of different EIS improves usability. Bonthron et al. (2003) found that access to e-journals via the library webpage was too complex for users and search engines were a preferred means of navigation. Federated searching would be a means of addressing the difficulties of users in this regard.
- The lack of awareness of students with respect to EIS indicates there is much room for publicising these resources and implementing a robust training programme aimed at both undergraduate and postgraduate level. The study by Atakan et al. (2008) demonstrates that the benefits of the training

implemented after a first survey, was clearly apparent when a follow on survey was conducted three years later. It had effected a marked impact on usage when it was subsequently measured again. This demonstrates clearly the advantageous implications of training on usage.

6.4 Recommendations for further research

Areas for further research are recommended and include the following:

The use of baseline benchmarking to track trends and patterns be developed and expanded to South African institutions on a national scale and eventually internationally as recommended by Dean (2008). Longitudinal evaluation of EIS use would map the level of usage and the preferences of users over time. As this is an area of constant change and rapid development, it would be preferable to monitor this on an ongoing basis. With an established baseline, it becomes increasingly important to develop the context of data within a larger whole. This can be achieved by benchmarking usage across institutions nationally. Dean (2008) has suggested the value of this could be extended internationally provided the statistics collected are comparable. This would provide support for the COUNTER (2008) standardised system of delivering statistics.

There is scope for qualitative research to interrogate EIS user behaviour and to expand the study of usage by employing different data collection instruments and approaches. New facts and data provide the stimulus for re-interpretation of patterns and better understanding of usage.

Further investigation into e-book usage and reading behaviour is required. The critical mass of subscribed resources available is somewhat limited with regard to e-books. Free resources like Google books can provide opportunities for research and to gain insights into the use of e-books. In this regard there is scope for a qualitative interpretivist approach which looks at reading habits, and other HCI issues.

Expanding the focus of EIS usage to include academic staff members will complete the picture of usage within the University. Some efforts in this direction are evident in the study by Mitha (2009), who concentrated her study on Medical staff members. This type of research needs to be expanded and applied to other faculties.

Exploring the HCI influence on usage, and criteria for the website search interfaces of EIS would lead to better understanding of EIS delivery. The increasing adoption of federated search engines[10] and ‘discovery tools’ which offer a common standard

[10] During 2008 UKZN Libraries implemented the TDNet federated search. Plans are well advanced to replace this search functionality with the implementation of the Ex Libris Primo search which offers more sophisticated functionality.

interface for searching across a number of resources, underscore the importance of the search interface to EIS usage.

6.5 Summary and conclusion

In higher education environments, the interaction between students and the online information environment is an increasingly important part of the learning and research process. Improving our understanding of aspects of this process through use studies allows the "the substantial gap in evidence" noted by Banwell et al. (2004, p. 304) to be filled.

As a baseline study, this research has mapped a profile of usage with particular reference to the characteristics of students in the Humanities and in Engineering. The research findings and conclusions largely reflect those of other studies carried out internationally in the US, UK and Europe. The prevailing behaviour patterns reported are subscribed to by the UKZN population sample surveyed. Further, the data presented in this thesis provides a springboard from which to explore EIS usage more thoroughly in the South African higher education context, and in so doing improve understanding of how the learning process benefits.

Executed as a pragmatic usage study, the findings recognise and contribute to the present role of academic libraries which is to facilitate access to EIS by the academic community. This is a departure from the role previously played by academic libraries which cast them primarily as the custodians of information collections.

The importance of COUNTER initiatives, to make the contribution of usage measurement meaningful, is emphasised. From a national standpoint, employing comparable standards would be an imperative in establishing a national benchmark of usage. Due consideration to the importance of context, in light of the rapidly changing online information environment, was an important element of the research undertaken. The research methods used were sensitive to contextual parameters as indicated in the analysis of data viz taking cognisance of "difference of opportunity" with regard to e-book usage. Although the study provides a limited snapshot of usage in a South African university, it is a valuable starting point.

References

Atakan, C., Atilgan, D., Bayram, O., & Arslantekin, S. (2008). An evaluation of the second survey on electronic databases usage at Ankara University Digital Library. *The Electronic Library, 26(2),* 249-259. Retrieved 10 October 2009 from the Emerald Insight Database.

Bannon, L. (2000). *Use-centred design and evaluation of systems*. Retrieved 20 April 2007 from http://www.irit.fr/ACTIVITES/GRIC/cotcos/pjs/MethodologicalApproaches/evaluationmethods/evaluationpaperBannon.htm

Banwell, L., Ray, K., Coulson, G., Urquhart, C., Lonsdale, R., Armstrong, C., ... Rowley, J. (2004). The JISC user behaviour monitoring and evaluation framework. *Journal of Documentation*, *60*(3), 302-320. Retrieved 20 April 2007 from the Emerald Insight Database.

Bar-Ilan, J., Peritz, B., & Wolman, Y. (2003). A survey on the use of electronic databases and electronic journals accessed through the web by the academic staff of Israeli universities. *Journal of Academic Librarianship*, *29*(6), 346-361. Retrieved 20 April 2007 from the Science Direct database.

Bar-Ilan, J. & Fink, N. (2005). Preference of electronic format of scientific journals: a case study of the Science Library users at the Hebrew University. *Library & Information Science Research, 27,* 363-376. Retrieved 20 April 2007 from the Science Direct database.

Bates, M.J. (2005). An introduction to metatheories, theories and models. In K.E. Fisher, S. Erdelez & L. McKechnie (Eds.), *Theories of Information Behaviour* (pp.1-24). Medford, N.J: Information Today.

Bawden, D. (2006). Users, user studies and human information behaviour. *Journal of Documentation*, *62*(6), 671-679. Retrieved 20 April 2007 from the Emerald Insight Database.

Bishop, A.P. (1998). Measuring access, use and success in digital libraries. *The Journal of Electronic Publishing, 4*(2). Retrieved 20 April 2007 from http://www.press.umich.edu/jep/04-02/bishop.html

Bonthron, K., Urquhart, C., Thomas, R., Armstrong, C., Ellis, D.K, Everitt, J., Fenton, R., … Yeoman, A. (2003). Trends in use of electronic journals in higher education in the UK: Views of academic staff and students. *D-Lib Magazine*, *9*(6). Retrieved 10 April 2009 from http://dlib.org/dlib/june03/urquhart/06urquhart.html

Borrego, A.S., Anglada, L., Barrios, M., & Comellas, N. (2007). Use and users of electronic journals at Catalan Universities: The results of a survey. *Journal of Academic Librarianship*, *33*(1), 67-75. Retrieved 10 April 2007 from the Science Direct Database.

Bryman, A. (2004). *Social Research Methods*. 2nd ed. Oxford: Oxford University Press.

Burke, M.E. (2007). Making choices: Research paradigms and information management. *Library Review, 56*(6), 476-484. Retrieved 10 October 2009 from the Emerald Insight Database.

Christianson, M. (2005). Patterns of use of electronic books. *Library Collections, Acquisitions, and Technical Services, 29*(4), 351-363. Retrieved 20 April 2007 from the Science Direct Database.

Cochenour, D., & Moothart, T. (2003). E-journal acceptance at Colorado State University: A case study. *Serials Review 29*(1), 16-25. Retrieved 20 April 2007 from the Science Direct Database.

Connaway, L.S. (2001). A web-based electronic book (e-book) library: The netLibrary model. *Library Hi Tech*, *19*(4), 340-349. Retrieved 10 April 2007 from the Emerald Insight Database.

Cooper, M. M. (2007). The importance of gathering print and and electronic journal use data: Getting a clear picture. *Serials Review*, *33*(3), 172-174. Retrieved 15 October 2007 from the Science Direct Database.

Coulson, G., & Banwell, L. (2004). The impact of the JUBLILEE toolkit in institutions. *Vine, 34*(4), 154-160. Retrieved 20 April 2007 from the Emerald Insight Database.

COUNTER. (2008). *The COUNTER code of practice for journals and databases*. Release 3. Retrieved 10 December 2008 from http://www.projectcounter.org/code_practice.html

Couper, M.P. (2000). Web surveys: A review of issues and approaches. *Public Opinion Quarterly*, *64*(4), 464-494. Retrieved 20 September 2009 from http://poq.oxfordjournals.org

Davis, P. (2002). Patterns in electronic journal usage: Challenging the composition of geographic consortia. *College & Research Libraries*, *63*(6), 484-497. Retrieved 10 April 2007 from http://people.cornell.edu/pages/pmd8/Davis_Consortia.pdf

Dean, C. (2008). *Statistics for electronic resources*. Unpublished MLIS thesis in the Faculty of Humanities, University of Cape Town.

Dillon, D. (2001). e-Books: The University of Texas experience, part 1. *Library Hi Tech, 19*(2), 113-24. Retrieved 10 April 2007 from the Emerald Insight Database.

Dillon, A., & Morris, M. (1996). User acceptance of new information technology: Theories and models. In M. Williams (Ed.), *Annual Review of Information Science and Technology* (pp. 3-32). Medford NJ: Information Today. Retrieved 10 April 2007 from http://portal.brint.com/cgi-bin/cgsearch/cgsearch.cgi?query=USER%20ACCEPTANCE%20OF%20INF

ORMATION%20TECHNOLOGY%3A%20THEORIES&vid=l6624971166I1276081422&tag=1638390943I1277794020&lout=dyn&partner=&category=&cfrom=metasearch&cgrdurl=http://www.ischool.utexas.edu/~adillon/BookChapters/User%20acceptance.htm

Eason, K., Richardson, S., & Yu, L. (2000). Patterns of use of electronic journals. *Journal of Documentation*, *56*(5), 477-504. Retrieved 20 April 2007 from the Emerald Insight Database.

Evans,J.R., & Mathur, A. (2005). The value of online surveys. *Internet Research, 15*(2), 195-219. Retrieved 28 September 2009 from the Emerald Insight Database.

Ferreira, S.M., & Pithan, D.N. (2005). Usability of digital libraries: A study based on the areas of information science and human-computer-interaction. *OCLC Systems & Services, 21*(4), 311-323. Retrieved 20 May 2007 from the Emerald Insight Database.

Fernandez, M. (2003). A usage comparison for print and electronic books in the University of North Carolina at Chapel Hill. Unpublished paper for the MS in LS degree. Retrieved 20 April 2007 from http://ils.unc.edu/MSpapers/2827.pdf

Fisher, K.E., Erdelez, S., & McKechnie, L. (Eds.). (2005). *Theories of information behaviour*. Medford, N.J.: Information Today.

Franklin, B., & Plum, T. (2002). Networked electronic services usage patterns at four academic health sciences libraries. *Performance Measurement and Metrics, 3*(3), 123-133. Retrieved 10 May 2007 from the Emerald Insight Database.

Gerlach, J.H., & Kuo, F-Y. (1991). Understanding human-computer interaction for information systems design. *MIS Quarterly*, *15*(4), 527-549. Retrieved from the JSTOR Database.

Gibbons, S. (2001). netLibrary ebook usage at the University of Rochester libraries. Retrieved 10 April 2007 from http://www.lib.rochester.edu/main/ebook/analysis.pdf

Goldkuhl, G. (2008). What kind of pragmatism in information systems research. Paper presented at the AIS SIG Prag Inaugural Meeting, Paris. Retrieved 8 October 2009 from http://www.adm.hb.se/~ml/pdf-filer/SIGPrag2008Proceedings_ny.pdf#page=7

Gunter, B. (2005). Electronic books: A survey of users in the UK. *Aslib Proceedings: New Information Perspectives*, *57*(6), 513-522. Retrieved 10 April 2007 from the Emerald Insight Database.

Kent, R. (2001). *Data construction and data analysis for survey research*. New York: Palgrave.

Lajoie-Paquette, D. (2005). Diffusion theory. In K.E. Fisher, S. Erdelez & L. McKechnie (Eds.), *Theories of Information Behaviour* (pp.118-122). Medford, N.J: Information Today.

Langston, M. (2003). The California State University e-book pilot project: Implications for cooperative collection development. *Library Collections, Acquisitions, and Technical Services, 27*(1), 19-32. Retrieved 10 April 2007 from the Science Direct Database.

Levine-Clark, M. (2007). Electronic books and the Humanities: A survey at the University of Denver. *Collection Building*, *26*(1), 7-14. Retrieved 10 April 2007 from the Emerald Insight Database.

Liew, C.L., Foo, S., & Chennupati, K.R. (2000). A study of graduate student end-users' use and perception of electronic journals, *Online Information Review 24*(4), 302-308. Retrieved 10 April 2007 from the Emerald Insight Database.

Lock, S., Cornell, E., & Colling, A. (2001). The acceptance of e-journals in higher education: Policy and use at the University of Leicester, with reference to the CORSALL report. *Information Services & Use*, *21*(3/4). Retrieved 10 April 2007 from the Academic Search Complete Database.

Lonsdale, R., & Armstrong, C. (2001). Electronic books: Challenges for academic libraries. *Library Hi Tech*, *19*(4), 332-339. Retrieved 10 April 2007 from the Emerald Insight Database.

Maguire, M. (2001). Methods to support human centred design. *International Journal of Human-Computer Studies, 55*, 587-634. Retrieved 20 May 2007 from the Science Direct Database.

Mahe, A., Andrys, C., & Chartron, G. (2000). How French research scientists are making use of electronic journals: A case study conducted at Pierre et Marie Curie University and Denis Diderot University. *Journal of Information Science*, *26*(5), 291–302. Retrieved 20 April 2007 from https://www.swetswise.com/eAccess/viewFulltext.do?articleID=17957628

Mahe, A. (2004). Beyond usage: Understanding the use of electronic journals on the basis of information activity analysis. *Information Research 9*(4), paper 186. Retrieved 20 April 2007 from http://InformationR.net/ir/9-4/paper186.html

Mawindo, D., & Hoskins, R. (2008). Use of print and electronic resources by the students of the University of Malawi College of Medicine. *Mousaion, 25*(1), 89-110. Retrieved 20 April 2009 from the SA ePublications Database.

Minishi-Majanja, M.K., & Kiplang'at, J. (2005). The diffusion of innovations theory as a theoretical framework in library and information science research. *South African Journal of Library & Information Science*, *71*(3), 211-224. Retrieved 20 April 2007 from the SA ePublications Database.

Mitha, S. (2009). New information seeking behaviours of academics in the Faculty of Medicine at the University of KwaZulu-Natal. *Innovation*, *39*, 19-33.

Nicholas, D., Huntington, P., & Watkinson, A. (2004). Scholarly journal use: The results of deep log analysis. *Journal of Documentation, 61*(2), 248-280. Retrieved online from the Emerald Insight Database.

Pather, R., & Stilwell, C. (2008). Costs and benefits of journal ownership versus full-text electronic access in a university-based faculty of science. *Mousaion, 26*(2), 22-45. Retrieved 20 April 2009 from the SA ePublications Database.

Ramirez, D., & Gyeszly, S.D. (2001). netLibrary a new direction in collection development. *Collection Building*, 20(4), 154-164. Retrieved online from the Emerald Insight Database.

Robinson, L. (n.d.). *Notes on the Diffusion of Innovations Theory*. Retrieved 20 May 2007 from http://media.socialchange.net.au/people/les/Summary_Diffusion_Theory.pdf

Rogers, E.M. (1976). New product adoption and diffusion. *Journal of Consumer Research, 2*(4), 290-301. Retrieved 20 May 2007 from the JSTOR Database.

Rogers, E.M. (2004). A prospective and retrospective look at the diffusion model. *Journal of Health Communication, 9,* 13–19. Retrieved from the Academic Search Complete Database.

Rusch-Feja, D., & Siebeky, U. (1999). Evaluation of usage and acceptance of electronic journals: Results of an electronic survey of Max Planck Society researchers including usage statistics from Elsevier, Springer and Academic Press. *D-Lib Magazine*, *5*(10). Retrieved 20 April, 2007 from http://www.dlib.org/dlib/october99/rusch-feja/10rusch-feja-summary.html

Sanville, T.J. (2001). Use of electronic journals in OhioLINK'S electronic journal center. In *67th IFLA Council and General Conference, 16-25 August 2001*. Retrieved 20 April, 2007 from http://www.ifla.org/IV/ifla67/papers/118-141e.pdf

Serotkin, P., Fitzgerald, P., & Balough, S. (2005). If we build it, will they come? Electronic journals acceptance and usage patterns. *portal: Libraries & the Academy*, *5*(4), 497-512. Retrieved 10 April 2007 from the Project Muse Database.

Sridhar, M.S. (1995). Understanding the user - why, what and how? *Library Science with a Slant to Documentation and Information Studies*, *32*(4), 151-164. Retrieved 20 April 2007 from http://eprints.rclis.org/archive/00009340/01/J38_Understanding_User.pdf

Sundin, O., & Johannisson, J. (2005). Pragmatism, neo-pragmatism and sociocultural theory: Communicative participation as a perspective in LIS. *Journal of Documentation 61*(1), 23-43. Retrieved 10 April 2009 from the Emerald Insight Database.

Talja, S. (2005). The domain analytic approach to scholars' information practices. In K.E. Fisher, S. Erdelez & L. McKechnie (Eds.), *Theories of Information Behaviour* (pp.123-127). Medford, N.J: Information Today.

Taylor, D.M. (1970). *Explanation and meaning: An introduction to philosophy.* Cambridge: Cambridge University Press.

Tenopir, C., & Read, E. (2000). Patterns of database use in academic libraries. *College & Research Libraries*, *61*(3), 234-246. Retrieved 20 April 2007 from http://www.ala.org/ala/acrl/acrlpubs/crljournal/backissues2000b/may00/tenopir.pdf

Tenopir, C., Hitchcock, B., & Pillow, A. (2003a). *Use and users of electronic library resources: An overview and analysis of recent research studies.* Washington, D.C.: Council on Library and Information Resources. Retrieved 20 April 2007 from http://www.clir.org/PUBS/reports/pub120/pub120.pdf

Tenopir, C., King, D. W., Boyce, P., Grayson, M., Zhang, Y., & Ebuen, M. (2003b). Patterns of journal use by scientists through three evolutionary phases. *D-Lib Magazine*, *9*(5). Retrieved 20 April 2007 from http://www.dlib.org/dlib/may03/king/05king.html

van Lill, C. (2001). A model for studying users' information needs and use. *South African Journal of Library & Information Science, 67*(1), 38-40. Retrieved 20 April 2007 from the Academic Search Complete Database.

Van Selm, M., & Jankowitz, N.W. (2006). Conducting online surveys. *Quality and Quantity, 40*(3), 435-456. Retrieved 21 September 2009 from http://www.springerlink.com/content/3h4585r434778415/fulltext.pdf

Webopedia: The online encyclopedia dedicated to computer technology. (2005). Retrieved 20 May 2007 from http://www.webopedia.com/TERM/P/PDF.html

White, M.D. (2001). Diffusion of an innovation: Digital reference service in Carnegie Foundation master's (comprehensive) academic institution libraries. *Journal of Academic Librarianship, 27*(3), 173-187. Retrieved 20 April 2007 from the Science Direct Database.

Wilson, T.D. (2006). Revisiting user studies and information needs. *Journal of Documentation, 62*(6), 680-684. Retrieved 20 April 2007 from the Emerald Insight Database.

Wolf, M. (2001). Electronic journals: Use, evaluation and policy. *Information Services & Use*, *21*(3/4), 249-261. Retrieved 10 April 2007 from the Academic Search Complete Database.

Woodward, H., Rowland, F., McKnight, C., Pritchett, C., & Meadows, A.J. (1998). Café jus: An electronic journals user survey. *Journal of Digital Information*, *1*(3). Retrieved 20 April 2007 from http://jodi.ecs.soton.ac.uk/Articles/v01/i03/Woodward/

Wright, K.B. (2005). Researching Internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *Journal of Computer-Mediated Communication, 10*(3), article 11. Retrieved 20 September 2009 from http://jcmc.indiana.edu/vol10/issue3/wright.html

Appendix A: Questionnaire and Declaration of Consent

e-Resources User Study

Dear Participant,

Thank you for agreeing to take part in this study which investigates the use of e-resources among UKZN students at Howard College. Your participation in this project will contribute to understanding of the use of library resources at our university. For the purposes of this study, e-resources are journals, books, databases and other information resources which are delivered online on the Internet.

Your participation is anonymous, voluntary and all information you provide will be treated with confidentiality. Should you decide to withdraw at any point, you are free to do so. Please complete the declaration below to indicate your consent.

This research is being undertaken for a Masters degree in Digital Media, under the supervision of Ms Kathy Murrell (Tel: 031-260 2478 Email: murrell@ukzn.ac.za).

Regards
Avenal Finlayson (Tel: 031-2602064 Email: finlaysona@ukzn.ac.za)

There are 20 questions in this survey.

A note on privacy

This survey is anonymous. The record kept of your survey responses does not contain any identifying information about you unless a specific question in the survey has asked for this. If you have responded to a survey that used an identifying token to allow you to access the survey, you can rest assured that the identifying token is not kept with your responses. It is managed in a separate database, and will only be updated to indicate that you have (or haven't) completed this survey. There is no way of matching identification tokens with survey responses in this survey.

Declaration

* I hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.
Please indicate your agreement to participate by clicking on the Yes option below.
Clicking No will end the survey.

- Yes
- No

Background Information

1. Gender: Male Female

2. Age:
 25 years or younger
 26-39 years
 40-55 years
 Over 55 years

3. Degree: Engineering Humanities & Social Sciences

4. Level of Study: Undergraduate Postgraduate

5. What Qualification are you studying towards?
……

6. Computer proficiency:
 Poor Adequate Good Excellent

Research Questions

7. Are you aware of e-journals, e-books, and databases on the Internet?

 Yes
 No
 Other (Please explain)
……

8. Do you know that many of these online resources are made available by UKZN Libraries?

 Yes
 No
 Other (Please explain)
……

9. How do you know about these resources?

 Library orientation
 Your lecturers
 Fellow students
 The library webpage
 Google Scholar
 Other (Please specify)
.....……

10. Do you consult and read e-books?

 Yes
 No
 Other (Please specify)
……

11. If No, please give reasons why

……
……

12. If yes, how often do you use them?

- Daily
- Weekly
- Fortnightly
- Monthly
- Other (Please specify)

……

13. Do you consult and read e-journals?

- Yes
- No
- Other (Please specify)

……

14. If No, please give reasons why

……
……

15. If yes, how often do you use them?

- Daily
- Weekly
- Fortnightly
- Monthly
- Other (Please specify)

……

16. Why do you make use of these online information sources? [You may tick more than one answer.]

- To locate information for your assignment or project
- Recommended by your lecturer
- More convenient to use than print resources
- Research purposes
- To keep up-to-date with current research
- Other (Please specify)

……

17. How do you navigate to the resources you use? [You may tick more than one answer.]

- Publishers' websites
- Personal subscription
- Resources at the library webpage
- Resources retrieved by search engines such as Google and Google Scholar
- Email alerts

 Other (Please specify)
……

18. How do you rate the online resources you use?

 Poor Adequate Good Excellent

19. Where do you access online resources?

 Computer in the LAN on campus
 Computer in the library
 Computer off-campus e.g. at home or work
 Other (Please specify)
……

20. Do you experience problems when using online resources?

 Yes
 No

Please explain:
……
……

21. Would you like to volunteer for a follow-up interview?
 Yes
 No

If yes, please provide your contact details
…….....

22. Should you wish to receive a summary of the research findings resulting from this research, please supply your email address below:

Email: ……

Thank you for completing this questionnaire

Appendix B: Ethical clearance certificate

UNIVERSITY OF
KWAZULU-NATAL

RESEARCH OFFICE (GOVAN MBEKI CENTRE)
WESTVILLE CAMPUS
TELEPHONE NO.: 031 – 2603587
EMAIL: ximbap@uzkn.ac.za

7 JULY 2008

MRS. AJ FINLAYSON (761767626)
DIGITAL MEDIA STUDIES

Dear Mrs. Finlayson

ETHICAL CLEARANCE APPROVAL NUMBER: HSS/0318/08M

I wish to confirm that ethical clearance has been approved for the following project:

"Patterns of use of web-based library e-resources among students on the Howard College Campus on the University of KwaZulu-Natal"

PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years

Yours faithfully

MS. PHUMELELE XIMBA

cc. Supervisor (Ms. K Murrell)
cc. Mrs. L Marriott

Appendix C: List of subscribed EIS, 2008

Abi-Inform Global (ProQuest)
Academic Research Library (ProQuest)
Academic Search Complete (Ebsco)
ACM Digital Library
Africa-Wide: NiPAD (Ebsco)
African Index Medicus (AIM)
African Journals Online (AJOL)
African Writers Series (Chadwyck & Healey)
Agriculture Journals (ProQuest)
American Chemical Society Journals
American Medical Association (AMA)
Abstracts and Indexing (ProQuest)
American Physical Society Journals
Annee Philologique
ArchUP (Sabinet)
Art Full Text (WilsonWeb)
ArticleFirst (Sabinet / OCLC)
ASCE Research Library
ASME Digital Library
ATLA Religion Database (Ovid / (Ebsco)
Biological Sciences (CSA)
Biology Digest (CSA)
Biosis Previews (Web of Knowledge)
BMJ Online
Book Data (Sabinet)
Business Source Complete (Ebsco)
CAB Direct
Cambridge Online Journals
Cement and Concrete (Sabinet / OCLC)
CINAHL (Ebsco)
Cochrane Library
Columbia International Affairs Online
Combined Health Information Database
Communication and Mass Media Complete (Ebsco)
Compendex Plus (Engineering Village2)
Computer Science Index (Ebsco)
Conference Papers Index (CSA)
Current and Completed Research (Sabinet / Nexus / OCLC)
Diseasedex
Dissertations and Theses A&I (ProQuest)
Ebsco Electronic Journal Service (EJS)
EconLit (Ebsco)
Education Full Text (WilsonWeb)
Educational Management Abstracts
Emerald Engineering Database
EmeraldInsight
ERIC (Ebsco) / CSA)
Faculty of 1000 Biology
Family Law Reports Online
FirstConsult
Forestry (Sabinet /OCLC)
Global Books in Print
Global Market Information Database
Government Gazettes (Sabinet)
Health & Medical Complete (ProQuest)
Health Source: Consumer Edition (Ebsco)
Health Source: Nursing / Academic Edition (Ebsco)
Highwire Press
Humanities Full Text (WilsonWeb)
Index to South African Periodicals (Sabinet /OCLC)
Industrial Relations Network
IngentaConnect
INSPEC (Engineering Village2)
Institute of Physics Journals
International Bibliography of the Social Sciences (CSA)
IRWI: Information Research Watch International (CSA)
ISI Citation indexes – Arts & Humanities; Social Sciences; Science (Web of Knowledge)
Joanna Briggs Institute RAPid Database
Journal Citation Reports (Web of Knowledge)
JSTOR
Juta's Unreported Judgements
Juta e-Publications
Legal Periodicals Full Text (WilsonWeb)
LexisNexis Academic
LexisNexis Butterworths
Library and Information Science Abstracts (CSA)
Library, Information Science and Technology Abstracts (Ebsco)
LWW Journals @ OVID
Master File Premier (Ebsco)
MathEduc
MathSciNet
McGregor BFA Library
MDConsult Core Edition
Medline (CSA / (Ebsco) / PubMed)
Mintek (SABINET / OCLC)
MLA Directory of Periodicals (Ebsco)

MLA International Bibliography (Ebsco)
Music Index Online (Ebsco)
Navtech (Sabinet / OCLC)
NDLTD (Sabinet)
Newspaper Source (Ebsco)
New Testament Abstracts (Ebsco)
Old Testament Abstracts (Ebsco)
Oxford University Press Journals
Parliamentary Bills (SABINET)
Philosopher's Index (Ebsco)/Ovid)
PILOTS Database (CSA)
PlanUP (Sabinet)
Plant Science (CSA)
Project Muse
ProQuest Research Library: Health Module
Provincial Gazettes (Sabinet)
PsycInfo (Ebsco)
Psychology Journals (ProQuest)
PubMed
Religion and Philosophy Collection (Ebsco)
Religious and Theological Abstracts
RILM Abstracts (Ebsco)
Royal Society of Chemistry Journals
SA ePublications (Sabinet / OCLC)
SA Gazettes (Sabinet)
SA Media (Sabinet)
SA Transport Conference Index (Sabinet)
SACat (Sabinet/ OCLC)
SAGEOLIT (Sabinet)
SAPA (Sabinet)
ScienceDirect
Social Services Abstracts (CSA)
Sociology of Education Abstracts
Sociological Abstracts (CSA)
South African National Bibliography (Sabinet)
SwetsWise Journals
Toxline (CSA)
Travel & Tourism Digital Library
Ulrich's Periodicals Directory
Union Catalogue of Theses and Dissertations (Sabinet / OCLC)
U.S. National Newspaper Abstracts (ProQuest)
Water Resources Worldwide (Ebsco)
WebSciFinder
Westlaw
Wildlife and Ecology Abstracts
Worldwide (Ebsco)
Worldcat (OCLC)
WorldCat Dissertations and Theses (OCLC)