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**THE USE OF WORLD WIDE WEB TECHNOLOGIES FOR
COURSE DELIVERY AT TERTIARY INSTITUTIONS
IN SOUTH AFRICA**

BY

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i

DECLARATION

I hereby declare that this dissertation is result of my own investigation and research and that it has not been submitted in part or in full for any other degree or to any other University.

Shaun Pather

01 December 1999



SYNOPSIS

As the world perches on the dawn of a new millennium, the strides humankind has made in the advancement of information and communications technologies such as the World Wide Web (WWW) and Internet, have surpassed even the greatest of expectations. Technology is a force that is reshaping the way we live. In the field of Public Administration it is being given increased prominence as a social restructuring force which has immense potential to assist with the delivery of public services. One of the areas in which it is having a notable impact is in the field of education.

This study investigates the role of World Wide Web (WWW) technologies in the delivery of education at South African Tertiary institutions. An overview of the experiences of practitioners in the higher education arena in using Web-based technologies is provided. Both the problem-areas as well as positive aspects of Web-based teaching are reviewed. Specific emphasis is placed on the benefits of using the WWW to support resource-based, student-centred learning as envisaged in the *Education White Paper 3: A Programme For The Transformation Of Higher Education* and *Technology-Enhanced Learning in South Africa: A Strategic Plan*.

Lecturers from fifteen South African tertiary institutions were surveyed. From the results of the survey the extent of usage (currently and in the immediate future) of specific WWW features for course delivery are determined. Possible problems that exist in our institutions, which may be impeding the implementation of Web-based courses, are also highlighted in the analysis of the survey. Lastly, the survey provides some insights into the key aspects of Web-based courses that are important in supporting student-centred learning.

The following recommendations are suggested, bearing in mind the limited sample size with which the survey was conducted:

- Lecturers designing Web-based courses should make a concerted effort to move away from the use of the Web to merely support delivery of lectures and to

incorporate WWW features that would support a more dynamic, interactive, student-centred approach to course delivery.

- Management at the departmental, faculty and institutional level should be encouraged to create the possibility for and invest in adequate training of both academic and support staff to support WWW-based course delivery.
- Heads of academic units (Departmental Heads) should support lecturers in the adoption of WWW technologies by creating a psychological and physical space to experiment and try out new ideas.
- Tertiary institutions should investigate possible collaboration with external partners in the private sector, e.g. vendors of information and communication technologies as a means of alleviating the high financial costs associated with implementing Web-based courses.
- The design of Web-based courses should be based on a student-centred learning approach in which the learner is able to select an individualized path in the learning process, and achieve the learning objectives at his/her own pace. Further, the Web course should include the following features to support such an environment: Hosting of students' Web pages; interactive platforms to promote synchronous communication; online drill and testing; course management functions; tracking facilities; and features to provide a secure environment to maintain integrity of students' work and other confidential information.

DEDICATION

*To the fallen foot soldiers, the young lions of
Africa, who did not live to realise their
dream....*

-Hamba Kahle

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"Generosity is not giving me that which I need more than you do, but it is giving me that which you need more than I do"

- Kahlil Gibran

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TABLE OF CONTENTS

CHAPTER ONE: INTRODUCTION

1.1	BACKGROUND OF THE STUDY	1
1.1.1	<i>Emergence of the internet and world wide web (www) for teaching and learning...</i>	2
1.1.2	<i>South African education policy</i>	4
1.2	JUSTIFICATION FOR THE STUDY	8
1.3	OBJECTIVES OF THE STUDY	9
1.4	RESEARCH METHODOLOGY	10
1.4.1	<i>Literature search</i>	10
1.4.2	<i>Data collection and analysis</i>	11
1.5	LIMITATIONS OF THE STUDY	11
1.5.1	<i>Sample Size</i>	11
1.5.2	<i>Sample Bias</i>	12
1.5.3	<i>Method of Sampling</i>	13
1.5.4	<i>Problems with the Web-based questionnaire</i>	13
1.6	OVERVIEW OF THE STUDY	14
1.7	CLARIFICATION OF KEY CONCEPTS	16

CHAPTER TWO: HIGHER EDUCATION SERVICE DELIVERY WITHIN A PUBLIC ADMINISTRATION FRAMEWORK

2.1	INTRODUCTION	20
2.2	DELIVERY OF HIGHER EDUCATION COURSES WITHIN THE CONTEXT OF PUBLIC ADMINISTRATION	21
2.2.1	<i>THE GENERIC ADMINISTRATIVE PROCESS MODEL</i>	21

2.2.1.1	<i>Shortcomings of the generic administrative model</i>	23
2.2.2	<i>THE PUBLIC MANAGEMENT MODEL</i>	25
2.3	THE RELATIONSHIP BETWEEN PUBLIC ADMINISTRATION AND THE DELIVERY OF COURSES AT TERTIARY INSTITUTIONS USING THE WORLD WIDE WEB	29
2.3.1	<i>The Constitution of the Republic of South Africa</i>	30
2.3.2	<i>Delivery of courses as a functional activity</i>	31
2.3.3	<i>The WWW for delivering education within the Technological Environment</i>	31
2.4	ETHICAL NORMS GOVERNING THE PROVISION OF HIGHER EDUCATION USING WWW TECHNOLOGY	34
2.5	SUMMARY	38

CHAPTER THREE: THE EVOLUTION AND PERSPECTIVES OF THE WORLD WIDE WEB

3.1	INTRODUCTION	39
3.2	HISTORY OF WWW TECHNOLOGIES.....	39
3.2.1	<i>Evolvment of the Internet</i>	40
3.2.2	<i>Evolvment of the World Wide Web (WWW)</i>	42
3.2.3	<i>Important distinctions between the WWW and the Internet</i>	43
3.3	GENERAL APPLICATIONS OF THE WWW	44
3.3.1	<i>Applications of the WWW in education</i>	47
3.4	OVERVIEW OF REPORTED BENEFITS OBTAINED FROM THE USE OF THE WWW FOR COURSE DELIVERY.....	48
3.4.1	<i>Cross-platform distribution</i>	49
3.4.2	<i>Ease of updating and expansion</i>	49
3.4.3	<i>Delivery of multimedia</i>	50
3.4.4	<i>Interactivity</i>	50

3.4.5	<i>Access to experts.....</i>	51
3.4.6	<i>Testing</i>	51
3.4.7	<i>Ease of use</i>	52
3.4.8	<i>Use of frames, image maps and tables</i>	53
3.4.9	<i>Multiple communication facilities</i>	53
3.4.10	<i>Support of student-centred learning</i>	53
3.5	REPORTED PROBLEMS ASSOCIATED WITH THE DELIVERY OF COURSES	
	USING WWW	54
3.5.1	<i>Difficulty of Tertiary Educators adapting to Web</i>	54
3.5.2	<i>Management issues.....</i>	55
3.5.3	<i>Availability of Bandwidth</i>	56
3.5.4	<i>Multi-media environment and lost in "hyperspace" effect.....</i>	56
3.5.5	<i>Unfamiliarity of entry level students with technology</i>	57
3.5.6	<i>Use of the WWW to administer tests</i>	57
3.5.7	<i>Lack of guidelines</i>	58
3.6	SUMMARY	59

CHAPTER FOUR: THE APPLICATION OF THE WWW TO SUPPORT STUDENT-CENTRED, RESOURCE-BASED LEARNING

4.1	INTRODUCTION	61
4.2	TRANSFORMATION OF THE NATIONAL HIGHER EDUCATION SYSTEM	61
4.3	WWW: A NEW TEACHING AND LEARNING TECHNOLOGY TO PROMOTE RESOURCE-BASED EDUCATION.....	63
4.4	RESOURCE-BASED LEARNING	64
4.5	STUDENT-CENTRED LEARNING AND THE WWW	65

4.6	OVERVIEW OF SELECTED STUDIES HIGHLIGHTING THE ROLE OF WWW TECHNOLOGIES TO SUPPORT STUDENT-CENTRED LEARNING	69
4.6.1	STUDY ONE: A Virtual Classroom Model	69
4.6.2	STUDY TWO: Case based on Nova South Eastern University.....	72
4.6.3	STUDY THREE: A Constructivist perspective of a WWW environment.....	75
4.6.4	STUDY FOUR: Case based on the University of Twente, Netherlands.....	76
4.6.5	STUDY FIVE: Case based on a National Technical University of Athens project.....	77
4.6.6	STUDY SIX: Case based on a University of Jyväskylä (Finland) project.....	78
4.6.7	STUDY SEVEN: University of Melbourne project.....	79
4.6.8	STUDY EIGHT: A guide to teaching on the Web	81
4.6.9	STUDY NINE: Case based on a University of Maryland project	85
4.6.10	STUDY TEN: Educational goals attained via use of the WWW	87
4.6.11	STUDY ELEVEN: Case based on a University of Pretoria (South Africa) course.....	88
4.6.12	STUDY TWELVE: Case based on Monash University (Australia) project	90
4.6.13	STUDY THIRTEEN: Open University, United Kingdom experience	91
4.6.14	STUDY FOURTEEN: Case based on Trinity College (Dublin) experience	93
4.7	A SYNTHESIS OF STUDIES	94
4.8	SUMMARY	96

CHAPTER FIVE: RESEARCH METHODOLOGY

5.1	INTRODUCTION	97
5.2	DESCRIPTION OF RESEARCH METHODOLOGY.....	98
5.2.1	Establishing the theoretical foundation for the research (Literature Review)	99
5.2.2	Assessment of the established theory.....	100
5.2.3	Theoretical conjecture.....	101
5.2.4	Hypothesis/Empirical generalized formulation.....	101

5.2.5 Measuring instrument.....	102
5.3 CONDUCTING THE SURVEY	103
5.3.1 Pilot study.....	104
5.3.2 Sample selection.....	105
5.3.3 Testing and analysis	106
5.4 SUMMARY.....	108

CHAPTER SIX: DATA ANALYSIS AND INTERPRETATION

6.1 INTRODUCTION	109
6.2 SUMMARY OF RESPONDENTS TO THE SURVEY.....	109
6.3 TESTING OF THE HYPOTHESES	111
6.3.1 Description of process of item analysis and establishment of significant statements.....	112
6.3.2 Analysis and interpretation of statistical tests	117
6.4 INTERPRETATION OF STATISTICAL ANALYSIS.....	124
6.4.1 Section C : Institutional-based problems impeding the implementation of Web- based courses.....	124
6.4.2 Section D : Issues important to the design and implementation of Web-based courses.....	127
6.5 QUESTIONNAIRE INSTRUMENT RELIABILITY.....	129
6.6 SUMMARY.....	130

CHAPTER 7 /...

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION 131

7.2 LEVELS OF USAGE OF DIFFERENT WWW FEATURES 131

7.3 PROBLEMS IN THE IMPLEMENTATION OF WWW-BASED COURSES 136

7.4 ISSUES IN THE DESIGN OF WWW-BASED COURSES TO SUPPORT STUDENT-
CENTRED LEARNING 138

7.5 THE ANTICIPATED FUTURE OF WWW TECHNOLOGIES IN THE SOUTH AFRICAN
HIGHER EDUCATION ARENA 140

7.6 FUTURE WORK 141

7.7 SUMMARY 143

BIBLIOGRAPHY 145

APPENDICES

APPENDIX A - QUESTIONNAIRE..... 161

APPEXDIX B - RESPONSES TO QUESTIONNAIRE (SECTION A).....169

APPENDIX C - RESPONSES TO QUESTIONNAIRE (SECTION B).....172

APPENDIX D - RESPONSES TO QUESTIONNAIRE (SECTION C).....179

APPENDIX E - RESPONSES TO QUESTIONNAIRE (SECTION D).....182

APPENDIX F - RELIABILITY ANALYSIS SCALES.....187



LIST OF TABLES AND FIGURES

TABLE 1: CHANGING EDUCATIONAL PARADIGMS	6
TABLE 2: THE DEVELOPMENT OF THE INTERNET.....	41
TABLE 3: TECHNOLOGY USE AND ITS POTENTIAL IMPACT ON THE QUALITY OF LEARNING.....	68
TABLE 4: SIX FUNCTIONS OF A WEB-BASED TEACHING MODEL COMPARED TO CONTEMPORARY TEACHING	73
TABLE 5: WWW SUPPORT OF KEY TEACHING ACTIVITIES	76
TABLE 6: SUPPORT FOR REQUIREMENTS IN WWW BASED COURSES	93
TABLE 7: A SYNTHESIS OF ISSUES IMPORTANT IN WWW COURSES TO SUPPORT A STUDENT- CENTERED LEARNING ENVIRONMENT	95
TABLE 8: MAJOR TYPES OF RESEARCH DESIGNS	98
TABLE 9: STEPS IN THE PASSIVE RESEARCH PROCESS	99
TABLE 10: EXCLUSION OF RESPONDENTS FROM ANALYSIS.....	110
TABLE 11: NO. OF RESPONDENTS WHO HAVE USED WWW FEATURES IN THEIR COURSES.....	118
TABLE 12: GROUPS OF HIGHEST AND LOWEST SCORING RESPONDENTS	121
TABLE 13: T-VALUES, DEGREES OF FREEDOM AND LEVEL OF SIGNIFICANCE FOR QUESTIONS IN SECTION C	122
TABLE 14: T-VALUES, DEGREES OF FREEDOM AND LEVEL OF SIGNIFICANCE FOR QUESTIONS IN SECTION D	123
TABLE 15: STATEMENTS IDENTIFIED OF HAVING A SIGNIFICANCE (OR P VALUE) LESS THAN 0.05 FROM SECTION C OF QUESTIONNAIRE	125
TABLE 16: STATEMENTS IDENTIFIED OF HAVING A SIGNIFICANCE (OR P VALUE) LESS THAN 0.05 FROM SECTION D OF QUESTIONNAIRE	127
TABLE 17: ALPHA VALUES TO TEST INSTRUMENT RELIABILITY.....	129
FIGURE 1: THE PUBLIC MANAGEMENT MODEL	28
FIGURE 2: METHODS CONTINUUM	85
FIGURE 3: DATA FLOW FROM RESPONDENTS (FOR SECTIONS C & D OF QUESTIONNAIRE) TO STATISTICAL PHASE	115
FIGURE 4: LEVELS OF USE OF WWW FEATURES	119
FIGURE 5: A COMPARATIVE SURVEY OF WWW USAGE.....	133



CHAPTER ONE

INTRODUCTION

"As the information revolution gathers yet more pace and strikes deeper roots, it is already redefining our understanding of the world."

(Mandela, 1998)

The first president of the new era of democracy in South Africa, Nelson Mandela, aptly captures the broad impact of the "*information revolution*" on Southern African society. In particular the recent rapid advancements in information and communication technologies (especially Internet and World Wide Web technologies) are also redefining the way courses are delivered in the education arena.

1.1 BACKGROUND OF THE STUDY

Every public institution is created to provide specific products or services, and for the provision of each product appropriate functions have to be performed (Cloete, 1994:236). The delivery of education is one of the functional activities of government (Cloete, 1994:238). Such a functional activity takes place within a broad environment. Fox et al. (1991:4), in proposing a *Public Management Model*, identify computer technology as a "supportive technology and technique". This study examines the roles of computer technology, specifically

the World Wide Web (WWW), as a supportive technology for the delivery of courses in the tertiary education environment.

Given the present climate of change in South Africa, and the concomitant policies of National Government to implement transformation, the traditional methods of education delivery has come under the spotlight. The following sub sections provide a brief background of the emergence of World Wide Web (WWW) technologies as a means of delivering courses and an overview of the national policies that underpin the utilisation of technology for education delivery.

1.1.1 EMERGENCE OF THE INTERNET AND WORLD WIDE WEB (WWW) FOR TEACHING AND LEARNING

When the United States Department of Defense created ARPANET in the 1960s (Starr, 1997:8), it was not envisaged that by the turn of the century it would be transformed into such a dynamic communication medium (Peffer & Bloom, 1999¹).

¹ *Note on referencing material from Web Sites:* Where information has been electronically obtained from Web-sites, no page numbers are provided, since these would only be available in the original printed texts.

The Internet and more recently the World Wide Web (WWW) have impacted not only on commerce and industry, but there are strong indications that it is in the process of changing the way that tertiary education is delivered (Appelbome, 1999). The WWW is a means of delivering programs on-line, and Pilgrim and Creek (1998:189) argue that it has the potential to significantly change the face of higher education. There is a growing trend amongst teaching staff to use the WWW to increase access to effective instructional materials in a variety of ways (Kinzie et.al., 1996:59); (Oakman, 1997:33-34)) and to support course instruction (Duchastel, 1997). The emergence of the Internet as a new technology in our tertiary institutions, is also redefining the methods we employ in teaching, research and in communications between teachers and students (Pather et. al., 1998:2). Higher education is facing a paradigm shift of historic proportions (Barnard, 1997:30). It is argued that the way "we obtain education in the late 1900s and early 2000s will be shaped inter-alia, by converging computer and communication technologies" (Blissmer, 1996). Koutoumanos et al. (1999:2079) argue that contemporary educational systems have many drawbacks. They point out that conventional universities have been denounced for the constraints they impose on the time and place of instruction delivery. They propose that the introduction of computer-mediated communications and computer networks in the traditional education process of universities have enormous potential. In the education domain the integration of information and communication technologies is inevitable and the future of education in the

Information Society depends on its successful incorporation (Camacho, 1998:266).

1.1.2 SOUTH AFRICAN EDUCATION POLICY

At a national level, there is no separate policy that specifically deals with the implementation of emerging communication technologies like Internet and WWW in Higher Education. The need for the implementation of new technologies become evident after examining the broad transformation goals for Higher Education outlined in the *Green Paper on Higher Education Transformation* (1996) and the *Education White Paper 3: A programme for the transformation of Higher Education* (1997).

The South African National Ministry of Education, in 1996, published the *Green Paper on Higher Education Transformation*. The aim of the National Ministry was to bring higher education in line with world trends (Cronje, 1997) by calling for the following:

- **Open and flexible programmes**, concentrating on resource-based learning, that are modular and credit-based with multiple entry and exit points, are advocated within a range of delivery methods.
- **Horizontal and vertical mobility** will be facilitated by incorporating adequate routes of articulation, including flexible entry and exit points in the higher education system.

- **Intermediate qualifications** within multi-year qualifications are envisaged leading to a ladder set of certificates, diplomas and degrees.
- **Integration of academic development** approaches in mainstream programmes will be encouraged.
- **The focus in the curriculum** should be on South Africa as a developing and modernising African country in a period of transition.
- **Increased access** should lead to improvement of throughput and completion rates.

In 1997 the government published *Education White Paper 3: A Programme for the Transformation of Higher Education*. It outlines policy for the transforming structure, qualifications framework, admission and language policy (South Africa, 1997).

In the forward of this White Paper, the South African Minister of Education in 1997, Professor S.M.E. Bengu, states that

“...the higher education system must be transformed to redress past inequalities, to serve a new social order, to meet pressing national needs and to respond to **new realities and opportunities**” (South Africa, 1997).

The Education White Paper 3 outlines numerous goals to meet these new realities and opportunities. Of the ten goals it sets out to achieve, it outlines the following in respect of learning:

"To promote the development of a flexible learning system, including distance education and resource-based learning based on open learning principles." (South Africa, 1997).

This strong support for resource-based learning based on open learning principles, is a crucial first formal step that shifts our focus away from traditional teaching approaches. It is also a means of giving effect to outcomes-based education which has one of its fundamental aims making teaching more learner-centred (Malan, 1997). It suggests a shift in educational paradigms, as described by Oakman (1997:33) in Table 1. This shift is underpinned by broad technology implications. The World Wide Web supports each of the technology implications outlined by Oakman.

OLD MODEL	NEW MODEL	TECHNOLOGY IMPLICATIONS OF NEW MODEL
Classroom lectures	Individual exploration	Networked PCs with access to information
Passive absorption	Apprenticeship	Requires skills development and simulations
Individual work	Team learning	Benefits from collaborative tools and E-mail
Omniscient teacher	Teacher as a guide	Relies on access to experts over networks
Stable content	Fast-changing content	Requires networks and publishing tools
Homogeneity	Diversity	Requires a variety of access tools and methods

Table 1: Changing Educational Paradigms (Oakman, 1997: 34)

Resource-based learning is defined by the South African Institute on Distance Education (SAIDE) as the move away from the teacher as the source of knowledge/information to the teacher as the facilitator of learning from resources (SAIDE, 1997). This definition is corroborated by Forsyth (1997:193) whose findings indicate that there is evidence that a change is taking place which involves placing students and technology, rather than instructors and curricula, at the centre of educational practice. Further, there is an increasing focus on computers because of a trend to gradually shift towards a more student-centred approach in education and a more individualized approach to learning in all its forms (Zandvliet & Farragher, 1997: 423).

In order to give effect to this aspect of policy (outlined in the White Paper) the National Department of Education is actively engaged in promoting **technology-enhanced learning** in South Africa. It has initiated a five-year strategic plan, through the National Centre for Educational Technology, to build an infrastructure to support technology-enhanced learning (South African National Department of Education, 1997). This plan defines technologies to support the provision of course materials to learners as being "made up of predominantly of the wide range of information and communications technologies: from the printed book and other printed materials to television and radio to multimedia computers and the Internet" (South African National Department of Education, 1997).

1.2 JUSTIFICATION FOR THE STUDY

Given the background of government policy, outlined in the preceding subsection, it becomes imperative that South African institutes of higher education begin to take active steps to implement their programmes using resource-based learning methods in a technologically rich environment. A wide range of information and communications technologies are outlined in the Department of Education's strategic plan (Department of Education, 1997). This study will essentially investigate the Internet, and more specifically World Wide Web (WWW) technologies.

According to Ip and Canale (1996) the World Wide Web is the best candidate to provide an integrated open system of learning. Further there is increased usage of this medium in our education system for teaching and learning (Appelbome, 1999; Cronje, 1999; Greening, 1998: 24; Kinzie et al., 1996: 61; Oakman, 1997: 34; Pather et al., 1998: 2) and there is a growing trend to use WWW technologies in education (Koutomanos et al., 1999: 2079; Rosenblum & Healy, 1996; Casey, 1998: 51). Mayes (1994) highlights the claim that the use of WWW leads to student-centered learning and enhances the teaching and learning process (Wells & Anderson, 1997: 96).

The research referred to in the preceding paragraph, is an indication that the use of WWW technologies is gaining ground as a significant means of course delivery and further it supports the growing trend towards student-centered and

resourced-based learning. In this regard, this study on WWW for course delivery is justifiable since it is both relevant and deals with a topic that is fairly recent and warrants investigation.

A pilot study that was conducted by the researcher in the first quarter of 1999 indicates that WWW technologies are being used mainly to support courses, rather than as a fully-fledged course delivery tool (Pather & Erwin, 1999). Further, an intensive literature survey reveals that thus far there has been no research undertaken on the status of WWW usage for course delivery at tertiary institutions in South Africa.

1.3 OBJECTIVES OF THE STUDY

The main objective of the study is to investigate the usage of World Wide Web (WWW) technologies for course delivery at South African Universities.

Within this investigation the study, specifically, aims to:

- ❑ *Provide an overview of the experiences of practitioners in the higher education arena in using Web-based technologies.*

Both the problem-areas as well as positive aspects of Web-based teaching will be reviewed in Chapter Three. Specific emphasis is placed on the benefits of using the WWW to support student-centred learning;

- ❑ *Establish the extent of usage of Web technologies for course delivery at South African Universities currently and in the immediate future.*

The areas of usage focussed on are adapted from an international survey conducted by Rutgers University, USA (Peppers & Bloom, 1999);

Finally, the study aims to *promote the use of WWW as a technological tool to improve the education delivery system by*

- ☞ *Highlighting how the WWW can be used to support student-centred learning.*

1.4. RESEARCH METHODOLOGY

The research methodology consisted of the following:

1.4.1 Literature search

A literature study was undertaken of available texts, which included relevant books, journals, dissertations, official publications, conference proceedings, and the WWW. A study was also undertaken of fourteen papers and reports (see Chapter Four), using expository research (see Melville & Goddard, 1996:5) to analyze and synthesize all points of view in order to generate new sights.

1.4.2 Data collection and analysis

A non-experimental, survey method (see McMillan & Schumacher, 1993:31; Grover, 1998) was used to collect data using a structured questionnaire. The questionnaire was aimed at collecting data in respect of:

- WWW features in past, current, and future use;
- Problems in the implementation of WWW courses; and
- Issues in the design of WWW courses (only questions listed in 6. and 7. of section D of the questionnaire, pertaining to learning-styles and features to support student-centred learning, is utilised in this study).

Statistical analysis of the data involved the use of item analysis, inferential and descriptive statistics. Chapter Five provides a more concise description of the data collection and analysis methodologies employed in this study.

1.5 LIMITATIONS OF THE STUDY

The limitations of this study have been identified as follows:

1.5.1 Sample Size

Altogether thirty-seven questionnaires were received (thirty eight per-cent of the hard copies sent out and seven electronic returns). Thirty questionnaires were used for analyses (See Table 10 in Chapter 6). The relatively small sample of 30 respondents has been a hindering factor in administering statistical analysis.

Whilst the researcher has taken great care to ensure correct statistical treatment of the data, McMillan & Schumacher (1993: 343-344) point out that in cases with a small sample size it is difficult to find a significant difference when doing item analysis (Item analysis was used in the statistical treatment of the data). As an indicator of the problem of the small sample size, Emory and Cooper (1990:221) advise that when doing item analysis there should be at least 25 persons in each of the groups being compared. This study only used a total of nine (top 30% and bottom 30% of aggregate scores) respondents in each of the groups. This indicates that the sample was inadequate by at least 64%.

1.5.2 Sample Bias

According to Melville & Goddard (1996:30), a sample is said to be biased if it represents only a specific subgroup of the population or if particular sub-groups are over or under-represented. Due to the nature of sampling employed by this study, the majority of the thirty respondents used in the survey were from the Computer Science (CS) and Information Systems (IS) disciplines. The sample therefore was biased. Unfortunately the responses from non-CS/IS lecturers were very poor.

1.5.3 Method of Sampling

To identify lecturers who were using WWW for course delivery was difficult. Questionnaires were sent electronically, via the WWW and also given out as hard copies to eighty lecturers. The method of sampling used was non-probability sampling (also called convenience or availability sampling) (McMillan & Schumaker, 1993: 160). One of two major limitations of this method according to these authors is that the sample is not representative of a larger population, so generalizing is more restricted. Thus greater caution is necessary in generalizing the results. The second limitation is that such a sample may be biased. This has already been discussed in the foregoing paragraph.

1.5.4 Problems with the Web-based questionnaire

The researcher used a Web-form to attempt to reach as wide as possible an audience. This posed two problems. Firstly, some respondents indicated via Email that the host server was not online when they attempted to access the relevant Web-page. This was due to maintenance work on the server on which the Web-form was hosted. Moreover, several questionnaires were returned successfully, but unfortunately with no data in it. A possible reason for this was the use of incompatible browsers by certain respondents.

1.6. OVERVIEW OF THE STUDY

The study is divided into seven chapters. Chapter One demarcates the field of the study and provides the background and motivation of the study. It includes a formulation of research objectives and study goals. The research methodology is briefly outlined. The limitations of the study are discussed and finally key terms used in the study are presented.

Chapter Two provides a conceptualisation of higher education service delivery within a public administration framework. Two models of public administration and management are presented, and the study is placed in the context of the relevant aspects of these models.

Chapter Three provides an overview of the use of Web-technologies. A brief history of the Internet and how the WWW evolved from it is presented. The scope of this study, vis-à-vis WWW technologies, is demarcated. This chapter then draws on the experiences of higher education practitioners internationally and to a lesser extent locally to give some insight to the positive contribution that Web technologies have made to teaching and learning as well as the problems that have been experienced.

Chapter Four, places in context, more concisely, the study of WWW by referring to national policy documents viz. the Education White Paper 3 and the national

policy for Technology-Enhanced Learning in South Africa. Thereafter pertinent reports on the use of WWW for course delivery, to support student-centered learning that were identified in the literature survey are presented. Finally, the important issues from these reports, relevant to student-centered learning are synthesized and presented as a summary.

A description of the research methods employed in this study is outlined in Chapter Five. The design of the questionnaire and the statistical methodology applied in its analysis are also described.

Chapter Six provides details of how the survey was conducted. The responses of the survey and the results of the statistical analysis are presented.

The results of the survey that were outlined in Chapter Six are discussed in Chapter Seven and several recommendations are made. Firstly, a discussion of the current and future status of Web-technologies for delivering courses at local universities (Section A of questionnaire) is provided. The current status is also compared with the results of a similar international survey. This is followed by a discussion of the factors that affect the implementation of Web-based courses (Section B of questionnaire). Lastly, issues critical for consideration in the design of Web-based course, that are relevant to student-centered learning (Section C of questionnaire) are discussed. Finally, this chapter provides some insight into possible future work as a result of this study.

1.7 CLARIFICATION OF KEY CONCEPTS

It is important for the purpose of this study to provide definitions and explanations of key concepts.

1.7.1 World Wide Web (WWW)

Oakman (1997:5) defines the WWW as :

The most popular part of the Internet today, a method of storing and distributing materials in several media over the network so that it can be viewed with browser software on a personal computer.

December & Randall (1996) define the WWW as:

The Web is a world-wide repository of linked information known as hypermedia, and incorporates text documents that allow for graphic, audio and video elements to become links to other documents or multimedia elements.

This study investigates the use of the WWW for course delivery at tertiary institutions. A distinction is made between the WWW and the Internet. The reference to the WWW in this study is specifically that service provided by the Internet as described above.

1.7.2 Internet

O'Brien (1997: 128-133) provides the following description of the Internet:

...the largest networks of networks today, and the closest model we have to the information superhighway of tomorrow. The Internet (Net) is a rapidly growing global web of thousands of business, educational, and research networks connecting millions of computers and their users in more than 100 countries to each other.

He further explains that:

*...most local area networks are eventually connected to other LANs or wide area networks to create **internetworks**.*

Oakman (1997: 2) defines the Internet as:

The largest network of interconnected computers in the world and the most common name for the Information Superhighway.

Campbell & Campbell (1995) define the Internet as:

A large interconnected network of thousands of networks from around the world.

The Internet is not the focus of this study. However, the proliferation of the Internet since the early 1990s was due to the development of the Internet. It is therefore necessary to note the distinction between the Internet and the WWW.

1.7.3 Network

Blismer (1996: 150) describes a network as:

A group of computers and other devices connected by communication facilities in which information is processed and communicated in the form of sound, data, and images over common media.

Oakman (1997: 232) provides the following definition of a network:

A group of computers or other devices, like printers, connected to form a system that can communicate with each other directly through a physical link.

The existence of the WWW is as a result of a networked environment. All the features of the WWW discussed in this study, only exist because of the physical

network structure. The clarification of a network is therefore important in this study,

1.7.4 Web-based teaching and learning

Koutoumanos et al. (1999:2080) define a Web-based educational system as one that:

...is created on the World Wide Web to support learners and teachers in performing instructional related tasks via computer mediation.

This study deals with teaching via the WWW. Web-based teaching is the use of WWW facilities to deliver courses and Web-based learning describes the learning experiences of the student in this environment.

1.7.5 Hypertext

Donellan (1997) describes hypertext as follows:

They create an association between a word or icon on the screen and a separate document (which could be on another Web site).

McKeown & Watson (1996: 8) describe hypertext as

...a method of linking related information in which there is no hierarchy or menu system. In terms of documents, hypertext involves reading one document on the computer screen, finding a keyword of interest, clicking on that keyword... and automatically being switched to another document that provides more information on that keyword.

Hypertext is the basis on which the WWW is organized. This concept is clarified here to provide an understanding of the concept of linking of Web-pages as several references is made to it in the study.

1.7.6 HTML (hypertext mark-up language)

Polyson et al. (1996) define HTML as follows:

HTML can be regarded as the programming language of the Web. All Web documents are created using HTML. The initial specifications for HTML were defined to provide platform-independent viewing and enable files to be viewed by any computer under any operating system.

A clarification of HTML is important, as it is the principal language used in documents on the WWW to code appearance and create hyperlinks.

1.7.7 Synchronous and asynchronous communication

Erwin & Blewitt (1996:608) point out that two common ways to co-ordinate the transfer of data between source and destination computers in a network are synchronous and asynchronous transmission.

In this study synchronous communication refers to two-way communication in which the sender and receiver are both online and can receive data simultaneously, e.g. chat-rooms. Asynchronous communication refers to two-way communication in which the sender and receiver do not have to be online at the same time, e.g. E-mail.

CHAPTER TWO

HIGHER EDUCATION SERVICE DELIVERY WITHIN A PUBLIC ADMINISTRATION FRAMEWORK

2.1 INTRODUCTION

The basic values and principles governing public administration, in South Africa, is enshrined in Chapter 10 of the Constitution, Act 108 of 1996 (South Africa: 1996). The core of public administration is the basic services that are provided to the public and included *inter-alia*, education, health, defence, police services and housing.

The objective of this Chapter is to place this study in a conceptual framework within the Public Administration paradigm. In attempting to locate education delivery (specifically delivery of courses in higher education) within a Public Administration framework, it is necessary to review dominant models in Public Administration and assess their relevance to the delivery of education and more specifically to the use of the WWW.

2.2 DELIVERY OF HIGHER EDUCATION COURSES WITHIN THE CONTEXT OF PUBLIC ADMINISTRATION

In order to determine the focus of the study within the discipline of Public Administration, the following two dominant approaches are discussed:

- the generic administrative process model, and
- the public management model.

2.2.1 THE GENERIC ADMINISTRATIVE PROCESS MODEL

South Africa, as is the case with every other state, has an intricate network of public institutions. These institutions exist to provide public goods and services. For the creation, maintenance and operation of the public institutions a variety of activities, also known as functions and processes, have to be carried out. These activities/processes/functions are collectively known as public administration (Cloete, 1991:50).

The generic administrative paradigm, advanced by J.J.N. Cloete, holds that Public Administration is a distinctive field of study comprising all the functions undertaken by officials in public institutions in the provision of public services and goods to the community (Cloete, 1994:57). These functions, also referred to as processes or activities, are classified into four main groups (Cloete, 1994:220):

- a. generic administrative and managerial;
- b. auxiliary;
- c. instrumental; and
- d. functional, also referred to as line functions.

Cloete (1994: 236) asserts that every public institution is created to provide specific products or services. For the provision of each product or service appropriate functions have to be performed. This means that every public institution is identified and characterised by its functional activities (also known as line functions).

Although no meaningful classification of the functional activities of public institutions has yet been devised, Cloete (1994: 238) argues that because there is such a variety of these activities, it is advisable to classify these activities for study purposes. Cloete (1994: 238-241) classifies nine functional activities:

- Maintenance of Law & Order
- Protection functions
- Education Services
- Health Services
- Regulation and protection of labour affairs
- Agriculture, Forestry and Water Affairs
- Transport
- Economic functions

- Public Works and land affairs

Thus every institution has a functional field of work. For example, the National Department of Education's functional field of work is to provide education. To enable it to perform its unique functional activities, a public institution (e.g., a state department or parastatal institution) must, with the performance of the generic administrative functions, be provided with policies to be implemented and essential requirements such as finance, personnel, organisational structures and work procedures to give effect to the policies (Cloete, 1994:241).

From the foregoing, the delivery of courses at tertiary institutions, in terms of the generic administrative approach to public administration, can therefore be viewed as one of the means of achieving the objectives of a functional activity viz., provision of education.

2.2.1.1 Shortcomings of the generic administrative model

While the generic administrative approach of public administration has established itself as a predominant approach to the Theory of Public Administration in South Africa, recent challenges have been made to the generic process approach (Pillay, 1997:16). One of the challenges of the generic administrative approach is that no clarity exists as to how officials

should apply or interpret the functions in particular circumstances (Hanekom & Thornhill in Gildenhuis, 1988:75).

Pillay (1997:16) argues a further criticism of the generic approach in that the environment within which management structures and functions operate is not given high priority. According to Fox et al. (1991:18) significant modern management applications such as organisational development and strategic management, which are important components of the public management model, would require a proper analysis and assessment of the environment.

More serious criticisms of the generic administrative process approach lie in the areas of reductionism, reification and relevance (Schwella, 1999: 334). These criticisms of Schwella are paraphrased by Groenewald (1992: 68-71) as follows:

- Reductionism, which reduces the complexity of public administration to merely the administrative process and therefore the administrative functions of policy-making, organising, financing, personnel provision and utilisation and control.
- Reification, by elevating theoretical constructs and concepts to the level and status of reality, thus elevating one approach, being the generic administrative process, to the status of reality.

- Relevance, where it is clear that the generic administrative approach was lacking in relevance because it did not reflect the serious problems in the systems of governance and administration in the South Africa of the past. As the approach is systematically biased towards internal aspects of bureaucracy rather than the relationships between the system of public administration and its complex societal environment, it will also not reflect on present and future problems in South African Governance and administration in a critical way.

In view of the criticisms levelled at the generic administrative process, it is therefore necessary to examine the delivery of higher education within the context of a more recent model i.e. the public management model.

2.2.2 THE PUBLIC MANAGEMENT MODEL

Fox et al. (1991:2), in advocating an open systems approach, define public administration as:

- *"that system of structures and processes,*
- *operating within a particular society as environment,*
- *with the objective of facilitating the formulation of appropriate governmental policy, and*
- *the efficient execution of the formulated policy."*

This definition stresses the importance of the environmental context, politics and policy, policy execution and management. In defining public administration in this way Fox et al. (1991:2) differentiate between public management and public administration. The latter is much wider in scope than the former. Public management is only a part of public administration and these authors advocate that care should be taken not to reduce public administration to public management (Fox et al., 1991:2).

The Public Management Model shown in Figure 1, on the following page, accepts the fundamental premises of the contingency approach to management. The contingency approach is based upon open systems theory and stresses the importance of the environment for the theory and practice of management. Public management functions and public managerial skills should be constantly assessed in terms of the public management environment (Fox et al, 1991:4).

2.2.2.1 Components of the Public Management Model

The components of the above model are described by Fox et al. (1991: 5-4) as follows:

a. The public management environment

The public management environment consists of general and specific components. The general component includes the political, economic, social,

cultural and technological aspects of the environment. The specific environment includes suppliers, regulators, competitors and consumers.

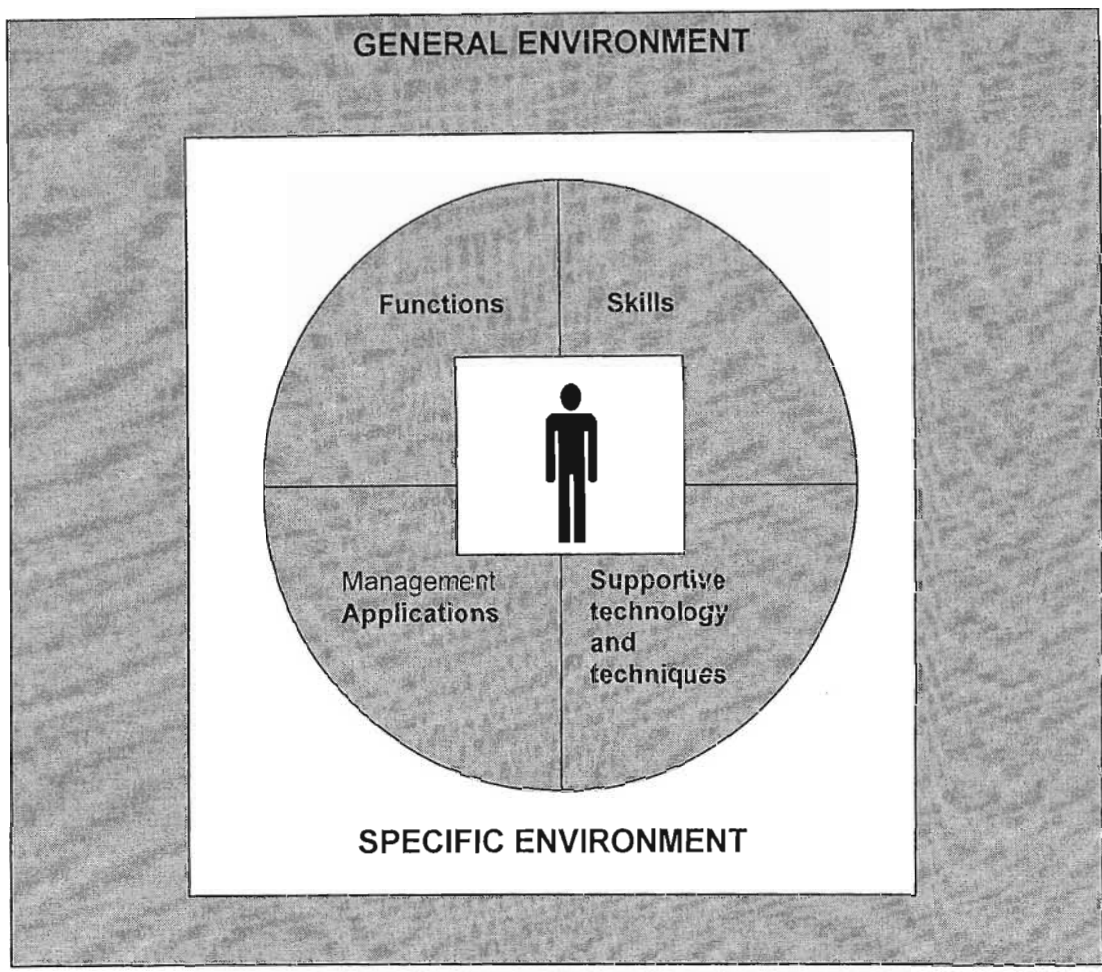
From the foregoing, the general environment, in respect of education, is the National Ministry of Education, the various stakeholders, the various constraints facing the country and tertiary education generally, and national policies for the transformation of higher education. The specific environment would refer to students, staff, and industry with links to tertiary education.

b. The public management functions

These refer to the ongoing concerns of the public manager, and serve to conceptualise the management tasks. Some of the functions listed are policy-making, planning, organising, leading and control.

c. Public management skills

Public management, like management generally, is a professional and practical effort at reaching objectives efficiently. The professional public manager requires skills in competent decision-making, constructive negotiation, the successful management of change and skilful bargaining.



GENERAL ENVIRONMENT				
Political	Social	Economic	Technological	Cultural

SPECIFIC ENVIRONMENT			
Suppliers	Competitors	Regulators	Consumers

FUNCTIONS	SKILLS	APPLICATIONS
Policy making Planning Organising Leading Control and Evaluation	Decision-making Communication Management of Change Management of Conflict Negotiation	Policy analysis Strategic management Organisation development
		SUPPORTIVE TECHNOLOGY & TECHNIQUES
		Computer technology and information management Techniques for public management

Figure 1: The Public Management Model (Fox et al, 1991:4)

d. Applications for public management

The dynamic environment of public management presents a host of daunting challenges. Developments in this environment have provided numerous systematic applications to assist the practising public manager in the execution of his functions and skills. These are the functions of policy-making, planning and organising.

e. Supportive technology and techniques

In exercising the public management functions and skills, public managers can be assisted by using available supportive technological aids and techniques. The Public Management Model encompasses computer technology and information management in this component.

2.3 THE RELATIONSHIP BETWEEN PUBLIC ADMINISTRATION AND THE DELIVERY OF COURSES AT TERTIARY INSTITUTIONS USING THE WORLD WIDE WEB

The preceding sub-sections reviewed two dominant models in public administration. The following outline how these models are relevant to a study on the use of WWW for course delivery at South African tertiary institutions.

2.3.1 The Constitution of the Republic of South Africa

The Public Management Model distinguishes five functions in the public administration environment. Policy-making is one of these five functions. The supreme law of most democracies (which can also be regarded as the supreme level at which policy framework is entrenched) is its constitution. South Africa's Constitution contains a Bill of Rights, which outlines the following in respect of education:

"Every one has the right to ... further education, which the state, through reasonable measures must make progressively available and accessible" (South Africa, 1996).

Therefore at the level of the Constitution, there is an indication of the state's responsibility in respect of providing higher education. Service delivery (in respect of education) by the state through public administration is both a consequence of and integral to the rights of its citizens (Freysen, 1999: 26) as enshrined in the Constitution.

2.3.2 Delivery of courses as a functional activity

Cloete's (1994) generic administrative model of public administration highlights five processes of public administration. Of these the functional activity (or line functions) of public administration fall into nine areas. The provision of education has already been identified as one of nine functional activities of public administration. The methods used to deliver education is a means of carrying out this functional activity.

In light of the foregoing, this study is of importance to Public Administration since it investigates a new way of providing education. It is an investigation into an approach of enhancing the manner in which a functional activity such as education is delivered to the citizens of the country.

2.3.3 The WWW for delivering education within the Technological Environment

The Public Management Model, espoused by Fox et al. (1991) is an important model in that it takes into account the environment in which public management occurs. In the context of this study, the general environment, as already indicated, would include the Ministry of Education, the various stakeholders, the various constraints facing the country and tertiary educational institutions generally, national higher education policies (e.g., the White Paper for the Transformation of Higher Education) and national transformation initiatives.

The specific environment refers to suppliers, competitors, regulators and consumers. These would include all tertiary institutions, donors, students, staff and organisations in South Africa with direct links to tertiary institutions.

Of particular relevance to this study, is the technological environment which is listed amongst the various "general environments". Indeed, in this age of rapidly advancing technologies, especially various information and communication technologies (such as the WWW), the technological environment is becoming increasingly significant in all spheres of life, including that of public management.

Bearing testimony to the importance being leveled at the role of new technologies within public administration, is the recently established Commonwealth Network of Information Technology for Development (*COMNET-IT*). There is recognition by COMNET-IT that information and communication technologies are powerful tools for the development of particular domains, such as Public Administration, Education and Commerce (*COMNET-IT*, 1999). On a broad level, the opportunities that advancements in Information Technology have brought about for the public service include concepts such as one-stop services, integration of functions, public and business interaction with government via electronic media and data sharing across agencies.

The importance of emerging technologies in the field of education is captured by the Commonwealth Secretary General, Chief Emeka Anyaoku, who, in a forward of a COMNET-IT publication states that

"...information and communication technologies (ICTs) are also essential instruments in the informatisation of society, and are making an increasing contribution to education - ultimately the hallmark of a country's achievement in multiple areas of endeavor and the key to the effective management of a nation's resources" (Anyaoku, 1999:5).

The South African public system, in delivering education to its consumers cannot ignore the role that emerging technologies have to play. Hodge & Anthony (1984:66), (in Fox et al., 1991:20) view technology as the use of machinery and processes to produce and distribute goods and processes. The "machinery" in the context of this study is the WWW and associated technologies, and the "goods" are the delivery of courses to students in the higher education arena.

2.4 ETHICAL NORMS GOVERNING THE PROVISION OF HIGHER EDUCATION USING WWW TECHNOLOGY

Public administration is recognised as a distinctive field of work because of the requirement that those who practise public administration (i.e. the political office-bearers and public officials) have to respect specific guidelines that govern their conduct when carrying out their work. These guidelines which are derived from the body politic of the state and the prevailing values of society, are the foundations of public administration (Cloete, 1994:56).

The '*basic values and principles*' governing public administration as enunciated in the Constitution of the Republic of South Africa (Act No. 108 of 1996), are in essence the founding principles of the guidelines referred to in the preceding paragraph. Some of these guidelines contained in the Constitution, relevant to this study are:

- A high standard of professional ethics must be promoted and maintained;
- Efficient, economic and effective use of resources must be promoted;
- Public administration must be development oriented.

With the advent of computer networked environments, a number of ethical issues has arisen. A number of authors have debated whether the information revolution has brought on an ethical crisis e.g., (see O'Brien, 1997: 483). Whether a crisis exists or not is not important. What is important is that these

ethical issues are taken into consideration when network technology like the Internet and WWW are used to deliver education.

Some of the ethical issues that have arisen as a result of the information revolution are privacy, accuracy, property rights, and access (Martin et al., 1994:703). Consequently issues that could arise in the design and implementation of Web-based courses could include:

- **Privacy:** To what extent does the lecturer assume ownership of the networked environment in a teaching department? Should a lecturer be able to open any file created and saved by a student, or should access be limited only to work specifically submitted for assessment. Are students made aware of the extent to which their electronic work is private? On the other hand who is responsible if a student gets hold of test questions, or other private information by hacking into a lecturer's computer?

The issue of privacy, therefore, is one which may not normally be on the planning agenda of a lecturer implementing a Web-based course. It is therefore important, that such courses, incorporate features that ensure the integrity of both the students' and the department's work. (See Table 7 in Chapter Four).

- **Property rights:** The world of electronic information makes available a host of information to the student and academic after just a few keystrokes at a computer with an Internet connection. There has to be strict control over plagiarism, since electronically transferred information can so easily be pasted into a document and passed off as one's own.

Therefore, course instructors should make referencing of Uniform Resource Locators (or Web-site addresses), a stringent pre-requisite for all submissions. Another alternative, which is only possible in Web-based intranet situations is to download information for a class onto the server of the local area network, and to then bar access to external Internet locations.

- **Access:** To what extent does an academic who utilises WWW technology to deliver courses, have to ensure that the students are well equipped to access the course? What information does a student or department have a right or privilege to obtain, under what conditions, and with what safeguards?

Given the South African situation, a large number of students come from backgrounds that make them technology illiterate (Shear, 1998:138). An institution that offers courses, utilising technology like the WWW, would therefore be disadvantaging these students, and would possibly be violating the constitution of the country. One would therefore argue, that these students need to be provided with the necessary skills in a bridging course, before actually commencing with the Web-based course.

- **Accuracy:** Who is responsible for the authenticity and accuracy of information? Similarly, who is to be held accountable for errors in information?

Just as a lecturer would be responsible for the content of course material printed and distributed to his/her students, so too would the lecturer be responsible for content he/she publishes on the Web server of an institution.

The following advice offered by Descy (1997:51-52) could to some extent, alleviate some of the problems listed above: "In light of the fact that there is no real privacy, both lecturers and students need to be made aware of how the Internet operates and what its limitations are. Users should be aware that once they venture the world of cyber space, there is a good chance that their every move is being watched and recorded". Students and academic staff alike, must also be aware that each Internet user is responsible for assessing the accuracy of information published on the Internet, since according to Descy (1997:52), anyone can pose as an expert; anyone can pretend to be a reliable source. As long as lecturers and students understand the rules that govern the Internet, they should be able to minimize the risks associated with it and use it to its fullest capacity.

Finally, it would be important to bear in mind the following ethical principles, as espoused by O'Brien (1997:487), when implementing any form of technology:

- a. **Proportionality.** The good achieved by the technology must outweigh the harm or risk.
- b. **Informed consent.** Those affected by the technology should understand and accept the risks.
- c. **Justice.** The benefits and burdens of the technology should be distributed fairly.
- d. **Minimized risk.** Even if judged acceptable by the preceding three guidelines, the technology must be implemented so as to avoid all unnecessary risk.

2.5 SUMMARY

The study of the use of WWW for course delivery at South African tertiary institutions has been placed in context within the field of public administration. Two models of public administration have been discussed. The relevance of the broad education function and a method for its delivery viz., use of WWW technologies, to the two models have been shown. Lastly, the ethical norms that govern the delivery of education using WWW technology have been discussed.

CHAPTER THREE

THE EVOLUTION AND PERSPECTIVES OF THE WORLD WIDE WEB

3.1 INTRODUCTION

The history of the development of the WWW and the Internet are presented in this Chapter. Thereafter a distinction is made between the WWW and the Internet so as to place in the correct context, the role of the WWW in terms of the global network, the Internet. This is followed by an overview of the broad field of WWW, and the ambit of this study is demarcated. The last two sections highlight important benefits and problems associated with the use of the WWW for teaching and learning, that were reported in the literature survey.

3.2 HISTORY OF WWW TECHNOLOGIES

The WWW is one of the services offered on the Internet. Interestingly, the concepts Internet and WWW appear to cause some confusion, as many people think that they are synonyms. Jawadekar (1998: 14) affirms this notion.

This study deals specifically with WWW technologies, which is actually one of the services on the Internet (Starr, 1997:7). Sections 2.1.1 and 2.1.2 hereunder, outline a brief history of the two technologies and highlight how the WWW evolved from the Internet.

3.2.1 Evolvment of the Internet

Although the rapid growth of the Internet only began in the late 1980s, it is actually a by-product of the Cold War (Galbreath, 1997). Table 2, outlines the growth of the Internet, from the period in which it was conceived as a result of a military objective, to its present stature of an international system of global communication:

Time period	Events
1960s	<ul style="list-style-type: none"> The United States Department of Defence (USDoD) created the Advanced Research Project Agency Network (ARPANET). ARPANET began as an experiment in reliable, decentralized networking, linking the DoD with military contractors and universities funded to conduct military research.
1970s	<ul style="list-style-type: none"> In the 1970s additional North American Universities and research bodies joined the network. In 1973 the first European organisations were connected. In the same time period, Bell Labs' UNIX began to rise to prominence as a solution for networked computing. Eventually, a second network, called MILNET took over military traffic, while European (EUNET) and Japanese UNIX networks became established. In Europe, the United Kingdom set up the Joint Academic Network (JANET). 1974 was a crucial year, as this was the beginning of work on TCP/IP by Vinton Cerf and Robert Kahn. By 1997 there were 100 hosts on ARPANET.
1980s	<ul style="list-style-type: none"> In 1986, the US National Science Foundation set up NSFNET, which linked five US university supercomputer centres. This was a major milestone in the development of the Internet. The TCP/IP protocol was established for ARPANET. This conversion to TCP/IP was completed by the end of 1983 and the Internet was born. Late in the 1980s, several US and foreign networks were becoming interconnected, thus forming what is now known as the Internet. The name server was developed at the University of Wisconsin. By July 1989 there were 130 000 hosts on the Internet.
1990s	<ul style="list-style-type: none"> Arpanet discontinued. By 1997 there were 16.1 million hosts on the Internet.

Table 2: The development of the Internet

(Sources: Galbreath, 1997; Donellan, 1997; Rosenberg, 1997; Wendell, 1997; Mayr, 1999).

Growing out of subsidized defence and education networks, the Internet today, is one of the fastest growing technologies in the world. It can be simply defined as a global interconnection of networks, with a universal addressing scheme allowing real-time, computer to computer, location-independent communication and information exchange. This definition can be further defined as any network running TCP/IP (Transmission Control Protocol/Internet Protocol) (Jawadekar, 1998: 514).

3.2.2 Evolvement of the World Wide Web (WWW)

The European Laboratory for particle physics (Centre Europeenne Pour La Recherche Nucleaire -CERN) is the place where the WWW was born (Zacharova, 1999). It was originally developed only for world-wide communication for physics researchers. The driving force behind the development of the WWW was Tim Berners Lee who wrote the first WWW client and the first WWW server and defined standards such as URL, HTML, and HTTP while working at CERN. The WWW was released by CERN in 1992 and the number of Internet hosts then broke the 1 million mark (Mayr, 1999).

HTML, which was the new hypertext protocol for the Internet could communicate graphic information on the Internet. An individual could create graphic Web pages (a Web site), which then became part of a huge, virtual hypertext network called the WWW (Wendell, 1997).

3.2.3 Important distinctions between the WWW and the Internet

Starr (1997: 7) describes an important distinction between the Internet and WWW in the following way:

"The Internet is an unorganized collection of networks that includes local area networks, dedicated computer lines, telephone lines and satellite links. The World Wide Web is the global network of hyperlinked, multimedia documents on the Internet. It is one of several services on the Internet, easily the most glamorous, and largely responsible for the tremendous increase in Internet users".

The WWW differs from other Internet applications that are primarily text-based in that it encompasses not only text, but also hypertext, graphics, sound and multimedia. The incorporation of a point and click graphical interface and a simple markup language for document development has made the Web an appealing tool for student-centred research and discovery (Quinlan, 1997:15). It is the multimedia capability of the WWW that sets it apart from other Internet-based applications.

Hypertext is the basis on which the WWW offers a user navigational functionality. Campbell & Campbell (1995:25) offer the following overview of the development of hypertext: Documents developed for the Web follow the hypertext model, which allows the selection of highlighted text to transport you to either a new section of the text or a brand new document. Hypertext itself is

not new. It was first touted as a solution for the Information explosion in the 1960s and was later popularized in the Macintosh environment with the introduction of a software program known as HyperCard, which allowed users to construct their own hyper text applications easily. The Web introduces these hypertext features for text data stored on Web servers. In fact the Web goes beyond hypertext and could more properly be called a hypermedia tool since it supports video, graphics and audio. The exact capabilities available to you when you use the Web depend on the browser or viewer you use to access Web documents.

Clearly from the exposition, the WWW is a subset of a larger network, the Internet. Further, its evolvement has brought about a new communication means via the global network, since it supports a the use of multiple platforms with multimedia capabilities.

3.3 General Applications of the WWW

A number of different services have developed over the years to facilitate the sharing of information between the many sites on the Internet. Because the Internet was originally research-oriented, many of these services were difficult to use and poorly documented. Now that the Internet has been opened to commercial and private sites, new services are being developed that are easier to use, and new interfaces to the older services make them more friendly (Wendell, 1997).

The introduction of the WWW, in particular has made the use of the Internet popular. Four years after the Web (World Wide Web) came into being, it has become one of the most popular services on the Internet (Crossman, 1997:26). Its exponential growth is an indication of its popularity. In 1995 there were 15 million hosts on the Internet and by 2000 this would increase to approximately 101 million (Maddux & Johnson, 1996:5).

There are a number of applications of the WWW, some of which are Commerce, Entertainment and Leisure and Information Resources (Bishop *et al*, 1996). Singh (1999: 1) identified the following sub-categories into which these application can further be broken down:

❑ Commerce

- ◆ Banking and Financial Services, e.g. Standard Bank (www.standardbank.co.za) and MasterCard International (www.Mastercard.com);
- ◆ Commercial Guides and Virtual Shopping e.g. High Street Directory (www.highstreet.com) and Online Bookstore (www.amazon.com); and
- ◆ Employment Services, e.g. The Personal Concept (www.personal.concept.co.za).

☐ Entertainment and Leisure

- ◆ News, e.g. CNN Interactive (www.cnn.com) ;
- ◆ TV and Radio, e.g. SABC (www.sabc.co.za);
- ◆ Electronic Magazines, e.g. The Economist
(www. enews. com/ magazine/economist/);
- ◆ Sport, e.g. South African Rugby Football Union (www.sarfu.org.za/);
- ◆ Travel, e.g. Airlines of the Web
(www.haas.berkeley.edu/%7Eseidel/airline.html);
- ◆ Music and Films, e.g. The Internet Movie Database
(www.cm.cf.ac.uk/Movies/);
- ◆ Books, e.g. Juta Books (www.juta.co.za); and
- ◆ Games, e.g. Emulation Excitement (www.emux.com).

☐ Information Resources

- ◆ Universities, colleges and schools, e.g. University of Durban- Westville
(www.udw.ac.za);
- ◆ Libraries, e.g. public libraries with Internet services
(www.halcyon.com:80/treasure/library.html);
- ◆ Encyclopaedias, dictionaries and thesauri e.g. Britannica Online
(www.eb.com);
- ◆ Science and Technology, e.g. SCI-TECH (www.cnn.com/TECH/);
- ◆ Arts and Humanities, e.g. The Complete Works of Shakespeare
(<http://the-tech.mit.edu/Shakespeare.html>);

- ♦ Governments, e.g. The South African Reserve Bank
(www.resbank.co.za); and
- ♦ International Organisations, e.g. United Nations (www.un.org/).

In addition to the applications identified above, the WWW is increasingly playing an important role in the education arena.

3.3.1 Applications of the WWW in education

There are various issues involving the WWW and the field of education, that have possibilities for investigation. At a conference on WWW applications in September 1999 at the Rand Afrikaans University in Johannesburg, South Africa, the following areas were topical issues in the field of education:

- Outsourcing Web site development and maintenance;
- Task analysis of the Webmaster;
- Educational intranet;
- Web monitoring techniques;
- Search engine technology;
- Using the Web for research;
- Web-based marketing of institutions;
- The Web as a medium for course delivery.

This study focuses on the use of the Web in the area of course delivery. This entails various aspects, *inter-alia*, the development of instructional software, management issues, installing and maintaining Web-servers and networks, designing of interfaces, maintaining security of the electronic environment, and the development of Web-based courses. The primary aim of the study is to examine how educational practitioners in the higher education environment develop Web-based courses to support student-centered learning.

The following sections will provide an overview of the broad advantages Web-based courses offer the educational environment, as well as the problem areas and pitfalls. Thereafter, in Chapter Three, the issues concerning student-centered learning are considered.

3.4 OVERVIEW OF REPORTED BENEFITS OBTAINED FROM THE USE OF THE WWW FOR COURSE DELIVERY

This section reports on the experiences of various educationists who have had experience in utilizing WWW technologies for delivering their courses. The literature survey draws from the broad field of experiences in a variety of disciplines internationally and locally.

3.4.1 Cross-platform distribution

The universal environment that the WWW provides has created opportunities to make available educational software systems that have historically been tied to a particular type of computer and operating system (Boroni et al.,1997: 199). See also Kinzie et, al. (1996: 61) and Wade & Power(1998: 243-244). Course instructors using the Web do not have to worry about separate versions of a course for different computers as materials delivered via the WWW can be distributed over many platforms with ease (Starr, 1997:9).

3.4.2 Ease of updating and expansion

The Web allows a course instructor to easily update course materials, and expand existing courses. New information can be uploaded as quickly as it can be typed into the correct format, producing instructional materials that may be years ahead of text-books (Starr, 1997:9). See also (Ip & Canale, 1996:6).

Clearly the course instructor using the Web as an instructional delivery mechanism has a distinct advantage as compared to relying heavily on the use of printed material. Printed material dates quickly, whereas Web affords "a feasible opportunity to produce courses more quickly and flexibly (Carswell, 1998: 49). See also Duchastel & Spahn (1996: 1); Saltzberg & Polyson (1996); Greening (1998).

3.4.3 Delivery of multimedia

The WWW differs from other Internet applications that are primarily text-based. It encompasses not only text, but also hypertext, graphics (including animation), sound, and video (Quinlan, 1997:15; Starr, 1997: 8). This ability of the WWW to support different types of media (i.e. multimedia) sets it apart from other educational technologies.

Ng (1994), in Greening (1998: 28) found that greater informational content served by the use of Multimedia was well received by students (see also Bronkhorst, 1997:142). Ellis (1998: 279) describes how multimedia and Web materials can be used to support and extend the presentation of content and teaching in a C programming course.

3.4.4 Interactivity

The advent of Java and other similar languages enable true interactive instructional transactions on the Web and, according to Duchastel & Spahn (1996) will most likely reshape the field of instructional software.

Starr (1997: 8), points out that with the use of WWW technologies, true interactivity goes beyond static Web pages and page linking, and creates truly interactive pages with information exchange between the user and the server. He further points out that forms are one way in which the user is able to transfer data to a web server, and that Common Gateway Interface (CGI) scripting can

be utilized to program responses back to the user. The use of CGI to make Web pages dynamic and interactive is also supported by many other Web designers, e.g. Shoecraft (1996).

3.4.5 Access to experts

WWW courses that allow learners to access links to external sources make communication with various individuals, news and discussion groups, a simple task. Collis (1999) provides a good example of such a course at the University of Twente, where students were provided with guided collaboration with external experts. These students were able to write chapters in assignments by working collaboratively with experts on the subject, by asking questions via Email and other WWW facilities such as Newsgroups.

3.4.6 Testing

The issue of maintaining the integrity of tests is one of the major objections to the use of the Web for this purpose (see Sub-heading 2.4). If, however, the technology is used to test under supervised conditions then there are some benefits. For example, Zandvliet and Farragher (1997: 426) found that there were advantages when using the Multiple Choice Questioning. Test items can be stored in large data banks and these could then be selected randomly or by specific characteristics. This allowed variety in the testing situation. Further, they found that the use of a computer environment allowed ongoing analysis

and editing of test items, as well as the possibility of tailoring the difficulty levels of different tests to a particular student group. The study also showed that the ability to provide an immediate feedback on test scores was a frequently listed advantage by the sample group (Zandvliet & Farragher, 1997: 430).

There are, however, more recent developments in Web technology that improves the way tests are conducted. One such example is the *Tutorial Gateway* which is a filter for a CGI compliant HTTP server that makes it easier to develop tutorial style questions and have them presented by a Web browser (Ip and Canale, 1996). *See full text for further information of Tutorial Gateway and its benefits.*

3.4.7 Ease of use

The WWW interface (point and click) presents an easy to use course instruction medium (Quinlan, 1997:15). Besides being easy to use for the learner, the creation of course materials is not so difficult with the multitude of Web-authoring tools now available, e.g. Web course in a box (see Saltzberg & Polyson, 1996). Instructors do not have to have expertise with HTML coding. Many of the earlier technical and logistical challenges have been solved by new software products designed to make it easier for instructors to create, serve and administer online courses (Polyson et al., 1996).

3.4.8 Use of frames, image maps and tables

A study by El-Tigi & Branch (1997: 25) found that frames, image maps and tables optimize information presentation to better represent the way we learn. *Frames* offer the ability to have multiple screens and allow for multi-dimensional access to separate document sets. *Image maps* can be varied in size to manage screen space and downloading time. They also are colourful and attractive and allow the user to keep track of his/her navigation. A *table* is a two dimensional matrix formed by intersecting rows and columns. Tables provide an organizational structure and are multi-dimensional in application.

3.4.9 Multiple communication facilities

The WWW offers the instructor various means of communication. Saltzberg & Polyson (1996) identified the following: Email, Discussion groups (see also Joliffe, 1998: 81), and Chat Rooms. Other communication facilities are Question and Answer Board using Javascript (see Cook, 1998: 36), and video-conferencing (Rosenblum & Healy, 1996).

3.4.10 Support of student-centred learning

There is increasing support for the use of the WWW to support student-centered learning, incorporating constructivist approaches (see Greening, 1998; Berge, 1997). This benefit of the WWW is dealt with in detail in Chapter Three.

3.5 REPORTED PROBLEMS ASSOCIATED WITH THE DELIVERY OF COURSES USING WWW

There is often a misconception that the use of technology in a teaching environment results in problem free courses in which the technology takes care of all the hiccups. Like any other technology, the WWW has advantages and disadvantages. Implementations that capitalize on the strengths and added value of the technology and that circumvent or adjust for its limitations, can be expected to be successful in terms of learning outcomes (Hiltz (1995), in Koutoumanos (1999:2082). This section reports on some of the issues that have presented difficulties for higher education practitioners who have implemented Web-based courses.

3.5.1 Difficulty of Tertiary Educators adapting to Web

Claeys et al. (1997: 146) report that teachers are reluctant to adopt new technologies as they are afraid of losing power in the classroom and even of becoming redundant in the learning process. See also Spitzer (1998:53) and Camacho (1998:266).

Duchastel (1997) asserts that the business community as a whole is aggressively developing new business processes through the use of intranets (e.g., Sprout, 1995:161; Tapscott, 1995), leveraging the real potential of web technologies, and taking in stride and building on the enterprise restructuring that is entailed by these process improvements. He contrasts this business

attitude with that of a university community. The latter is struggling to understand the implications of the web phenomenon. Furthermore, the university community has much difficulty in acting timeously in re-examining its functional processes and developing new ways of doing things, yet alone restructuring.

3.5.2 Management issues

Various reports (Claeys, et al, 1997; De Marco & Lister, 1987; Spitzer, 1998, Sherry & Morse, 1995) show that it is imperative that where new courses based on the use of technology such as the WWW are introduced, management needs to give serious considerations to the following:

- Human resources: Investment in proper training and sourcing of technical support;
- Financial:
 - ☞ Procuring of funds for equipment, maintenance and upgrading;
 - ☞ Funds for development of course material;
 - ☞ Training of staff;
 - ☞ Financial needs on the part of the student (especially distance students) for use of an Internet connection (Ip & Canale, 1996).
- Management of space and infrastructure;
- Providing flexibility of the instructors duties to accommodate the work involved in maintaining a Web-based course.

3.5.3 Availability of Bandwidth

Ip & Canale (1996) identified bandwidth as a problem for the dynamic updating of courseware. When the student is connected via a relatively low speed modem, the wait for a multimedia file to download and then play can be frustrating.

Other experiences also indicate that insufficient bandwidth could pose serious problems, e.g. Wade & Power (1998), Cronje(1999), Guruwitz (1998).

3.5.4 Multi-media environment and lost in "hyperspace" effect

One of the reasons that the WWW is being increasingly considered as a tool for course delivery, is its ability to offer the course instructor multi-media capabilities with ease (see Starr, 1997:8; Quinlan, 1997:15). However Greening (1998:30), cites Atkins (1993), who issues a warning that the interactive multi-media environment may be more desirable to students on the basis of its fancy trimmings than its learning benefits. This problem then creates the possibility for the student to "detract from serious academic inquiry" (Quinlan, 1997: 16) and may also "rob" the student of search time (El-Tigi & Branch, 1997:25).

In situations where students have to access external links that support content provided by the institution, instructors are also cautioned about enticing Web-sites which attract students. Quinlan (1997:21) describes how students in her

institution ended up printing schedules of basket-ball games instead of investigating the task set out. Further, the ease at which hypertext provides links to other Web-sites can very quickly ensure that a student does not suffer from a "lost in hyperspace" effect (Ng, 1994 in Greening, 1998:28).

3.5.5 Unfamiliarity of entry level students with technology

Thompson et al. (1998, 177-179) argue that if universities are to deliver courses electronically, and do it effectively, the user has to be familiar with the medium's interface. Their research, however, has indicated that first-year university students - whether school leavers or mature age- are surprisingly ignorant of the scope and use of a range of communications technology (Anwyl, 1996; Burmeister & O'Dwyer 1996). Further, interfacing with various media is a daunting experience for first year students and so much more energy is spent on mastering the interface, that it interferes with the learning of new content (Thompson et. al, 1998:179).

3.5.6 Use of the WWW to administer tests

The use of the Web's interactive facilities make the administering of tests a viable option. There are problems that the course instructor should be aware of. This is especially problematic where students share the same computer centre and may follow each other in consecutive sessions to complete a Web-

based test. Starr (1997:9) highlights the following problems in such an environment:

- The user has control over many display features on the screen and can override the designer's settings;
- The status line at the bottom of the screen displays the pathway and filename of the linked page, when the cursor passes over the link. Thus for example, when a student passes over an answer choice, he/she notices that the link is to a file called 'Error.htm' and thus realises the obvious consequence.
- When users are sharing a computer, they have a clear idea of the links chosen by previous users, since links change colour when accessed.

Other problems that need to be addressed in non-institution based testing situations (i.e. administering tests to distance students) is ensuring the integrity of a remote student. It is often difficult to determine that it is actually the bona-fide student at the remote end, and this makes testing over a distance a serious challenge.

3.5.7 Lack of guidelines

Duchastel (1997: 221) contends that models of instruction that are appropriate for the Web is "sorely lacking". This is also corroborated by Maddux & Johnson (1997:6) who identified a scarcity of design guidelines as being partly responsible for the great diversity of quality in Web-based instructional material.

They suggest that whilst there are many sources for general Web page design, there are very few publications for design of education-based material.

3.6 SUMMARY

This Chapter presented an overview of the WWW and presented a brief history of the Internet and the evolvement of the Web. A clear distinction was made between the latter and the former.

The general applications of the WWW were outlined, and the uses of the Web in the domain of education were briefly highlighted. This provided a demarcation of this study within the broad field of WWW. Of the various roles of the WWW in education, the use of the Web for course delivery was identified as being the focus of this study.

Finally, the reported advantages and disadvantages of using WWW technologies for course delivery were presented. The next Chapter, will examine in greater detail, the role of the WWW in student-centred and resource-based learning.

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CHAPTER FOUR

THE APPLICATION OF THE WWW TO SUPPORT STUDENT-CENTRED, RESOURCE-BASED LEARNING

4.1 INTRODUCTION

Chapter One provided a brief motivation for the study of WWW for the purpose of course delivery in a resource-based learning situation. This Chapter will place in context, more precisely, this study of the WWW by referring to National policy documents, viz. the Education White Paper 3 and the national policy for Technology-Enhanced Learning in South Africa. Thereafter, pertinent reports on the use of WWW for course delivery, to support student-centered learning identified in the literature survey will be presented. Finally the important issues from these reports, relevant to student-centered learning are synthesized and presented as a summary.

4.2 TRANSFORMATION OF THE NATIONAL HIGHER EDUCATION SYSTEM

The National Government's vision to transform the higher education system in South Africa is entrenched in the Education White Paper 3, *A PROGRAMME FOR THE TRANSFORMATION OF HIGHER EDUCATION* (South Africa, 1997). Ten goals, which are "key targets and outcomes that should be

pursued in implementing the transformation strategy" (South Africa, 1997) are outlined in the White Paper. In particular Section 1.27 states that the transformation policy should aim "To promote the development of a flexible learning system, including distance education and resource-based learning based on open learning principles" (South Africa, 1997). Section 2.57 further articulates the need for resource-based learning as follows: "...resource-based learning, based on the principles of open learning, have a crucial role to play in meeting the challenge to expand access, diversify the body of learners, and enhance quality, in a context of resource constraint. They enable learning to take place in different contexts, at a multiplicity of sites, at the learner's own pace, using many media and a variety of learning and teaching approaches". Section 2.63 states more specifically that in order to meet the challenges of providing such an education system the Ministry of Education "is committed to help harness the new teaching and learning technologies, especially through its technology enhanced learning initiative (*TELI*)".

From the foregoing it is evident that one of the pillars on which the transformation of the higher education system in South Africa is based is the provision of a **resource-based learning system, that promotes student-centered learning using new teaching and learning technologies.**

4.3 WWW: A NEW TEACHING AND LEARNING TECHNOLOGY TO PROMOTE RESOURCE-BASED EDUCATION

The TELI initiative, quoted in the White Paper is a key area of focus to promote resource-based learning. It is presently being co-ordinated by the Department of National Education's Directorate of Distance Education, Media and Technological Services, in the Centre for Educational Technology and Distance Education. They presently have in place a policy document, which outlines a broad five-year strategic plan which will serve as the basis for implementing the Department of Education's policy on the use of technologies in education and training (Department of Education, 1997).

The policy document entitled "*TECHNOLOGY-ENHANCED LEARNING in SOUTH AFRICA: A STRATEGIC PLAN*" states that there is a number of possible technologies to support the provision of course materials to learners. It further states that "these technologies are predominantly made up of a wide range of information and communications technologies: from the printed book and other printed materials to television and radio to multimedia computers and the Internet" (Department of Education, 1997). It is therefore in this context that the WWW, which is one of the fastest growing services on the Internet (see Chapter Three), is being investigated.

4.4 RESOURCE-BASED LEARNING

Sub-heading 4.2 above, makes several references to *Resource-based learning*. In Sub-heading 4.3, the WWW is identified as one of the technological means of promoting resource-based learning.

The National Department of Education has identified that the introduction of resource-based learning is already emerging strongly in the 1990s as more 'contact' institutions (including universities and colleges of education) are becoming 'dual-mode' institutions, offering both distance and face-to-face education programmes. In addition to this the Department has found that resources developed for 'distance education' programmes are now being used in many 'contact' programmes. This trend is a result of the emergence of new communications technologies, which allow for much easier and cheaper production and dissemination of knowledge, through various media (Department of Education, 1997).

The Department of Education outlines its interpretation of resource-based learning as follows: "In essence, the notion of resource-based learning means that a significant but varying proportion of communication between learners and educators is not face-to-face, but takes place through the use of different media as necessary" (Department of Education, 1997).

Quinlan (1997:22) defines resource-based learning as an environment in which "the teacher must become the navigator of student learning, leading students through bits and pieces of information that students combine into unique, ever changing images and transform these into a new kaleidoscope of knowledge".

4.5 STUDENT-CENTRED LEARNING AND THE WWW

The White Paper for the transformation of higher education clearly spells out the shift towards student-centred learning. There are various sources that assert that the use of computer technology, more specifically the Internet is one way of achieving this (see Means & Olson, 1995; Claeys et al., 1997; Greening, 1998:23). Negroponte et al. (1997) (in Lerner, 1997), from the Massachusetts Institute of Technology, argue that digital technologies can enable students to become more active and independent learners: The Internet will allow new "knowledge-building communities" in which children and adults from around the globe can collaborate and learn from each other. Computers will allow students to take charge of their own learning through direct exploration, expression, and experience. This shifts the student's role from "being taught" to "learning" and the teacher's role from "expert" to "collaborator" or "guide." See also McIsaac & Blocher (1998: 43-44). These ideas are an integral part of constructivism.

Constructivism is both a theory of learning and a strategy for education. It builds on the "constructivist" theories of the child psychologist Jean Piaget, and asserts that knowledge is not simply transmitted from teacher to student, but rather is actively constructed in the mind of the learner (Lerner, 1997). This theory suggests a strong connection between doing and learning: It asserts that activities such as making, building, and programming provide a rich context for learning (Resnick, 1997:3). Instruction within the constructivist paradigm typically involves active learning, peer tutoring, collaborative learning (Murphy et al., 1997:24), and involves the learner actively constructing an internal representation of knowledge by interacting with the material to be learned (Sherry, 1996:338). See also Cohen, 1997; Brooks & Brooks, 1993.

The WWW provides a medium that is readily accessible (both physically and in terms of its skill requirements) and potentially well aligned to the tenets of constructivism. This suggests that it will play a prominent role in the development of computer-assisted constructivist learning environments (Greening, 1998:28). This is also corroborated by Brandt (1997:112) who avers that constructivism is an essential basis while applying the WWW for teaching and learning.

In the same way that people have grown to understand the importance of diversity in an ecological system, we need to understand the importance of diversity in educational systems. In order to allow students to take more

responsibility for their learning we must allow them to place concepts into personally meaningful contexts. Students retain more information and have more fun learning when material is presented in this way. Computers make these meaningful contexts possible by providing students with highly individualized education (Resnick, 1997:3).

Though it is not exclusive to the WWW, simulation is another important application of computer technology. According to Shank & Cleary (1995:76) computer simulation allows students to explore phenomena that would otherwise be too expensive or too impractical for the classroom. Simulations are effective because they provide a guiding context for students to integrate what they learn. They learn details in the context of a larger task and are not faced with decontextualized facts that have no relevance to their lives or goals.

A summary of the impact that the WWW has on the quality of learning is provided by Claeys (1997: 145). In a study on the use of Information and Communication Technologies Claeys' outlines four broad uses of technology and its potential impact on the quality of learning activities:

ACTIVITIES	IMPACT ON QUALITY OF LEARNING
<i>Acquisition of knowledge</i>	
<ul style="list-style-type: none"> • collect information (cognitive development) • structure and analyse information, quantitatively and qualitatively • problem solving • simulations • remembering experience 	<ul style="list-style-type: none"> • enhances knowledge construction • skill-based learning • problem-oriented learning • changing the emphasis from content to the ability to build on and tackle new situations
<i>Teacher-oriented activities</i>	
<ul style="list-style-type: none"> • educational games • tutorial software • drill & practice 	<ul style="list-style-type: none"> • continuous activity • adaptation to the student's rhythm of learning • improves concentration
<i>Communication of knowledge (synchronous & asynchronous)</i>	
<ul style="list-style-type: none"> • create and perform presentations • internet • email 	<ul style="list-style-type: none"> • development of creative talent • creating a community of learners • sense of belonging
<i>Collaborative working with multimedia and Internet</i>	
<ul style="list-style-type: none"> • project research in groups • cross curricular activities, thematic approaches • networking with different cultures • sharing information 	<ul style="list-style-type: none"> • enhancement of teamwork • sharing information • development of social skills • bringing structure into attitude and behavior of student

Table 3: **Technology use and its potential impact on the quality of learning activities** (Source: Claeys et al., 1997:145)

4.6 OVERVIEW OF SELECTED STUDIES HIGHLIGHTING THE ROLE OF WWW TECHNOLOGIES TO SUPPORT STUDENT-CENTRED LEARNING

Thirteen international and a South African study on the use of the WWW will be presented hereunder. The studies have been specifically selected to highlight the role of the WWW in supporting student-centered learning and the tenets of constructivism highlighted in the previous Sections.

4.6.1 STUDY ONE: A Virtual Classroom Model

Saltzberg & Polyson (1996) advocate the use of the Web either as a Course Supplement Model or a Virtual Classroom Model. In the former the lecturers and students meet in the traditional classroom where the lecture is delivered whilst lecture notes, assignments, calendars, course syllabus, and other related materials are made available to students via the WWW. In this model much of the instruction continues to be delivered synchronously, and some asynchronous components are added, e.g. Email communication between instructors and students.

In the Virtual Classroom Model, Saltzberg & Polyson (1996) have found that there are a growing number of institutions that are moving beyond a basic information delivery model for the WWW. Virtual classrooms are being developed where courses and entire degree programs are delivered in whole

and in part over the WWW. Components of such course delivery systems include the following (elucidation of each of the components are from the Saltzberg & Polyson (1996) studies of Web-based courses :

- **Online lectures and instructional materials.** A web page can incorporate hypertext, images, sound, video, animation and the delivery of binary versions of spreadsheets, presentations and other documents. For example, the instructor can make available a PowerPoint presentation or an Excel Spreadsheet from a Web Page, and it can be viewed at every student's desktop; and this capability is transparent (the 'download' from the web server to the desktop occurs at the click of a button).
- **Interactive multimedia textbooks.** The Web allows for the creation of textbooks that integrate images, video and sound, and other binary files. These textbooks can include hyperlinks to encourage exploratory learning, or can remain linear to provide more content control.
- **One-to-one communications.** Email between faculty and students can be integrated into the Web environment. The Web page allows email to be sent to other staff members and classmates, and a Pop Mail system can be integrated for reading email messages. In both cases, email can include attachments of any binary file (e.g., word processing files, spreadsheets, graphic images, and even sound and video files).

- **Access to remote systems.** Links on a Web page can provide access to library resources and other academic databases, which require a login sequence.
- **Asynchronous group communications.** The primary tool for interactive dialogue is provided by Usenet news/discussion groups (similar to Bulletin Boards). This asynchronous tool allows faculty to post assignments, students to submit homework, and groups to work collaboratively on projects.
- **Synchronous group discussions.** Chat areas are virtual meeting places where students and faculty meet both formally and informally to discuss assignments, or accomplish group projects. They offer a great way to simulate a brainstorming session where all participants are actually (rather than virtually) present.
- **Experiential learning.** This is accomplished by creating "virtual realities" where students and faculty can participate in role-playing and simulation exercises.
- **Course and content management.** The course's instructional content can be closely controlled, and involvement monitored using the flexible tools available on the WWW.
- **Online testing.** The Forms capability on the Web allows faculty to create and grade tests online.

- **Online assessment.** The capability of continually monitoring both the academic and technical abilities of the student can be built-in by establishing a standard query section.

It is evident that a significant benefit derived from these virtual classrooms is the creation of "**Student Centered, Collaborative Learning Environment**". This indeed is of relevance to a student-centered learning environment and the principles of constructivist learning. It was found that the learning models implemented on the WWW emphasize a student-centered environment and encouraged greater collaboration among students. Emphasis is placed on interactive problem-solving; the teacher is not just an expert, but increasingly takes the role of facilitator.

4.6.2 STUDY TWO: Case based on Nova South Eastern University

Duchastel (1997) presents four basic requirements for learning that are present in any instructional setting: information, interactivity, structure and communication. A Web-based model that sets out six functions that define an advantageous approach to web teaching is proposed. It is argued that a model for Web-based teaching is necessary, to break out of the traditional paradigm of "professor-centered" university instruction. These functions are presented in Table 4 and are contrasted with contemporary university teaching functions:

Web teaching	Contemporary teaching
1. Specify goals to pursue	Specify content to learn
2. Accept diversity of outcomes	Demand common learning results
3. Request production of knowledge	Request communication of knowledge
4. Evaluate at the task level	Evaluate at the knowledge level
5. Build learning teams	Work individually and in groups
6. Encourage global communities	Work locally

Table 4: Six functions of a Web-based teaching model compared to contemporary teaching

These six functions are described below:

- **Specify goals to pursue:** Learning efforts are based on wide ranging resources rather than one or few particular sources of information. This provides an information rich environment which is more appropriate to guide the students towards expected end-results and let them organize their learning on their own.
- **Accept diversity of outcomes:** It is generally accepted that diversity of outcomes exist at the institutional level. Web technologies contribute to the need to revisit traditional theory and accept that there will be diversity of outcomes at the course level. Duchastel contends that "professors often believe that one of their prime responsibilities lies precisely in specifying to their students what is important to learn and what is not". There has to be a new mentality that accepts that there will be more diversity in the specifics of what the students tackle and, therefore, in what they learn.

- **Request production for knowledge:** The intent of this model is to avoid the typical regurgitation of knowledge that is often the case in university courses where knowledge is assimilated during the term and then lost soon afterwards. The possibility that the vast information resources of the Web will magnify this problem, is rejected. Rather the production of knowledge in response to challenges arising out of open-ended questions is not only a guarantee that students will go beyond simple communication of knowledge, but also that they will better use the full potential of the Web in studying.
- **Evaluate at task level:** The assessment approach should move away from standard testing and allow for diversity and production. This is best achieved by aligning evaluation not with knowledge, but with task accomplishment that utilizes knowledge.
- **Build learning teams:** With much broader access to learning resources and dispersed information on the Web, and with an accent on production of knowledge rather than simple assimilation of it, it would seem natural to move towards a mode of operation that is team-based rather than individual or large group-based. This is especially so if the tools are available to support collaborative work.

- **Encourage global communities:** Given the dispersed nature of information on the Web, and of knowledgeable or inquiring persons, it becomes possible to forge links with external person-resources in the pursuit of educational goals. This brings the classroom outside the confines of the institution and deepens the diversity of perspectives that can be made use of in tackling some domain of knowledge.

4.6.3 STUDY THREE: A Constructivist perspective of a WWW environment

A study by Greening (1998) explores the Internet and the WWW from a Constructivist perspective. McClintock (1993), cited in this study (pg. 27), highlights the following educational advantages that are derived from networked environments such as the Internet and WWW:

- the asynchronous nature of communications facilitate collaborative activities without threatening individual autonomy;
- increased accessibility;
- access to resources, increasing the likelihood of generating spontaneous projects.

Greening's study (1998:28) highlights the benefits of the presentation of lecture notes on the WWW, with suitable internal links. These were well received by

students, who found them easy to use, containing greater informational content by virtue of their use of multimedia.

The use of hypermedia (the WWW is based on Hypertext which supports the transfer of different media) leads to student-centred learning Mayes (1994: 2) in Greening (1998: 28).

4.6.4 STUDY FOUR: Case based on the University of Twente, Netherlands

Collis (1999) found that the Web was able to support fundamental aims , of what she calls a " being a good teacher". This study was based on the experiences at the University of Twente, which according to Collis (1999) was one of the "pioneers in the use of WWW as a course environment". (See Table 5).

ASPECTS OF BEING A GOOD TEACHER	WWW SUPPORT
Communicating personally with ones students	Via E-mail forms made accessible via a Web-site.
Providing regular feedback and models of good practice for assignments	Via models answers and links to examples of previous students work
Keeping ones course up to date and stimulating	Via external links and new sorts of activities such as working collaboratively with students in another university.

Table 5: WWW support of key teaching activities (Collis, 1999).

Collis also used the WWW as an extended lecture, which is defined as "a lecture whose benefits begin before the lecture and last after the lecture, and where the actual lecture itself is improved, all through tele-learning techniques". The following is an outline of the role of the WWW in this respect:

- The use of a WWW site to present lecture notes, as interactive pages with links, before the class;
- During the lecture, it involves using this same WWW site to illustrate points with multi-media examples from other sources;
- After the lecture students interact individually with the links and resources in the lecture notes, for deeper study than possible in the lecture and with reflective communication added;
- After the lecture, students can supplement the lecture resources by adding material to the WWW site.

4.6.5 STUDY FIVE: Case based on a National Technical University of Athens project

Koutoumanos et al. (1999: 2079-2082) report on a project that commenced in December 1997 at the National Technical University of Athens (NTUA). This university committed itself to the introduction of distance learning as a complementary course delivery mode, in parallel with traditional teaching. In an investigation into the needs of the University they found that the following components were a necessity in courses that would use WWW for delivery:

- Information distribution, e.g. announcing tips of the day, calendar, glossary, etc;
- Management of learning material, e.g. customisation of the user interface to the needs of the teacher, updating the learning material, etc;
- Multiple communication facilities, e.g. asynchronous and synchronous communication for submission and return of students' work, group discussion.
- Class management e.g. on-line marking of students' assessments, tracking learners' participation, management of learners profiles, etc.
- Issues of privacy, security and authentication.

4.6.6 STUDY SIX: Case based on a University of Jyväskylä (Finland) project

Makkonen (1998), in a study of WWW learning environments, found that hypertext and WWW affects learning positively. In an Informatics course conducted at the University of Jyväskylä, the approach to the use of WWW for teaching and learning incorporated the idea of trails and guided tours on the WWW, which supported the constructivistic approach for learning. The lecture notes on the WWW were in the form of a slideshow incorporating Microsoft® PowerPoint 97 and its Internet assistant. Thus the notes were organised in a strict form of a guided tour. Additionally, each slide included a

set of hyperlinks to interesting WWW sites, and in this manner could be comprehended as a trail. Students were also able to support their learning by using search engines. The ability of the student to use these WWW lecture notes as either a guided tour or trail, according to Makkonen, enabled different views of the lecture for the student and brought about a constructivistic way of learning. The role of the instructional media (the WWW) shifts from one which seeks to maximise the communication of fixed/content and/or skills to one in which students engage in the knowledge construction process: Construct interpretations, appreciate multiple perspectives, develop and defend their own positions while recognising other views, and become aware of and able to manipulate the knowledge construction process itself (Makkonen, 1998: 163-164).

Printed lecture notes and conventional lectures took place in parallel to the WWW based lectures as a means of supporting behaviouristic learning, since it was felt that the students needed guidance at the beginning of learning. In addition, students had access to the lecturers during office hours.

4.6.7 STUDY SEVEN: University of Melbourne project

Ip and Canales' (1996) study of the *Baseline Requirements for an Online Education System* argues that the Web offers an excellent medium for content delivery. They further assert that a properly designed Web course offers

interactivity and student control over learning. The following key requirements of a Web-based course were identified:

- **Symbols:** Courses that rely on the use of symbolism e.g. Mathematics and Chemistry must be designed using later versions of HTML or Virtual Reality Markup Language.
- **Animation and interactivity:** The use of animated GIF (Graphic Interchange Format) files, Macromedia Shockwave for Director and Sun Microsystems for Java are cited as some of the means of including animation and interactivity.
- **Assessment:** Students learning is directed by assessment. Thus this is an important component of the online course.
- **Dynamic update of courseware:** Only one centrally controlled copy of the course is needed on a server.
- **Common focus for discussion:** The traditional chalkboard has always been a common focus for discussion in a normal classroom environment. Such a facility is essential in a Web-based course, where both lecturer and students can post public messages. A new release by Netscape™ called Atlas makes possible textual and graphical data conferencing, which is an example of a very powerful technology for real-time education delivery.

4.6.8 STUDY EIGHT: A guide to teaching on the Web

Polyson et al. (1996) caution course instructors not to lose sight of teaching goals as one goes about mastering the use of the technology. They advise that the unique features of the Web should be incorporated into the teaching environment. Instructors are urged to think beyond traditional classroom paradigms when creating online course material. They have identified the following Web-based learning paradigms:

- **Personalized learning environment :** The Web lends itself to student-centered learning. The hypertextual organization allows materials at different levels of detail or difficulty to be made available to students without imposing a pre-determined path for them to follow. Students can create individually tailored paths to master the desired goals, moving at their own speed and retrieving additional information as needed. Tracing mechanisms can assist developers/teachers in learning what kinds of links students most often use.
- **Collaborative learning:** Studies have shown that learners' profit immeasurably from environments which encourage shared learning. The Web presents an especially good environment for asynchronous collaboration in which students work together but not necessarily at the same time. Teachers of English composition, for example, have found that a networked writing environment provides an effective means to encourage

students to write more and to learn from one another. Academic departments in many disciplines have found that Web-based discussion forums can lead to fuller participation in class discussion by all students.

- **Multimedia presentation of content:** The Web is providing an increasingly rich variety of media through which to present learning materials, including exciting new options like streaming audio and video (e.g., RealAudio at <http://www.realaudio.com>). Animations, for example, now possible through browser plug-ins such as Shockwave, can give effective simulations of science experiments. Using a variety of media (text, graphics, audio, video) to present the material may also accommodate individual learning styles, and provide approaches for both visual and auditory learners.
- **Reinforcing content:** Organizing materials in a hypertext format allows for their integration into a variety of contexts. Interactive testing through HTML forms (processed by server-based CGI scripts) or client-side JavaScript enables self-paced learning, or the regular review of covered materials. Weighted values can be assigned to items in order to generate automatically recommendations for remedial work or more advanced study. Another web process for online drill and practice is through Authorware Shockwave applications.
- **Up to date information:** Not only do textbooks by necessity use a one-size-fits-all approach to learning, but in our fast moving world also tend to become out of date soon after publication. Web materials allow for easy

updating, although it is of course the content providers' responsibility to do so. In many fields access to recent research over the Web is becoming more and more a reality, through discussion groups, electronic journals and on-line conference presentations. We are not yet at the point at which a study in any field can rely solely on the Web as a research source, but the Web is becoming indispensable in ensuring that the most recent disciplinary discussions are consulted.

- **Global resources:** One of the marvels of the Web has always been the ease and transparency with which local and global resources are combined. Instructors can put their own materials online and link them to resources throughout the world. From the student's perspective both are just a click away. This offers the possibility of students consulting disciplinary experts' online contributions as easily as they read the course syllabus.

In order to support teaching pedagogy, Polyson et al. (1996) have identified the following important features in "good" Web learning sites:

- **The Online Syllabus:** An online course syllabus provides the instructor with a way to change course material easily, and the student with a complete and up-to-date picture of the course requirements. The format need not (and probably should not) duplicate the print version. Hypertext links to sample relevant disciplinary web sites may be helpful in giving

students (and prospective students) a sense of the disciplinary context for the course.

- **Assignments:** Here again the Web page listing homework assignment, upcoming events and examinations can be more interactive than the familiar print version. If some homework assignments, for example, are based on online materials, they can be directly linked to the class schedule.
- **Announcements:** To be effective announcements need to be read; for that to happen the students need to know when a new announcement has been posted. Alert boxes or running footers (using JavaScript) or a blinking link added to a page can let students know of new announcements.
- **Personal home pages:** Personal home pages can be used to foster the sense that the class is not just a collection of isolated individuals but a community of learners, who can profit from interacting with one another. Home pages encourage students to learn about each so as to encourage contact and mutual curiosity.
- **Interactivity:** Adding discussion forums and chat sessions to your online course is a common way to add an interactive component to a web-based course. There are many implementations of bulletin board and chat session software to choose from, but we recommend that you choose one that allows attachments (as an easy way of sharing files). A second method of interactivity is, of course, email. It's a good practice to have an

online list of all registered students (and the professor) with their email addresses.

- **Testing:** Online drill and practice or testing can be used to reinforce material even if not used as part of a grade. Reading comprehension questions, for example, in short answer or multiple choice formats can provide students with self-assessment of their level of understanding of the text.
- **Course management:** Software should be available to add/delete students from a course, assign user ids and passwords, create/edit homepages, and manage the interactive discussion groups (e.g., delete old or unnecessary entries, and archive topics).

4.6.9 STUDY NINE: Case based on a University of Maryland project

Berge (1997: 35-47) (Director, Training Systems, University of Maryland) outlines selected teaching methods to show a relative relationship along a teacher-centered to student-centered continuum (See Figure 2):

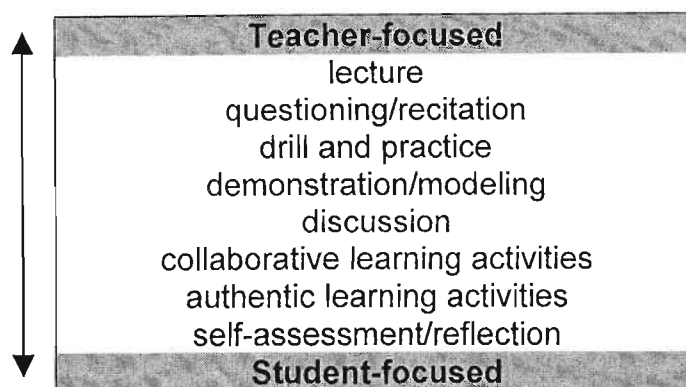


Figure 2: Methods Continuum (Berge, 1997: 38)

Berge asserts that online teaching is done through discussion, collaboration (an approach in which groups of students work together to solve a common problem), experiential learning (problem-based learning, inquiry and projects), and self-assessment or self-reflection (reflection on the learning and the processes used during learning). In other words online teaching leans towards student-focused teaching, or student-centered learning.

In a survey conducted among 42 tertiary educators using online methods for course delivery (mostly Web-based), Berge (1997:44-46) identified the following characteristics of Online Teaching:

- **Student-centered learning:** Courses were based on student-centered approaches. Predominantly, these were discussion, collaborative learning activities, and authentic learning activities, i.e. inquiry, problem-based activities, case studies, projects, peer critiques and support.

- **Collaborative learning environment:** There are two elements: The knowledge, experiences, language and culture of the students are valued and brought into the learning situation - there is shared authority among teachers and students. Secondly, students are invited to set specific goals for themselves, within the framework of what is being taught.
- **Self-Reflection:** Students are given a chance to reflect or assess their learning experiences, or the learning process in which they were involved.

4.6.10 STUDY TEN: Educational goals attained via use of the WWW

Dyrli & Kinnaman (1996) cited in Quinlan (1997: 16) identify the following fundamental educational goals that the WWW can help students achieve:

- developing strong basic skills;
- mastering core content;
- thinking critically and creatively;
- working collaboratively and cooperatively;
- using appropriate problem solving strategies;
- functioning as part of a global community; and
- making commitments to lifelong learning.

Quinlan advocates using the Web for the following:

- **As a tool for communication** to provide information about courses and assignments, and email tags to provide feedback or to post questions.
- **Subject-oriented resource guides** can be created by tailoring the wealth of information available to the specific needs of the students. Students can quickly find and use information relevant to their learning.
- **Communication with experts and access remote locations** to extend the learning experience beyond the student's immediate physical environment.

4.6.11 STUDY ELEVEN: Case based on a University of Pretoria (South Africa) course

Cronje (1999) in an assessment of a Web-based Master's degree course conducted at the University of Pretoria, made the following conclusions about the course:

- **Co-operative learning works well**, particularly in instances where students have had time to build a relationship of trust in the past.
- **Allowing students to define the scope of their own projects** works well. Comments from their peers are valuable. It may be necessary for the mentor to shape the project in terms of the size, as some students overestimate what can be done in three months.

- **A web site is a good place to store large quantities of information** for non-interactive purposes, while creating ownership by allowing students to add their own URLs contributes to the interactivity of a usually passive site.
- **An online discussion group works well** particularly when it is augmented by a lively forum such as *ITforum*. Students may not wish to air their views in public, but they might be prepared to discuss it with their classmates.

Cronje contends that in a Web-based course, the role of the presenter is to *guide* learners in the process of organising their learning, while at the same time allowing them to elaborate. This calls for a much more open design. The learner needs to be given more control.

The following principles of instructional design as set out by Merrill (1991), (in Cronje 1999) should be adhered to, and these characterize learning in a WWW environment:

- Learning is **constructed** from the experience of the learner.
- Interpretation is **personal**. There is no shared reality. Individual learners make different interpretations of the same material, based on their own previous knowledge, experience, etc.
- Learning is an **active process** whereby experience is converted into knowledge and skills. Learners should therefore not be “taught” but given learning tasks which they can only complete by acquiring certain knowledge and skills.

- Learning is **collaborative**, which means that it is enhanced by **multiple perspective**.
- Knowledge is situated in **real life** and that is where learning should take place.
- Testing should be **integrated** with the task.

4.6.12 STUDY TWELVE: Case based on Monash University (Australia) project

Ellis (1998:279) found that it was possible to make effective use of multimedia and the Web-based resources to support both educational objectives of the subject and the learning objectives of the student. . In a course involving teaching C Programming, at Monash University, Australia the following approaches were adopted:

- Provision of timely access to materials related to the subject - subject handbooks, assignment specifications, solutions to assignments and bulletin board type notices were provided via HTML Web pages.
- Provision of demonstrations (simulations) that cannot be done easily with more traditional means - complicated concepts such as functions and recursions were made available as simulations on the Web and as standalone programs.

- Provision of additional resources such as hyperlinked glossaries and question and answer sets in a way that facilitates easy access by the learner.

4.6.13 STUDY THIRTEEN: Open University, United Kingdom experience

Carswell (1998: 46-50) reports on the experiences of the Open University (OU) in the United Kingdom. It is argued from the OU experience that the Internet should not be used to just translate traditional materials and practices, i.e. "doing the same old thing but faster" (page 48). It is asserted that the OU should transform from existing practices not translate, if it is to exploit the Internet fully. Carswell identifies the following to be important in an Internet-based programme:

- **Discussion activity** which is part of the learning process enabling students to reconstruct information in their own world. Activities such as peer group learning, communication with others; group work and active learning should be supported. OU found that E-mail and conferencing are able to support such activity successfully.
- **Student administration** - the OU web-site was developed to include details of the Internet courses which support electronic queries and answers and allows online registration and enrolment of students using smart forms. This was a fast and effective means of capturing student

information electronically and was beneficial to students and administrators alike.

- **Assessment** was an area which was the biggest area of success. The courses had large-scale continuous assessment, which was fully electronic, paperless, and free of the usual bureaucratic form filling which usually accompanies distance assessment. They conducted smaller scale experiments with remote electronic examinations, which focused on the electronic delivery and return of the examinations using secure web-servers with traditional invigilation. Benefits were that students who could type found that they were able to answer more fully and examiners found the scripts much easier to read than traditional hand-written examinations.
- **Tutoring** using an asynchronous model was found to be successful since it does not exclude any student because of its dependence of time. Synchronous tutorials were hampered by equipment and cost. OU experimented with *CU-Seeme* and *Netmeeting* (Microsoft). They could not find a package that supported telephone quality audio, robust application sharing, shared media space, white board, ability to record and playback. All of these were considered to be important in a tutoring session. They are currently still researching synchronous tutoring.
- **Content:** Typically the OU delivers the bulk of its courses' content via paper-based systems. They tried to make printed material over the Web, but found that print and Web are not interchangeable. Books have the advantages of portability and familiarity over a computer.

4.6.14 STUDY FOURTEEN: Case based on Trinity College (Dublin) experience

Wade & Power (1998: 243-248) identified a set of general requirements necessary in designing a pedagogically successful WWW based educational experience. These requirements were derived from a study of a WWW based Computer Engineering and Computer Science course which was trialed over a period of three years at Trinity College, Dublin. The requirements that lend themselves to a student-centered learning environment are presented in Table 6:

WWW Instructional design	Methods employed by Virtual Learning environment & WWW courseware to satisfy requirements.
Multi-sensory	Course content contained graphics, animation, interactivity. Video and audio conferencing support provided.
Experimentation	External access to 'Real Life' database, case study based on real business example.
Testing & checkpoints	Oral exam, tutorial questions, project submission & evaluation
Cognitive support	Consistency, on-line support for bookmark storage and note taking.
Synchronous communication	Video and audio conferencing
Ergonomics	Consistency, structured content and interface. based on HCI principles.
Support service	Email contact with course tutor and peers.

Table 6 : Support for requirements in WWW based courses (Wade & Power (1998: 246)

4.7 A SYNTHESIS OF STUDIES

All fourteen studies present different perspectives of the various authors from their experiences with the use of WWW in the higher education environment. Table 7 provides a synthesis of common aspects, identified by the researcher, of WWW courses outlined in the aforementioned studies, indicating the features of a Web-based environment that support student-centered learning.

Collaborative learning approach	Use of a variety of media	Testing & reinforcing content	Providing access to external resources	Student able to create an individually tailored path
<ul style="list-style-type: none"> • Synchronous communication e.g. chat rooms for brain storming e.g. CU SeeMe, Netmeeting • Asynchronous communication - e.g. One-to-one communications e.g. use of E-mail and: • Electronic discussion groups e.g. to allow collaborative work on projects & building of learning teams • Facilitation of hosting of home pages for students to foster sense of student community • Common focus for discussion e.g. use of text and graphical data conferencing <p style="text-align: center;">↓</p>	<ul style="list-style-type: none"> • Online lectures - use of streaming audio, video • Animation e.g. use of plug-ins like Shockwave • Simulations - especially for abstract and complicated concepts • Experiential learning <p style="text-align: center;">↓</p>	<ul style="list-style-type: none"> • HTML forms for interactive testing (server side CGI scripts or client side Java script) • Testing by task accomplishment - students should be able to submit tasks electronically • Reinforcement of content e.g. Authorware Shockwave • Web pages allow review of material at students pace <p style="text-align: center;">↓</p>	<ul style="list-style-type: none"> • Encourage global communities - encourage students to use external newsgroups; collaborate with students in other universities • Students can identify and communicate with experts on the subject matter • Access to academic databases • Students could be guided to discipline specific resources previously identified by course instructor <p style="text-align: center;">↓</p>	<ul style="list-style-type: none"> • Hypertextual organization allows materials at various levels of difficulty to be made available without imposing a pre-determined path/ allows students to easily choose individualized path • Student forming his/her own path is able to produce knowledge rather than regurgitate facts presented to him/her • Online syllabus allows student to choose a personalized path of study <p style="text-align: center;">↓</p>
<p style="text-align: center;">ABOVE TO BE SUPPORTED BY FEATURES FOR:</p> <ul style="list-style-type: none"> ➊ Course management:: Instructional content can be closely controlled using flexible tools available on the WWW; Use of administrating software to manage student database (add/delete students, manage discussion groups). ➋ Tracking of students' progress. ➌ Security of student's work: Students should have a sense of security that work submitted electronically would be safe, and further would not be accessible to others before grading takes place. ➍ Keep course content current: Facilities to update course materials easily. 				

Table 7 : A synthesis of issues important in WWW courses to support a student-centered learning environment

4.8 SUMMARY

This Chapter highlighted the need for this study in terms of National policy documents viz. the White Paper for the Transformation of Higher Education and the Strategic Plan for Technology Enhanced Learning in South Africa. The concepts of resource-based learning and student-centered learning were then explored. This was followed by a presentation of fourteen studies from the literature, which highlight the use of the WWW for student-centered learning. Common issues raised in these papers were synthesized and presented in Table 7. The issues from this synthesis formed the basis of parts of Section C of the questionnaire (see Chapter FIVE).

CHAPTER FIVE

RESEARCH METHODOLOGY

"Before any of us were anything else, we were researchers. The child is first an explorer, a discoverer, a 'researcher'.... Research has always been done and will always have a place as long as there are people with inquisitive minds."

(Swarts, 1992:2)

5.1 INTRODUCTION

The objectives of this study were outlined in Chapter One. This Chapter describes the methodology used to conduct the research, with a view to attaining the objectives of the Study.

On a broad level, any research should be carried out in a systematic and programmatic manner (Hunter et al., 1983). To do this there are various techniques for conducting research, as outlined by various authors, e.g. Melville & Goddard (1996), Emory and Cooper (1996), McMillan and Shumacher (1993).

The terms "quantitative" and "qualitative" are used frequently to identify different approaches to research (McMillan and Shumacher, 1993:14). The major types of research designs within these two approaches are outlined by McMillan and Shumacher (1993:31) in Table 8.

QUANTITATIVE		QUALITATIVE	
Experimental	Non-Experimental	Ethnographic	Analytical
True experimental	Descriptive		Concept analysis
Quasi-experimental	Correlational		Historical analysis
Single Subject	Survey		Legal Analysis
	Ex post facto		

Table 8: Major types of research designs

The non-experimental, survey method was used to conduct the research. In the survey research method, the investigator selects a sample of subjects and administers a questionnaire or conducts interviews to collect data. Surveys are frequently used in educational research to describe attitudes, beliefs, opinions and other types of information (McMillan and Shumacher, 1993:36). This method is advocated by Grover (1998) whose studies have shown that survey research is a prominent methodology that is used to study problems in the Information Systems (IS) area (Grover, 1998).

The following sections will describe in detail the methodology adopted to conduct the research.

5.2 DESCRIPTION OF RESEARCH METHODOLOGY

Straub (1989) cited by Grover (1998) provides an overview of the general methodology that should be followed for conducting empirical research in the IS field. This overview includes establishing the theoretical foundation for the research, selecting an appropriate research design and data collection method,

properly implementing the study, and finally using correct data analysis techniques for interpreting the results.

Remenyi and Williams (1995), cited by Averweg (1998:133), use the term "passive research" to describe the survey method. They also advocate the use of this method in the study of IS. They outline passive observation as follows:

- | | |
|----|---|
| 1. | Literature Review |
| 2. | Assessment of Established theoretical Frameworks |
| 3. | Theoretical Conjecture |
| 4. | Hypothesis/Empirical Generalized Formulation |
| 5. | Measuring Instrument |
| 6. | Sampling |
| 7. | Testing/Analysis |
| 8. | Confirmation of Theoretical Conjecture and Development of Fuller/Refined Theory |

Table 9: Steps in the passive research process
(Remenyi and Williams, 1993)

The research methodology, whilst based on the broad framework provided by Grover (1998), will also draw on the steps outlined in Table 9 above.

5.2.1 Establishing the theoretical foundation for the research (Literature Review)

According to Remenyi and Williams (1995), cited by Singh (1999: 21), it is important for a researcher to evaluate the available literature on the subject being researched as it allows the researcher to review current theories and models that have been made by researchers in the field. Emory and Cooper

(1991: 122) suggest that the literature review should examine recent research studies that act as a basis of the proposed research, and move on to specific studies that are associated with the problem. Chapter Two, places the study within a conceptual public administrative framework. Chapter Three presents an overview of the development of WWW technologies, demarcates this Study of WWW technologies within the broad applications of WWW, and lastly reports on the benefits and problems associated with the use of WWW for course delivery. Chapter Four deals specifically with studies of WWW usage in tertiary education and its role in student-centered learning.

5.2.2 Assessment of the established theory

According to Remenyi and Williams (1995), (in Averweg, 1998: 133), it is important to decide early in a study on if the identified problem in the literature is sufficiently explicit and generally accepted by researchers in the field as a relevant problem for the researcher to be able to develop a theoretical framework and to derive a workable and testable hypothesis.

As already indicated in Chapter One (Section 2.3), WWW is an emerging technology for the purpose of course delivery. Various researchers have already suggested that there is still much to be done in order to fully realize the true potential of WWW in the educational arena (for example, see Duchastel (1997), Koutomanos (1999), Pilgrim and Creek (1998)). Further, the National

Ministry of Education and the Department of Education in South Africa are focusing on the use of technology (including WWW) to foster student-centered learning. Therefore a study of WWW technologies and its role in the outlined context would be of benefit to institutes of higher learning.

5.2.3 Theoretical conjecture

The basis of the study is as a result of an extensive survey of the relevant literature. From the information gathered during the literature review a theoretical conjecture was made:

The WWW is increasingly being used as a means to deliver courses in a student-centered learning environment. Consequently the learning styles supported by WWW based courses, and the features of a WWW-based course to support student-centered learning are significant factors in implementation of Web-based courses. Further, the problems associated with the implementation of such courses are an important consideration in order to ensure a measure of success in delivering courses.

5.2.4 Hypothesis/Empirical generalized formulation

The empirical generalizations for this research are set out in the questionnaire (See Appendix A) in Section C and Section D. Section C lists the generalizations about the problem areas in the implementation of Web-based

courses. Section D outlines the generalizations about the implementation of Web-based courses. Only the generalizations pertaining to *Learning Styles* (6.1 - 6.6) and *Necessary Features in a Web-based Environment* (7.1 - 7.10), in Section D, are relevant to this study.

5.2.5 Measuring instrument

Melville & Goddard (1996: 37), state that data can be obtained from laboratory experiments, models and people. To obtain data from people one can use either an interview or the questionnaire method (Melville & Goddard, 1996:41). The respondents to the study were from tertiary institutions in South Africa. In considering the financial constraints to travel to the various institutions in the nine regions in South Africa, it was decided to use the questionnaire method. A further factor in the choice of the questionnaire method for data collection was based on Grover's (1998) identification of the questionnaire as the most commonly used methodology in empirical IS research. McMillan and Shumacher (1993: 238-240) also provide other motivating factors for the use of a questionnaire: It is relatively economical, can ensure anonymity, and questions can be used for specific purposes.

Section B of the questionnaire consists of a list of items against which respondents place a tick if the items are a feature in their courses (past, present or future). Section C and Section D of the questionnaire measures the attitude

of the respondents. There are different scales for the measuring of attitudes of people (see Averweg, 1998: 137). For the purpose of this study the researcher has chosen the Item Analysis approach which involves the use of a summated scale (see Emory and Cooper, 1991: 219). The particular scale used was a five-point Likert Scale, which according to Kothari (1993) and Emory and Cooper (1991: 220) are the most frequently used scales in the measuring of attitudes.

Averweg (1998:137) reports that the popularity in the use of Likert-type scales can be attributed to its ease of construction, and the fact that it is considered to be reliable since respondents answer each statement in the instrument and thus provide more information.

After construction of the measuring instrument it was then administered. The process of the administration of the questionnaire is outlined in Sub-heading 5.3 below.

5.3 CONDUCTING THE SURVEY

The questionnaires were sent out during the period June 1999 and September 1999 as follows: Eighty hard copies were given out at two conferences involving tertiary educators; and the questionnaire was also coded using HTML and uploaded on the Web-server at the Department of Information Systems and Technology at the University of Durban Westville (UDW) and distributed to three

separate mailing lists. Respondents accessed the online questionnaire at <http://is.udw.ac.za/spather/survey.html>.

There were seven sections in the questionnaire, viz. :

- a. Demographic information;
- b. A section to determine if the respondent had (or planned to have) any hands-on experience with using Web-technologies for course delivery;
- c. Checklist of possible features of Web-based courses that respondents could be using;
- d. List of possible problem areas that could be impeding the use of WWW technologies, each on a five point Likert Scale;
- e. A list of 35 important considerations in the implementation of Web-based courses, each on a five point Likert Scale;
- f. A section for the respondents to rate their overall success with WWW technologies, and to comment on any shortfalls of the questionnaire.
- g. A table to determine the number of staff and students in the department where the respondent was teaching.

5.3.1 Pilot study

The pilot study was conducted at two stages. The first involved the testing of content in respect of omissions, ambiguity etc. and the second involved the testing of the Web-based questionnaire.

Heads of Departments of Computer Science and Information Systems at eight tertiary institutions in KwaZulu Natal (KZN) participated in the first stage. Comments made by these academics led to the refinement of the questionnaire.

Three lecturers at different KZN universities then tested the online questionnaire. Further testing of the reliance of Web-server to correctly transmit and receive the electronic responses were conducted by ten final-year IS students at the University of Durban Westville.

5.3.2 Sample selection

According to Emory and Cooper (1991: 242) the basic idea of sampling is that some of the elements in a population provide useful information on the entire population. They define an *element* as the subject on which the measurement is taken and a *population* as the total collection of elements about which we intend to make some inferences.

The elements of the sample were individual lecturers from South African universities who were either using or had an interest in the use WWW technologies for course delivery. It was difficult to identify lecturers who were using WWW for course delivery. Therefore the questionnaires were sent to as wide as possible an audience, and relied on return from lecturers who were

either using or had an interest in the use of WWW for course delivery. This method of sampling is called non-probability sampling. McMillan and Schumacher (1993: 160) state that this type of sampling (also called convenience or availability sampling) involves using whatever subjects are available to the researcher. The limitations imposed by this method of sampling are acknowledged by the researcher and have been elaborated upon in Chapter One.

A total of 37 responses were received. A comprehensive breakdown of the respondents by category is provided in Chapter Six.

5.3.3 Testing and analysis

After the collection of the research data, the empirical generalizations (see Sub-heading 5.2.4) had to be tested. The data was analyzed based on the answers provided by the respondents.

In Section B of the questionnaire, a score of 1 was allocated to each WWW feature that was ticked off by the respondent. This was done in each of the categories "Have been used", "Current use", and "Plan to use". The scores for each feature were then totalled and ranked for each category in an array to determine the degree of prevalence of each feature.

Each statement in Sections C and D of the questionnaire was on a five point Likert Scale. The purpose of the scale was to obtain the respondents attitude to each statement. All statements were equally weighted and the response of each academic were scored with the following values:

<i>Attitude</i>	<i>Score</i>
Strongly agree	5
Agree	4
Undecided	3
Disagree	2
Strongly Disagree	1

Averweg (1998: 142) contends that the above approach is widely adopted.

The analysis of Sections C and D used the approach advocated by Cooper and Emory (1991: 207). They outline the item analysis approach to analyzing scales. This entails calculating the total score for each respondent. Thereafter, individual items are analyzed by calculating *t* values (see Cooper and Emory, 1991: 221) to determine those that discriminate between persons or objects with high total scores and those with low total scores. The *SPSS* statistical package (ver 9.0 for Windows) was used to calculate the relevant *t* value for each statement. Based on each *t* value and the calculated degrees of freedom (see McMillan & Schumaker, 1993: 346) a level of significance was determined for each statement. Statements that were strongly significant (< 0.05) were then reported on.

5.4 SUMMARY

The overview of the research methodology employed in this study was presented in this Chapter. This included a description of how the theoretical foundation for the research was established, the measuring instrument that was used, the conduct of the survey and the methods of testing and analyzing the collected data.

The presentation of the statistical analysis process and the results and findings of the survey are presented in the next Chapter.

CHAPTER SIX

DATA ANALYSIS AND INTERPRETATION

6.1 INTRODUCTION

Chapter Five presented an overview of the broad research methodology. This Chapter provides reports on the data analysis and survey responses.

6.2 SUMMARY OF RESPONDENTS TO THE SURVEY

A total of eighty questionnaires were handed to lecturers at two conferences viz. the Annual Conference for WWW Applications (Rand Afrikaans University, September 1999), and the South African Computing Lecturers' Conference (Golden Gate, June 1999). In addition to this the Web address of the electronic questionnaire was posted via the following mailing lists: Technology in Education (TIE) and the mailing list of the South African Institute of Computer Scientists and Information Technologists (SAICSIT). Administrators of the mailing list were unable to provide the actual numbers of people who were on these mailing lists. A total of thirty-seven responses were received (twenty-seven hard copies and ten electronic returns). Thirty of these were used in the analysis. Seven responses were precluded for the following reasons.

Reason for excluding response	No. of respondents
Non South African institution	1
Not teaching at a tertiary institution	1
Electronic responses received via Web-form with no data	5
Total	7

Table 10: Exclusion of respondents from analysis

Table 11 provides a breakdown of the thirty respondents who were included in the survey according to various categories (See Appendix B for further details on demographic information):

	Number of respondents
<i>Departments / Centres in which respondents are teaching:</i>	
Computer Science/ Information Systems	23
Economics	1
Anatomy	1
Open Learning Centre	1
Computing & Telecommunications	1
Communication	1
Education	2
Total	30
<i>Regional breakdown:</i>	
KwaZulu Natal	6
Gauteng	13
Western Cape	5
Eastern Cape	5
North West	1
Total	30
<i>No. of Universities in which respondents teach</i>	11
<i>No. of Technikons in which respondents teach</i>	4
Total number of institutions	15

Table 11: Categorization of respondents

6.3 TESTING OF THE HYPOTHESES

McMillan and Schumacher (1993: 339-341) state that the calculation of means of responses in a survey are not enough to make a conclusion. Sampling and measurement error must be taken into account. Population means are estimated and compared to find the probability that the possible population means of each group are different. The probabilities are formalized by statements that are tested. These statements are referred to as **hypotheses**.

When we refer to probability in terms of sampling and measurement error, the statement used is called the **statistical hypothesis**. Statistical hypotheses are usually stated in what is called the "null" form. The **null hypotheses**, which is usually implied by the research hypothesis rather than stated explicitly, states that there are no differences between the population means of the two groups i.e. the population means are the same. The researcher employed an inferential statistical test to determine the probability that the null hypothesis is untrue. If the null is false, then there is a high probability that there is a difference between the groups. If we can show that there is a high probability of being correct in rejecting the null, then we have found evidence of a difference in the attitudes.

In conducting the statistical analyses (hypotheses testing), Section C and Section D of the questionnaire were treated differently, for the following reasons:

- Section C measured attitudes of the respondents to broad issues, identified in the literature, which could impede the implementation of Web-based courses. The participants in the survey were asked to respond to the factors as they existed in their departments or institutions. All statements in this Section were stated in the negative; whereas
- Section D measured attitudes to issues specifically concerned with the design and implementation of Web-based courses. The participants in the survey were asked to respond to these issues from their personal perspective of Web-based courses. All statements in this section were stated in the positive.

Therefore, since each section tested attitudes to two different issues, and further since they were worded differently (i.e. negatively and positively), it was decided to conduct the statistical tests for each section separately.

6.3.1 DESCRIPTION OF PROCESS OF ITEM ANALYSIS AND ESTABLISHMENT OF SIGNIFICANT STATEMENTS

In order to test the hypotheses, an item analysis was done in Section C and Section D of the questionnaire. Emory & Cooper (1991:221) outline a description of the item analysis process as follows:

- (a) Collect a large number of statements that meet two criteria: Each statement is believed to be relevant to the attitude being studied; and each statement is believed to reflect a favourable or unfavourable position to that attitude.
- (b) A group of persons responds to each statement by indicating their level of agreement with it, using a five-point scale.
- (c) Each person's response values are then added to secure a total score per person.
- (d) The total scores are arrayed, and some part of the highest and lowest total scores are selected. These two extreme groups represent the most favourable and least favourable attitudes to the topic being studied. They are used as criteria by which to evaluate individual statements. That is, through a comparative analysis of response patterns, to each statement by members of the two groups, we determine which statements consistently correspond with low favourability and which with high favourability attitudes.

- (e) The item means between the high-score group and the low score-group are then tested for significance by calculating t values. (See *Melville & Goddard (1996: 66-67); McMillan & Schumacher (1993: 345-349) for detailed explanation of how t values are calculated*).

Singh (1999:29) provides a graphical description of the process which involves item analysis and leads to the identification of statements of good discriminators:

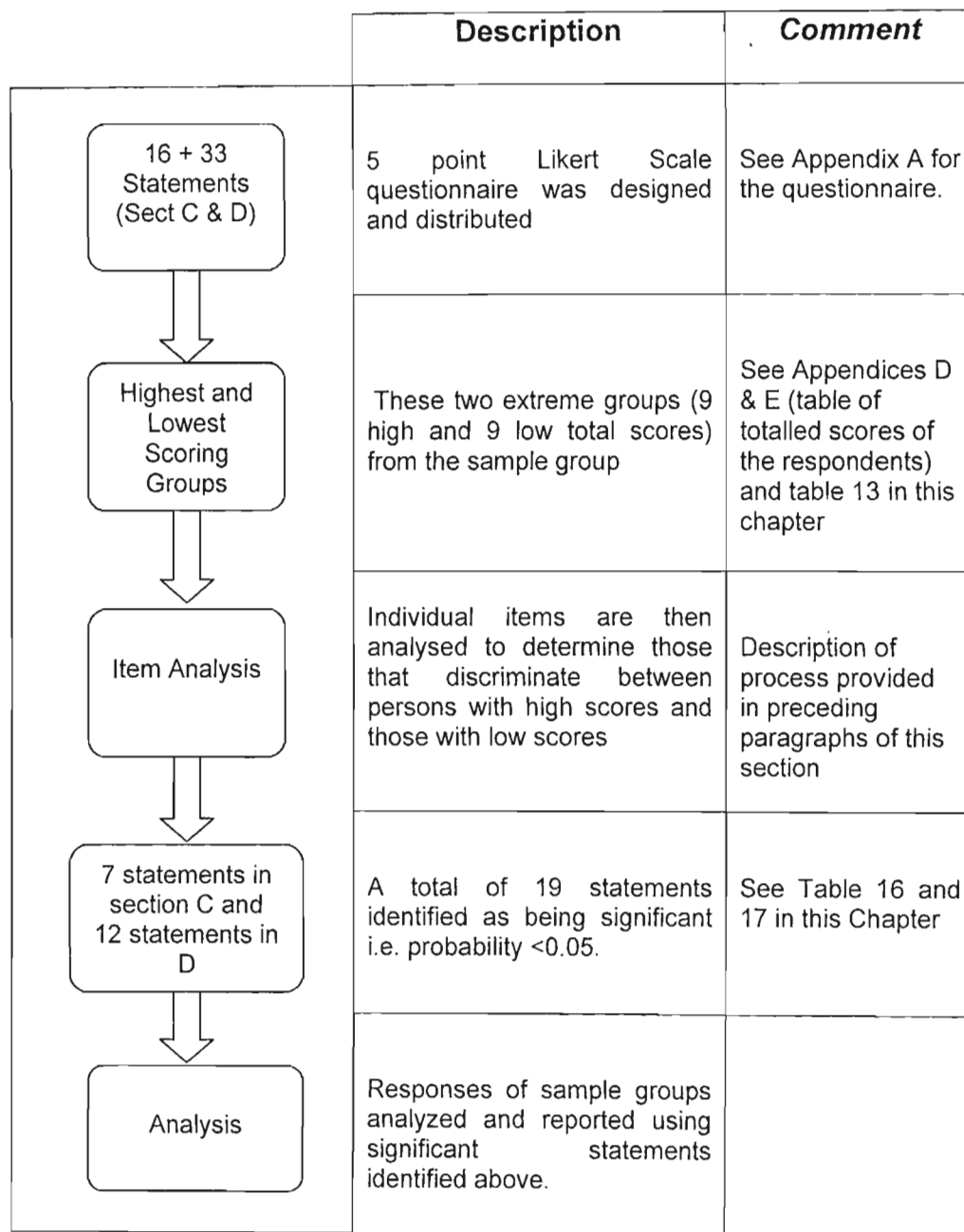


Figure 3: Data flow from respondents (for Sections C & D of questionnaire) to statistical phase (Adapted from Singh, 1999: 29).

Once the t values for each statement is calculated, the level of significance of each statement is established, according to McMillan & Schumacher (1993:346) as follows:

- (a) Determine the level of significance (also called probability level) desired.

The lower the level of significance, the more confidence we have in rejecting the null hypothesis. SPSS Handbook (1999: 103), suggests that levels of significance lower than **0.05** should be used to reject the null hypothesis. This probability level is corroborated by McMillan & Schumacher (1993: 342-343). Thus statements for which levels of significance are calculated to be greater than or equal to 0.05 were not included for discussion.

- (b) A table called the *distribution of t or critical values for the t -test* (see McMillan and Schumacher, 1993:347) is then used. For each statistical test there is a corresponding number of degrees of freedom (df) that is also calculated and this number is used to estimate the statistical significance of the test (see pg. 346 for full explanation of df). In the table the number at the intersection of the degrees of freedom row and the level of significance column is the relevant theoretical value of t . If this critical t is less than the t calculated by the t -test equation, it means that the observed difference in means is greater than could have been expected under the null hypothesis, so the hypothesis can be rejected at that level of significance.

6.3.2 ANALYSIS AND INTERPRETATION OF STATISTICAL TESTS

Note on the limitation of the sample size:

A special note on the limitation of this study, with specific reference to the small sample size needs to be borne in mind before the statistical results are presented. The researcher has undertaken rigorous statistical analysis of the responses to the survey. However, as pointed out by McMillan & Schumacher (193: 343 344) in cases with a small sample size (which makes it difficult to find a significant difference) a non-significant finding should be interpreted to mean that further research is necessary, not that there is no relationship.

Only the responses to Section C and Section D of the questionnaire were subjected to hypothesis testing as outlined above. The responses to Section B were totalled and arrayed in descending order to determine the levels of usage of specific WWW features. The analysis of Section B is presented followed by Section C and D.

6.3.2.1 Section B: Past, current and future use of WWW features

Table 12 presents a summary of the responses to Section B of the questionnaire in respect of the respondents who have used, are using, and plan to use WWW for course delivery.

	No. of respondents
Have used one or more WWW features	16
Are currently using one or more WWW features	17
Planning to use one or more WWW features	17

Table 11: No. of respondents who have used WWW features in their courses

Figure 4, on the following page shows the number of respondents corresponding to each WWW feature (See Appendix C for actual responses).

Responses to Section B

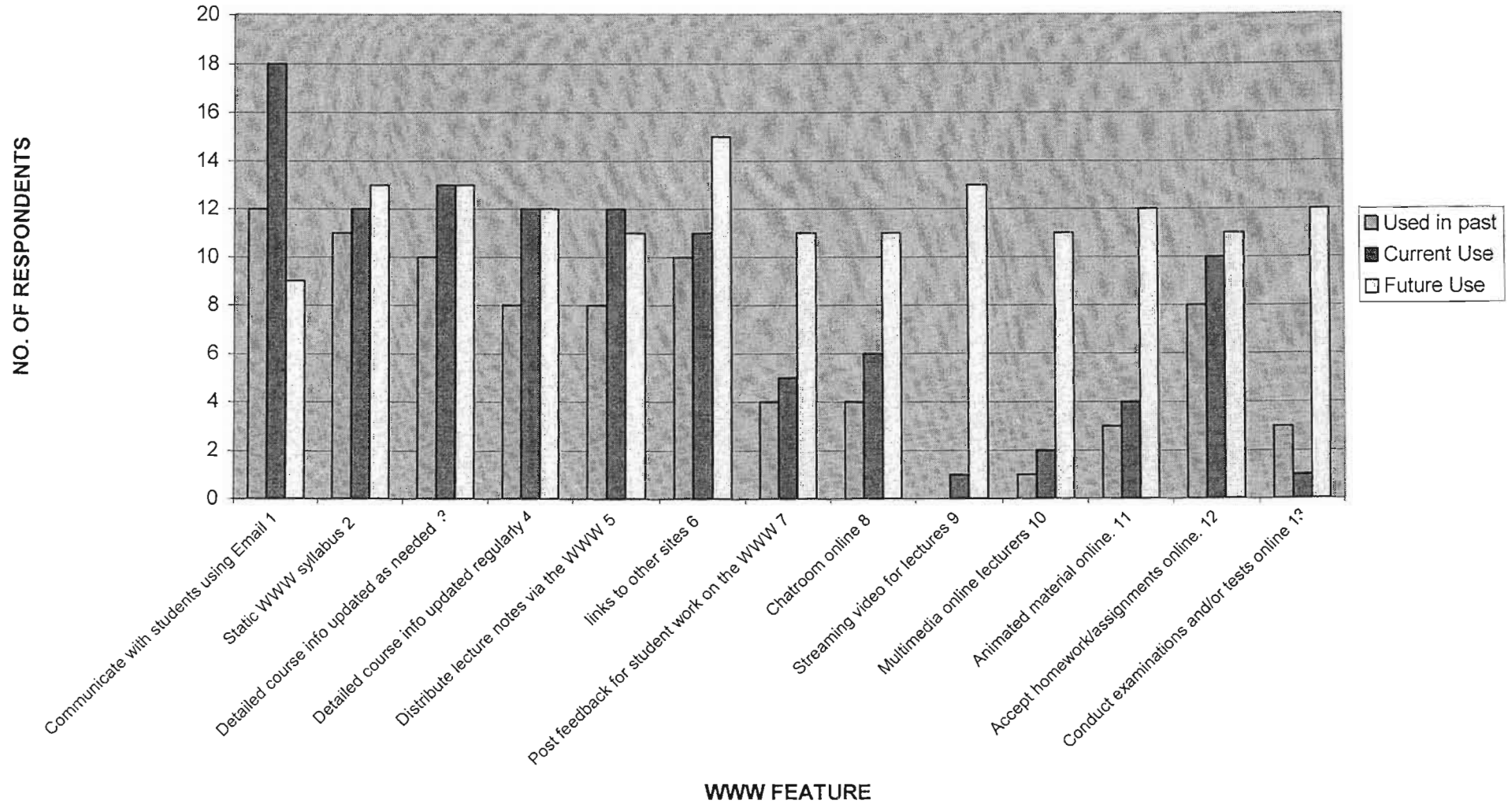


Figure 4: Levels of use of WWW features

An analysis of the responses to Section B of the questionnaire (as represented in Figure 4) reveals that the majority of the respondents are using some elements of WWW technologies in their courses. All the respondents are presently using Email to communicate with their students, 76% post course information on the WWW, updated when necessary and 71% post detailed course information which is updated regularly. Seventy-one percent maintain a static WWW syllabus, whilst 71% distributed lecture notes via the WWW, with 65% providing links to external WWW sites, and 59% accepting homework via the WWW. The latter reflects high usage of seven of the thirteen WWW features listed in the questionnaire. Respondents indicated a very low level of usage of the other six features listed. The level of use varied from 35% to 6%.

6.3.2.2 *Inferential analysis of Section C and Section D of questionnaire*

In establishing which statements were statements for good discriminators, the SPSS statistical package (Version 9 for Windows) was used to calculate t values and the associated degrees of freedom (df). It was not necessary to refer to a table of critical t values, since the SPSS package calculated the actual level of significance.

The results of the analysis at each stage, as described above are presented below:

- A. The highest nine and lowest nine total scores were identified.
(See Appendix D for all scores)

Section C									
Highest Nine Total Scores	48	48	49	50	51	51	52	58	61
Lowest Nine Total Scores	23	26	26	34	36	38	40	41	41
Section D									
Highest Nine Total Scores	126	126	127	128	129	129	131	133	142
Lowest Nine Total Scores	105	107	109	110	111	112	112	112	112

Table 12: Groups of highest and lowest scoring respondents

- B. The responses of the above groups were then used to conduct the *t*-test.
The calculated *t* value, the degrees of freedom and the significance (or *p* value) for each of the statements as calculated by SPSS (version 9 for Windows) are reflected below in Table 14:

SECTION C			
Item No.	t	df	Sig. (2-tailed)
QC1	2.392	19	.027
QC2	1.385	19	.182
QC3	2.927	19	.009
QC4	3.255	19	.004
QC5	3.684	19	.002
QC6	4.172	19	.001
QC7	2.911	19	.009
QC8	2.400	19	.027
QC9	.985	19	.337
QC10	3.120	19	.006
QC11	1.371	19	.186
QC12	1.132	19	.272
QC13	2.088	19	.050
QC14	.517	19	.611
QC15	.977	19	.341
QC16	4.479	19	.000

Table 13: *t* values, degrees of freedom and level of significance for questions in Section C

Table 15/...

SECTION D			
Item No.	t	df	Sig. (2-tailed)
Q1.1	1.474	16	.160
Q2.1	3.394	16	.004
Q2.2	.603	16	.555
Q2.3	1.395	16	.182
Q2.4	2.286	16	.036
Q2.5	2.561	16	.021
Q3.1	1.581	16	.133
Q3.2	1.767	16	.096
Q4.1	.329	16	.747
Q4.2	2.138	16	.048
Q4.3	.626	16	.540
Q4.4	.783	16	.445
Q5.1	1.414	16	.176
Q5.2	2.502	16	.024
Q5.3	1.525	16	.147
Q5.4	.616	16	.547
Q5.5	.985	16	.339
Q5.6	.478	16	.639
Q6.1	2.744	16	.014
Q6.2	1.342	16	.198
Q6.3	1.000	16	.332
Q6.4	1.890	16	.077
Q6.5	1.061	16	.305
Q6.6	.718	16	.483
Q7.1	.676	16	.509
Q7.2	2.064	16	.056
Q7.3	2.136	16	.048
Q7.4	3.395	16	.004
Q7.5	2.366	16	.031
Q7.6	3.606	16	.002
Q7.7	4.000	16	.001
Q7.9	2.596	16	.020
Q7.10	.970	16	.346

Table 14: *t* values, degrees of freedom and level of significance for questions in Section D

The shaded areas in the two tables above represent those statements that have a calculated level of significance less than 0.05 thus implying that the null hypothesis can be rejected in these cases. Therefore these are statements which consistently correspond with low favourability and with high favourability attitudes.

6.4 INTERPRETATION OF STATISTICAL ANALYSIS

The statements from Sections C and D of the questionnaire that have been identified as being significant (see tables 14 and 15 above) are now presented and interpreted in the following two sub-sections.

6.4.1 Section C : Institutional-based problems impeding the implementation of Web-based courses

The following statements identified in Table 16 are of significance:

Statement No.	Statement	Highest frequency of responses
01	The technical infrastructure (Network, software tools, servers etc.) for implementing Web Based learning is not available.	76.7% Strongly disagree <u>or</u> disagree
04	The organizational conditions allowing flexibility, time and incentives to experiment with WWW technologies do not exist.	53.4% Strongly agree <u>or</u> agree
05	Academic Staff do not have the necessary skills to design courses that are taught using WWW.	70% Strongly agree <u>or</u> agree
06	The support staff needed to run such a course are not available	60% Strongly agree <u>or</u> agree
08	There is no evidence of benefits from utilizing WWW for course delivery	76.7% Strongly disagree <u>or</u> disagree
09	The use of Web Based Learning drains attention away from teaching the underlying cognitive abilities needed to write, analyze, organize, formulate, communicate etc.	80% Strongly disagree <u>or</u> disagree
10	The decline of student-lecturer contact would not suit the courses that I teach.	66.7% Strongly disagree <u>or</u> disagree
16	The largest single obstruction to implement WWW/Internet for course delivery is the lack of appropriate staff	50% Agree <u>or</u> Strongly Agree; 30% Disagree of Strongly Disagree

Table 15: Statements identified of having a significance (or p value) less than 0.05 from Section C of questionnaire

An observation of the significant statements identified from this section of the questionnaire highlights the following:

- Most of the respondents (76%) have the technical infrastructure available for the implementation of Web-based courses. A possible reason for this could be that a large number of the respondents are teaching in CS/IS disciplines,

and the technological infrastructure is usually available in these disciplines due to the nature of these courses.

- The organisational conditions in just over half (53.4%) of the respondents' departments, do not allow the time and flexibility to experiment with WWW technologies.
- A large majority indicated that academic staff lack the necessary skills to design Web-based courses, and further the necessary support staff needed to run such courses were not available.
- Most respondents (76.7%) disagreed that there are no benefits from utilizing WWW for course delivery. This could imply that most people are aware of the benefits that could be obtained from utilizing the courses.
- There was strong disagreement (80%) that the use of WWW does not allow teaching and influencing of the cognitive abilities of the students.
- An indication that the decline of student contact time would not be problematic for the courses being taught by the respondents signals that the advent of teaching at a distance is a great possibility amongst the respondents.
- There was no strong agreement that the lack of appropriate staff to implement WWW-based courses is the largest single obstruction. This suggests that other factors could be major contributing factors rather than just the issue of appropriate staff.

6.4.2 Section D : Issues important to the design and implementation of Web-based courses

(One of the focuses of the study is on the use of the Web to support student-centered learning. Other issues in the designing of web-based courses are not included in the study. Therefore, only significant statements listed under Questions Six and Seven of the Questionnaire are presented.)

Statement No	Statement	Highest frequency of responses
Learning styles used in a Web-based course:		
6.1	Students should be able to create individually tailored paths to master desired goals at their own pace.	76.7% Agree <u>or</u> Strongly Agree
The following features are a necessity in a Web-Based Learning Environment		
7.3	Hosting of students' home pages.	60% Agree <u>or</u> Strongly Agree
7.4	Interactivity, e.g. discussion forums and chat sessions.	86.6% Agree <u>or</u> Strongly Agree
7.5	Online drill/practice and testing.	90% Agree <u>or</u> Strongly Agree
7.6	Course management to add/delete students from course, assign user ids/passwords, produce class lists, manage interactive discussion groups etc.	80% Agree <u>or</u> Strongly Agree
7.7	Tracking of student progress.	83.4% Agree <u>or</u> Strongly Agree
7.9	Security of student submissions, core content, student scores etc.	86.7% Agree <u>or</u> Strongly Agree

Table 16: Statements identified of having a significance (or p value) less than 0.05 from Section D of questionnaire

After analyzing the significant statements from this section, the following interpretations are made:

- Most respondents (76.7%) agreed that an important consideration in designing a WWW-based course is to ensure that students are allowed to create individually tailored paths to master desired goals at their own pace. Such an approach therefore precludes the mere use of WWW technologies to only support course delivery. Rather, WWW elements should be incorporated using interactive strategies to ensure that a constructivistic learning approach is adopted.
- A large majority of respondents (80% or more) were in favour of the following features being a part of Web-based courses:
 - ☞ Facility for students to host their own Web pages;
 - ☞ Interactivity such as discussion forums and chat sessions;
 - ☞ Online drill and testing;
 - ☞ Facilities to electronically manage routine course management functions such as adding/deleting students from the course, producing class lists etc;
 - ☞ Course instructors should have a means of tracking student's progress;
 - ☞ Lastly, Web-based courses should incorporate security features, to maintain the integrity of individual student submissions, core content and student scores.

6.5 QUESTIONNAIRE INSTRUMENT RELIABILITY

The data collated for Sections C and D was tested for reliability, using Cronbach's Alpha. The Cronbach Alpha is generally the most appropriate type of reliability for survey research and other questionnaires in which there is a range of possible answers for each item (McMillan & Schumacher, 1993: 230). Averweg (1998:150-151) also supports the use of Cronbach's Alpha to test questionnaire instrument reliability. Averweg cites Nunally (1978) who suggests an Alpha score above 0.7 for reliability. He further contends that according to Srinivasan (1985) Alpha scores of at least 0.6 are considered an acceptable level.

The Alpha scores, as calculated by the SPSS statistical package were as follows:

	Alpha
Section C	0.8508
Section D	0.7939

Table 17: Alpha values to test instrument reliability

The above Alpha values suggest an adequate level of internal consistency of the questionnaire instrument for Sections C and D, as they are above the 0.6 recommended value. Appendices F and G provides the complete table of Alpha values for each item contained in the questionnaire.

6.6 SUMMARY

This Chapter outlined the rationale for the hypotheses testing and presented the analysis of the responses to the Survey. Interpretations of the analysis were presented for Sections B, C and D of the questionnaire. Finally the reliability of the questionnaire was established.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The results of the statistical analyses presented in Chapter Six will be discussed in three parts, viz. the levels of usage of WWW features for course delivery; the possible problems that are impeding the implementation of Web-based courses; and finally the identified features of WWW courses that could support student-centered learning.

7.2 LEVELS OF USAGE OF DIFFERENT WWW FEATURES

The interpretation of the data collected on the levels of usage of different WWW features indicate that the current level of adoption of the thirteen Internet/WWW-based activities fall into two categories:

Relatively high level of use (7 activities)

These are activities that are widely used and are those that support traditional styles of teaching. They do not necessarily change the actual method of delivery. A possible reason for this could be that such activities could be implemented at a low cost and with no need to spend a large amount of time doing in-depth planning and design.

☞ **Very low or non-existent levels of use (six activities).**

This category involves activities that would significantly move away from traditional teaching methods. These are activities that require intensive planning and design, and are also dependent on a high availability of a technological infrastructure supported by adequately trained staff.

The observed trend is that there is an increased level of usage from past to the present level of utilization. Respondents also indicated an intention to increase level of use of activities that fall into the second category listed above. This is a positive indication, since the activities that fall into this category are those that will realise a paradigm shift away from traditional course delivery methods to a student-centred, constructivist approach.

These observations are based on returns from respondents from fifteen different institutions. The features listed in the Survey echoed those from a survey done by Rutgers University, USA, at the end of 1998 (Peffer & Bloom: 1999). The graph on the following page provides a comparison between the South African tertiary educators surveyed and those of the international survey conducted by Rutgers University.

Comparison between an International and local Survey on WWW usage

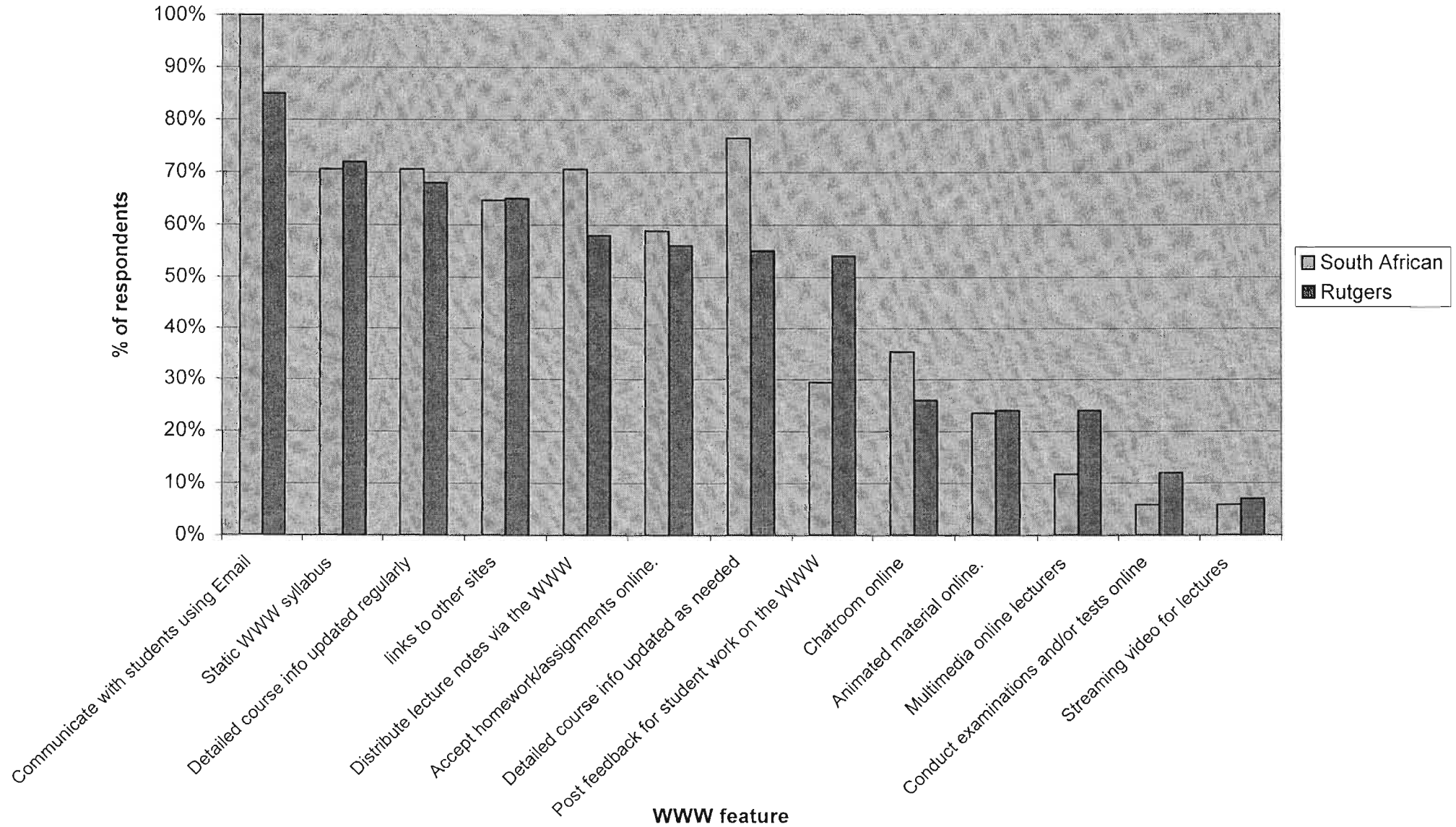


Figure 5: A Comparative Survey of WWW usage.

CHAPTER SEVEN CONTINUED ON FOLLOWING PAGE /...

From the graph, it is evident that our international counterparts have engaged these technologies in a similar fashion to those of the respondents surveyed. However, it is important to note that this is not a reflection of the broad South African situation, since the sample size of this study was extremely limited.

It is evident from the above observations that the use of WWW technologies is focused more on supporting the delivery of courses, e.g. use of Email for communication, posting of syllabi and lecture notes on the WWW. In the category of very low level usage, WWW features included the use of a variety of media (e.g. animation, multi-media lectures) and features to support student and lecturer interaction via synchronous interaction (e.g. discussion groups, chat-rooms). This indicates that WWW features that would support a student-centred learning environment (see Chapter Three) are being used infrequently. In light of this the following recommendation is made:

Recommendation One

Lecturers designing Web-based courses should make a concerted effort to move away from the use of the Web to merely support delivery of lectures and to incorporate WWW features that would support a more dynamic, interactive, student-centred approach to course delivery.

7.3 PROBLEMS IN THE IMPLEMENTATION OF WWW-BASED COURSES

The importance of the human element in the use of technology to deliver education cannot be under-estimated. The implementation of Web-based courses would warrant that either academic staff and/or instructional designers have the necessary know-how to implement WWW technologies in a course. Further, technical support staff would be required on an ongoing basis to provide support to course instructors.

The results of the survey suggest the following in respect of staffing problems: Academic staff do not have the necessary skills to implement Web-based courses;

The support staff needed to run Web-based courses are not available in the departments in which most of the respondents taught.

In view of this, and taking into cognisance the limited sample size of this study, the following recommendation is suggested:

Recommendation Two

Management at the departmental, faculty and institutional level should be encouraged to create the possibility for and invest in adequate training of both academic and support staff to support WWW-based course delivery.

The Survey also indicated that the organizational conditions such as time and flexibility in respect of work commitments do not allow academics (especially if they are novices at implementation of Web technologies) to experiment with WWW technologies. In view of the time-consuming task of developing Web-based courses the following recommendation is suggested:

Recommendation Three

Heads of academic units (Departmental Heads) should support lecturers in the adoption of WWW technologies by creating a psychological and physical space to experiment and try out new ideas. This might involve investigating the possibility of providing incentives, e.g. reduced teaching loads, to small teams of lecturers to engage in experimental Web-based course development. A pilot Web-based course in a discipline would therefore act as a catalyst by allowing other academics to benefit from the experience gained by the developmental team.

The above recommendation is especially important in the light of the Survey results showing that there is an acknowledgement by the respondents, of the broad benefits of teaching via the Web. Thus, unless the conditions are conducive for lecturers to experiment with the technology, it will not gain any momentum as a useful teaching tool.

The problem of shrinking financial resources is affecting service delivery at all levels of education in South Africa. Present cutbacks on expenditure could mean that institutions may not be able to bear the cost of implementing Web-technologies. In order to sustain the delivery of courses that rely on cost-intensive technology such as the WWW, tertiary institutions will have to put into action, creative and innovative plans. In view of this problem the following recommendation is suggested:

Recommendation Four

Tertiary institutions should investigate possible collaboration with external partners in the private sector, e.g. vendors of information and communication technologies as a means of alleviating the high financial costs associated with implementing Web-based courses.

7.4 ISSUES IN THE DESIGN OF WWW-BASED COURSES TO SUPPORT STUDENT-CENTRED LEARNING

In implementing Web-based courses, lecturers should strive to provide an environment that is conducive to student-centered learning that supports the principles of constructivism (see Chapter Three). In doing so, they would be keeping in line with government policy as outlined in the Education White Paper: *A Programme for the Transformation of Higher Education*, i.e. "To promote the development of a flexible learning system, including distance

education and resource-based learning based on open-learning principles" (South Africa, 1997).

The results of the Survey indicates that lecturers agree that an important consideration in the design of a Web-based course is allowing students to create individually tailored paths to master desired goals at their own pace. Giving consideration to this when designing a course would support the tenets of student-centred learning as envisaged in government policy (see the White Paper for the Transformation of Higher Education; and Technology-Enhanced Learning in South Africa: A Strategic Plan). Further to this, the respondents of the survey were in favour of several features as necessary components of a Web-based course (see Chapter Six).

Based on the foregoing the following recommendation is suggested:

Recommendation Five

The design of Web-based courses should be based on a student-centred, learning approach in which the learner is able to select an individualized path in the learning process, and achieve the learning objectives at his/her own pace. Further, the Web course should include the following features to support such an environment:

Hosting of students' Web pages; interactive platforms to promote synchronous communication; online drill and testing; course management functions; tracking facilities; and features to provide a secure environment to maintain integrity of students' work and other confidential information.

7.5 THE ANTICIPATED FUTURE OF WWW TECHNOLOGIES IN THE SOUTH AFRICAN HIGHER EDUCATION ARENA

An important consideration in evaluating the significance of WWW and Internet in course delivery is the extent to which this technology will become a dominant feature of future course delivery strategies. Professor Larry Cuban of Stanford University (Cuban: 1986) describes the history of education technology as a series of cycles as follows:

- Step one:* Acceleration, pioneering, implementing new technology.
- Step two:* Academic studies or statements to prove the effectiveness of this technology, actually most of the time they prove that it is as efficient as traditional education.
- Step three:* Teachers use it and complain about some logistical problem, some technical imperfections, and incompatibility with current programmes or curricula.
- Step four:* Reports see teachers use as very disappointing.
- Step five:* Harsh criticism of administrators who keep the technology in the closet, and stubborn teachers who are reluctant to use the new tools.
- Step six:* A new technology appears - **go to step one!**

Although the use of WWW for course delivery is not a commonplace at South African tertiary institutions at present, the results of the survey indicate that sufficient examples exist to indicate that it is a growing means of delivering education in various disciplines. The implementation of any technology for course delivery will never be without problems. Evidence to support the fact that Web-based technologies used for course delivery, have many advantages for both the course instructor and the learner have been provided in this Study. The experiences of many international institutes (University of Jyväskylä - Finland (Makkonen: 1998), Monash University - Australia (Casey:1998), The Open University - United Kingdom (Carswell: 1998), Nova University - Florida (Polyson: 1996) and certain South African institutes (University of Cape Town

(Cook: 1998), UNISA (Joliffe:1998), University of Pretoria (Cronje: 1997) affirm this. It is encouraging that there is no evidence of the technology going to Step 4 of Cuban's cycle (i.e. "Reports see teachers' use as very disappointing") yet. Currently, there appears to be no strong indication that this technology will follow the same fate of previous technologies, and wither away completely.

In view of the foregoing it would be both tactful and visionary for South African institutes of higher education to place an investigation into the role of the Internet and WWW high on their planning and transformation agendas. This may also be necessary for an institute to maintain a competitive edge, and to provide local alternatives to the inroads being made by international tertiary institutes in higher education. To effectively harness these technologies one has to be involved in a cost and skill-intensive exercise, that requires a paradigm shift away from traditional course delivery approaches, as already indicted in the study. This may be, in the longer term, a viable alternative in generating revenues in an era characterized by lack of financial resources.

7.6 FUTURE WORK

The introduction of WWW technologies in society at large and in education specifically, is fairly recent. Most of the literature surveyed indicates that course instructors have begun to implement these technologies from around 1993 onwards. Consequently, practitioners in the education arena have much

experience to gain insofar as the implementation of WWW technologies for course delivery. There is much to be done especially in utilizing the technology to support a constructivist approach to learning. The following are some issues that could be considered for possible future work:

- A further avenue of assessing the value of Web-based courses in respect of student-centred learning would be to conduct an investigation to evaluate the impact of Web-based learning on students who have completed such a course.
- Data was collected on several other aspects on Web-based course design, other than what was reported on in this study. These aspects could possibly be reported on in future research, journal articles or conference papers.
- The statistical indication of the reliability of the questionnaire that was used is extremely positive. This is an indication that the instrument used in this study for collecting data could be useful for collecting data from a much wider sample.
- On the basis of what is reported in this study, an investigation could be conducted into the possibility of implementing a Web-based course for the training of public officials. Many institutions in South Africa offer part-time course to these officials. However, access to most of these universities are largely restricted because of large distances for these public officials to travel. The use of WWW technologies to offer such a course would enhance

the possibility for many public servants to improve their qualifications which could have a positive impact on service delivery in the medium to long term.

- The capacity at tertiary institutions for online teaching is rapidly increasing. Consequently, a great deal more needs to be done in this field. More intensive investigation of international experiences, guidelines for designing Web-based courses, the long term effects of Web-based teaching on students, the role of academics, more user friendly authoring tools are some of the areas that require more research.
- As the use of the WWW gains momentum, the following issues, allied to course delivery would warrant investigation:
 - ☞ Marketing of courses;
 - ☞ Legal issues relating to copyright;
 - ☞ Financial issues such as the costing of courses;
 - ☞ Institutional alliances with industry;
 - ☞ Certification, accreditation & examination issues

7.7 SUMMARY

This Chapter presented a discussion, based on the results of the statistical analysis. Five recommendations have been made. Taking into cognisance the limitations of this study, it is envisaged that these would provide preliminary guidelines to lecturers who intend adopting WWW technologies for course delivery. The future status of WWW for course delivery is discussed, and

finally, a list of possible issues that could be further investigated is provided. These could form the basis of future work for the researcher or others that have an interest in this field.

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APPENDIX A

QUESTIONNAIRE



**University of Durban Westville (UDW)
Faculty of Commerce and Administration
Department of Public Administration**

PRIVATE BAG X54001
DURBAN
4000

Use of World Wide Web technologies for course delivery

Dear Colleague

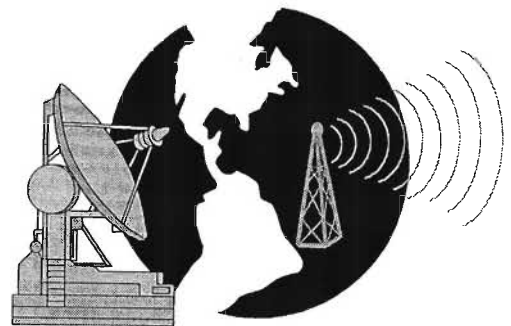
Thank you for accepting this questionnaire. I am presently engaged in research in the usage of World Wide Web technologies for course delivery.

Could you please spare 8-10 minutes of your time to respond to the attached questionnaire? I will be extremely grateful.

Please return the attached to me before the end of this conference or use the self addressed envelope.

Yours faithfully

.....
Shaun Pather
spather@is.udw.ac.za
Tel. 031 - 204 4060 / 4051
Fax. 031 - 204 4051



YOU MAY RETAIN THIS COVER PAGE

APPENDIX A: QUESTIONNAIRE

DEMOGRAPHIC INFORMATION

PERSONAL DETAILS ARE OPTIONAL. HOWEVER, ALL DETAILS SUBMITTED WILL BE TREATED CONFIDENTIALLY. DEMOGRAPHIC INFORMATION WILL ONLY BE USED IN SUMMARY FORMAT.

Today's date	
Title	
First name	
Surname	
Your position (lecturer, HOD etc)	
Name of Department/Division	
Name of Institution	
Province	
Telephone	

EMAIL																			

PLEASE MARK BOXES WITH AN 'X'

	Yes	No
Would you like a summary of the results of this survey to be mailed to you?		

SECTION A

On your use of Web-based technologies for course delivery:

	YES	NO
I have used Web technology for course delivery (or support of course delivery) prior to 1999.		
I am presently using Web technology for course delivery (or support of course delivery).		
I have already /almost finalised plans to use Web technology for course delivery (or to support course delivery) in 2000.		

If you have ANSWERED NO TO ALL THREE QUESTIONS ABOVE THEN SKIP SECTION B OF THE QUESTIONNAIRE AND GO ON TO SECTION C ON PAGE 3.

SECTION B

Which of the following items are a feature in your courses. Please note that these could have been on a WWW intranet available at your institution only		Have been used	Current use	Plan to use
01.	Communicate with students using Email			
02.	Syllabus (static) is available on the WWW			
03.	Post detailed course information updated as needed on the WWW			
04.	Post detailed course information updated regularly or frequently on the WWW			
05.	Distribute lecture notes via the WWW			
06.	Provide links for students to access other (non-department) course material on the WWW			
07.	Post feedback for student work on the WWW			
08.	Use a chat-room or similar interactive online environment for discussion			
09.	Distribute lectures across the internet using streaming video or similar technology			
10.	Incorporate multi-media in online "lectures"			
11.	Create animated material to show course concepts online.			
12.	Accept homework/assignments online.			
13.	Conduct examinations and/or tests online			
14.	Other use/s of WWW technologies:			
	a.			
	b.			

1. Are there any items above for which there is compulsory usage e.g. no written assignments are accepted (Item 12). **List item number only.**

2. Are basic skills for WWW/Internet usage formally taught to students?

YES		NO	
-----	--	----	--

3. Provide a brief description (e.g. IS fundamentals, Network Architecture) of the courses for which you have supported/delivered using Web technology.

SECTION C

Mark an X alongside each statement below to indicate your level of agreement. NOTE THAT THE STATEMENTS PERTAIN TO YOUR DEPARTMENT/INSTITUTION.

		Strongly agree	Agree	Undecided	Disagree	Strongly disagree
01	The technical infrastructure (Network, software tools, servers etc.) for implementing Web Based learning is not available.					
02	I have no confidence in our technological infrastructure being able to support learning in a Web-based environment.					
03	There are scarce resources in my institution (e.g. funds for computer equipment & networks) to implement Web based learning.					
04	The organizational conditions allowing flexibility, time and incentives to experiment with WWW technologies do not exist.					
05	Academic Staff do not have the necessary skills to design courses that are taught using WWW.					
06	The support staff needed to run such a course are not available					
07	Support staff are not adequately trained in using WWW technology.					
08	There is no evidence of benefits from utilizing WWW for course delivery					
09	The use of Web Based Learning drains attention away from teaching the underlying cognitive abilities needed to write, analyze, organize, formulate, communicate etc.					
10	The decline of student-lecturer contact would not suit the courses that I teach.					
11	If WWW is used widely for course delivery, there would be widespread abuse of the Internet facility by students.					
12	Use of WWW/Internet for course delivery is a short term teaching method, and will soon be replaced by yet another technology, thus not warranting much consideration at this point in time.					
13	There is a lack of guidelines for the implementation of Web based courses.					
14	Traditional course delivery methods (classroom based, chalk/talk), that are currently being used, are adequate.					
15	Academic staff generally favor traditional course delivery methods.					
16	The largest single obstruction to implement WWW/Internet for course delivery is the lack of appropriate staff					

SECTION D

Each of the following statements outlines an aspect that should be considered in the implementation of a Web-based course. Mark an X alongside each numbered statement to indicate your level of agreement.

		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
	Analysis of the target audience: Level of skill & maturity; Amount of prior knowledge; Whether they will be on or off campus; Receptiveness to use of Web for learning.					
1.1	The analysis of the target audience must be given sufficient attention in order to clearly define the goals and scope of the Web-based course.					
	Approach to the development of courseware					
2.1	All components of the intended Web course, from the definition of the goals and learning outcomes, the content & presentation techniques, to the implementation and maintenance should be decided upon fully before development work starts.					
2.2	There should be constant interaction with the students on the design, content and presentation technique throughout the development of the Web based course.					
2.3	Initially strong emphasis should be placed on the design of the interface with later consideration to content of the course.					
2.4	Analysing each component of the course, implementing it, then going on to the next component to do the same, until the entire course is implemented is a suitable approach.					
2.5	Development of the Web-based course should be outsourced to professional Web developers.					
	Access considerations:					
3.1	The availability of computers to students, and timetable flexibility to incorporate individual learning is absolutely necessary.					
3.2	Bandwidth (especially for use of substantial graphics/audio/video) has no bearing on the success of the Web based course.					
	Resources					
4.1	Hardware - The client workstations should support the intended presentation techniques of the course (such as use of graphics, audio, video).					
4.2	Software - It is important to establish whether the available browsers support the intended course presentation techniques(for example use of Java applets, streaming video, audio, frames).					
4.3	The availability of staff with the necessary experience and skill in Web design and presentation is of crucial importance to implementing Web based courses.					
4.4	The availability of suitably experienced support staff at the computer center/s is not important to sustain a Web based course.					
	Designing of the Web course					
5.1	The level of the course instructor's expertise in HTML/programming & scripting techniques is not important.					

<p><i>Each of the following statements outlines an aspect that should be considered in the implementation of a Web-based course. Mark an X alongside each <u>numbered</u> statement to indicate your level of agreement.</i></p>		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
5.2	Availability of suitable courseware tools that will incorporate all or most of the course features is very important.					
5.3	The design of the interface should be given higher priority than the course content.					
Designing of the Web course contd...						
5.4	The most difficult part of developing a Web-based course is creating the online content.					
5.5	It is not important for the course instructor to have knowledge on how to publish course material on a web server.					
5.6	It is important that the course instructor has technical skills to configure and maintaining a web server.					
Learning styles used in a Web-based course:						
6.1	Students should be able to create individually tailored paths to master desired goals at their own pace.					
6.2	A collaborative learning approach in which students are able to benefit from an environment that is conducive to shared learning is important.					
6.3	Using a variety of media accommodates individual learning styles and enhances retention of subject matter.					
6.4	Regular review of covered materials through interactive testing successfully reinforces content.					
6.5	Students should be able to experience virtual places and interact with environments that would not have normally been possible in the traditional learning environment.					
6.6	Links to resources available throughout the world is important to supplement institution based course material.					
The following features are a necessity in a Web-Based Learning Environment						
7.1	An online syllabus.					
7.2	Submission of assignments and feedback thereof.					
7.3	Hosting of students' home pages.					
7.4	Interactivity such as discussion forums and chat sessions.					
7.5	Online drill/practice and testing.					
7.6	Course management to add/delete students from course, assign user ids/passwords, produce class lists, manage interactive discussion groups etc.					
7.7	Tracking of student progress.					
7.9	Security of student submissions, core content, student scores etc.					
7.10	Facility that allows course material and links to be easily updated.					

SECTION E

If you have any experience using Web-based course delivery, rate your overall success with it:

Mark an **X** next to the most appropriate statement.

Overwhelming success, with extremely positive feedback from students.	
Fairly successful, with some positive feedback from students	
No clear results of success. Compares just as well with traditional teaching methods.	
Largely unsuccessful, and very little positive feedback from students.	
Absolutely no success with feedback from students being very negative.	

Any other comments on Web-based course delivery:

Comments on this questionnaire on aspects that have not been included:

SECTION F

Could you please supply the following information with respect to your department:

	Full-time	Part-time
No of students (approx. if exact figure is not available)		
Lecturers		
Academic support staff e.g. tutors		
Technical support staff e.g. network administrator		
Other:		

Thank you for your valuable time and effort!

Shaun Pather



APPENDIX B

RESPONSES TO SECTION A OF QUESTIONNAIRE

APPENDIX B: Responses to Section A of questionnaire

	PROVINCE					INSTITUTE														DEPARTMENT									
	KZN	Gauteng	W.Cape	Eastern Cape	North West		Univ. P.E.	Univ. of Durban	UNISA	Univ. of Capte	Univ. of Pretoria	Univ. of Wits	Univ. of Tshwane	UDW	RAU	Rhodes Univ.	Univ. of Zululand	Tech. Natal	Tech. Mpumalanga	Tech. Wits	PU for CHE		CS&IS/informati	Economics	Open Learning	Medical -	Computing &	Communication	Education
Respondent No.																													
1				1			1																	1					
2				1			1																	1					
3			1					1																1					
4		1							1																1				
5			1							1														1					
6			1					1																1					
7			1							1														1					
8	1																	1								1			
9		1									1																1		
10		1									1													1					
11		1										1												1					
12		1							1															1					
13				1									1															1	
14	1													1										1					
15		1													1														1
16				1												1								1					
17		1									1						1							1					
18									1															1					
19		1									1													1					
20	1																			1				1					

	PROVINCE				INSTITUTE												DEPARTMENT											
	KZN	Gauteng	W.Cape	Eastern Cape	North West	Univ. P.E.	Univ. of Gauteng	UNISA	Univ. of Capte	Univ. of Pretoria	Univ. of Wits	Univ. of Durban	UDW	RAU	Rhodes Univ.	Univ. of Witwatersrand	Tech. Natal	Tech. Wits	Tech. Wits	PU for CHE		CS&IS/informati	Economics	Open Learning	Medical -	Computing &	Communication	Education
Respondent No.																												
21			1							1													1					1
22			1											1						1								
23			1																				1					
24	1																	1										
25	1												1										1					
26	1												1															1
27			1								1												1					
28				1																			1					
29					1															1			1					
30																1							1					
Total	6	13	5	5	1	3	2	3	2	5	2	1	3	2	1	1	1	2	1	1		23	1	1	1	1	1	2

APPENDIX C

RESPONSES TO SECTION B OF QUESTIONNAIRE

APPENDIX C: Responses to Section B of Questionnaire

	1= Yes		0 = No													
				Communicate with students using Email			Static WWW syllabus			Detailed course info updated as needed			Detailed course info updated regularly			
	Have Used	Current	Plan to	1			2			3			4			
				have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	
Resp. No.																
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0
3	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
4	0	0	1	1	1	0	0	0	1	0	0	1	0	0	1	1
5	1	1	1	0	1	0	0	0	0	0	1	0	0	1	0	0
6	1	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0	0
10	1	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0
11	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	1= Yes		0 = No													
				Communicate with students using Email			Static WWW syllabus			Detailed course info updated as needed			Detailed course info updated regularly			
	Have Used	Current	Plan to	1			2			3			4			
				have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	
12	1	1	1	1	0	0	1	0	0	0	0	1	0	0	1	
13	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	
14	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	
15	1	1	1	0	1	0	0	1	0	0	1	0	0	1	0	
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
17	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0	
18	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	
19	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	
20	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
26	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

	1= Yes		0 = No												
				Communicate with students using Email			Static WWW syllabus			Detailed course info updated as needed			Detailed course info updated regularly		
	Have Used	Current	Plan to	1			2			3			4		
				have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	16	17	17	12	18	9	11	12	13	10	13	13	8	12	12

	Distribute lecture notes via the WWW			links to other sites			Post feedback for student work on the WWW			Chatroom online			Streaming video for lectures		
	5			6			7			8			9		
	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use
Resp. No.															
1	0	0	0	1	1	1	0	0	0	0	0	1	0	0	1
2	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1
3	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
5	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0
6	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1
7	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0
8	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1
9	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1
10	0	1	0	0	1	0	0	1	0	0	0	1	0	0	1
11	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0

	Distribute lecture notes via the WWW			links to other sites			Post feedback for student work on the WWW			Chatroom online			Streaming video for lectures		
	5			6			7			8			9		
	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use
12	0	1	0	0	0	1	0	0	1	1	0	0	0	0	1
13	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
14	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
15	0	1	0	1	0	1	1	0	0	0	1	0	0	0	1
16	1	1	1	1	1	1	0	0	1	0	1	1	0	0	0
17	1	0	0	1	0	0	1	0	0	1	0	0	0	0	1
18	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0
19	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0
20	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	8	12	11	10	11	15	4	5	11	4	6	11	0	1	13

	Multimedia online lecturers			Animated material online.			Accept homework/assignments online.			Conduct examinations and/or tests online		
	10			11			12			13		
	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use
Resp. No.												
1	0	0	1	0	0	1	0	0	0	0	0	0
2	0	0	1	0	0	1	0	1	0	0	1	0
3	0	0	0	1	1	1	1	1	1	1	0	0
4	0	0	1	0	0	1	0	0	0	0	0	0
5	0	0	0	0	1	0	0	0	0	0	0	0
6	0	1	0	0	1	0	0	1	0	0	0	1
7	0	0	0	1	0	0	1	1	1	0	0	0
8	0	0	1	0	0	1	1	1	1	0	0	1
9	0	0	1	0	0	1	1	0	0	1	0	0
10	0	0	1	0	0	1	0	1	0	0	0	1
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	1	0	0	1	1	0	0	0	0	0
13	1	0	1	0	1	1	1	1	1	0	0	1
14	0	0	0	0	0	0	1	1	1	0	0	1
15	0	1	0	1	0	0	0	1	0	0	0	1
16	0	0	0	0	0	0	0	0	1	0	0	1
17	0	0	1	0	0	1	1	0	0	1	0	0
18	0	0	0	0	0	0	0	1	1	0	0	1

	Multimedia online lecturers			Animated material online.			Accept homework/assignments online.			Conduct examinations and/or tests online		
	10			11			12			13		
	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use	have been used	Curr	Plan to use
19	0	0	0	0	0	0	0	0	1	0	0	1
20	0	0	1	0	0	1	0	0	1	0	0	1
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	1	0	0	1
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	1	0	0	1	0	0	1	0	0	1
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
Totals	1	2	11	3	4	12	8	10	11	3	1	12

APPENDIX D

RESPONSES TO SECTION C of QUESTIONNAIRE

APPENDIX D: Responses to Section C of Questionnaire

	The technical infrastructure not available.	Technological infrastructure cannot support learning in a Web-based environment.	Scarce resources	Organizational conditions do not exist	Academic Staff do not have skills	The support staff not available	Support staff are not trained	No evidence of benefits	Aware of benefits for students	WBL distracts from teaching cognitive abilities	Decline of student - lecturer contact	Abuse of the facility by students.	Short term teaching method	Traditional course delivery methods are inadequate.	Academic staff favor trad. course del. meth.	Largest single obstruction - lack of appropriate staff	
Item n of Sect C ----->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOT
Respondent No.																	
1	1	1	1	1	2	1	1	1	1	1	1	1	3	2	4	1	23
2	1	1	1	1	1	1	1	1	3	2	3	2	2	2	2	2	26
3	1	4	4	1	1	4	5	1	1	3	2	1	4	2	4	2	40
4	5	4	4	5	5	5	5	3	2	2	2	2	4	4	4	5	61
5	2	2	4	4	3	3	3	2	2	2	2	2	4	2	3	3	43
6	1	1	4	2	2	4	2	1	1	1	2	2	4	1	4	2	34
7	1	1	2	4	4	5	5	3	1	3	2	1	3	3	4	2	44
8	4	2	2	2	4	1	1	1	3	1	3	2	2	2	4	2	36
9	2	1	2	1	4	3	4	2	2	2	2	3	4	4	4	4	44
10	1	1	1	4	2	1	1	1	1	1	1	1	4	1	1	4	26
11	1	2	4	2	2	4	3	3	2	4	2	3	4	3	4	4	47
12	3	3	5	5	4	5	2	1	2	1	3	2	4	2	2	4	48
13	2	2	2	2	4	4	4	3	2	2	2	3	4	2	4	4	46
14	1	4	4	4	4	5	5	4	3	3	4	2	4	2	4	5	58
15	1	2	2	4	5	5	3	2	2	2	3	3	2	1	5	3	45
16	2	2	4	1	5	4	4	2	1	2	1	1	4	1	4	3	41

	The technical infrastructure not available.	Technological infrastructure cannot support learning in a Web-based environment.	Scarce resources	Organizational conditions do not exist	Academic Staff do not have skills	The support staff not available	Support staff are not trained	No evidence of benefits	Aware of benefits for students	WBL distracts from teaching cognitive abilities	Decline of student - lecturer contact	Abuse of the facility by students.	Short term teaching method	Traditional course delivery methods are inadequate.	Academic staff favor trad. course del meth.	Largest single obstruction - lack of appropriate staff	
Item n of Sect C ----->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOT
Respondent No.																	
17	2	2	2	2	2	2	2	2	3	2	3	2	4	4	4	3	41
18	2	2	3	3	4	4	3	2	2	2	4	2	3	2	4	3	45
19	2	2	2	3	4	3	4	4	4	3	2	2	4	2	4	3	48
20	4	2	4	4	4	4	4	2	2	3	2	2	4	2	5	4	52
21	1	1	2	4	4	3	2	3	2	2	2	1	5	3	3	4	42
22	4	2	5	2	5	5	5	2	1	3	2	1	4	1	4	5	51
23	1	5	2	4	2	2	4	2	2	2	2	2	2	2	2	2	38
24	4	2	2	5	4	4	4	2	2	4	4	2	2	1	4	5	51
25	4	4	3	2	4	3	3	1	1	4	3	1	4	2	4	4	47
26	2	4	4	4	4	4	4	2	2	2	2	2	4	2	3	4	49
27	2	2	5	5	4	4	4	1	3	2	2	2	5	2	2	2	47
28	2	2	2	5	4	2	4	2	1	2	4	2	4	1	4	2	43
29	2	3	4	4	4	4	4	2	2	3	2	1	5	2	4	4	50
30	2	2	3	4	4	4	2	2	2	2	2	2	4	2	4	4	45

APPENDIX E

RESPONSES TO SECTION D OF QUESTIONNAIRE

APPENDIX E: Responses to Section D of questionnaire

Item n of Sect D --- -->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1.1	2.1	2.2	2.3	2.4	2.5	3.1	3.2	4.1	4.2	4.3	4.4	5.1	5.2	5.3	5.4	5.5	5.6
Respondent No.																		
1	5	5	5	2	3	3	5	2	3	5	5	2	4	4	2	2	5	5
2	4	4	3	4	4	1	4	1	4	4	5	2	2	4	2	3	1	2
3	5	2	4	2	4	1	5	1	5	5	4	4	3	2	2	2	4	2
4	2	2	4	2	4	2	5	2	4	2	4	2	2	4	2	5	2	3
5	4	4	4	4	4	2	4	1	4	4	4	2	3	4	3	4	2	2
6	4	4	4	2	2	2	2	2	4	4	2	4	4	4	2	4	2	1
7	4	3	4	1	3	3	4	2	4	4	2	4	3	3	1	4	3	4
8	5	2	5	2	4	1	5	2	5	5	4	2	2	3	2	1	2	2
9	5	2	4	1	3	1	5	1	5	5	5	1	3	4	2	1	2	4
10	5	5	5	5	5	1	5	1	3	5	5	1	2	5	1	1	1	2
11	5	5	5	4	3	2	3	4	4	4	4	2	2	4	2	4	2	2
12	4	2	3	2	4	3	5	1	4	4	5	3	2	4	2	3	2	3
13	4	4	4	3	4	4	4	2	4	4	4	2	2	4	4	4	2	2
14	4	2	4	4	4	3	5	1	5	5	5	1	2	4	4	2	2	1
15	5	5	4	3	3	1	5	3	5	5	4	4	4	4	3	4	4	1
16	4	4	4	2	2	2	4	1	5	2	5	2	2	4	1	2	1	1
17	4	4	4	4	4	2	4	2	4	4	4	4	3	4	4	4	3	3
18	3	2	4	2	3	2	5	3	4	4	4	1	2	3	2	3	3	2
19	4	4	3	2	2	2	4	2	4	4	4	4	2	4	2	4	2	3
20	5	5	5	1	3	2	5	1	5	5	5	1	2	4	1	4	1	4
21	4	4	4	4	2	2	4	1	5	5	5	2	2	5	2	4	2	2
22	5	5	4	4	4	3	5	4	4	5	5	1	1	4	3	3	3	3
23	4	4	2	4	4	2	5	5	5	5	5	5	2	4	3	2	2	2

Item n of Sect D --- -->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1.1	2.1	2.2	2.3	2.4	2.5	3.1	3.2	4.1	4.2	4.3	4.4	5.1	5.2	5.3	5.4	5.5	5.6
Respondent No.																		
24	5	5	4	2	4	2	5	2	4	4	4	2	4	4	2	2	4	4
25	5	4	5	1	4	3	5	3	5	5	4	2	4	4	1	3	4	2
26	4	4	4	2	4	4	5	2	5	4	5	5	4	4	2	2	2	2
27	5	4	2	2	4	1	4	2	5	5	3	2	2	3	2	2	2	2
28	5	4	4	2	1	2	5	1	5	5	3	1	2	3	1	2	2	2
29	5	5	5	1	5	3	5	1	5	5	5	1	3	5	1	2	2	2
30	4	4	4	2	4	4	5	1	5	5	1	5	4	4	2	2	1	1

Item n of Sect D --- -->	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	
	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.9	7.10	TOT
Respondent No.																
1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	142
2	3	3	4	4	4	4	4	4	4	3	4	4	4	4	5	112
3	2	2	3	5	5	5	5	3	1	3	5	1	4	5	5	111
4	2	4	5	5	4	4	5	5	2	4	4	2	2	2	4	107
5	2	4	4	4	4	4	4	4	4	4	4	3	3	4	4	115
6	3	4	5	4	4	4	5	2	3	4	4	4	4	4	5	112
7	4	4	5	5	3	5	5	4	4	4	4	4	4	3	4	118
8	4	5	4	3	5	4	5	3	3	4	2	3	3	5	5	112
9	4	4	5	5	4	5	4	4	5	5	4	3	3	2	3	114
10	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	131

Item n of Sect D --- -->	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	
	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.9	7.10	TOT
Respondent No.																
11	3	3	3	4	3	5	4	3	3	3	3	4	4	4	4	114
12	5	4	4	5	4	3	4	4	2	4	4	3	4	5	3	114
13	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	126
14	4	5	5	4	5	5	5	4	4	3	4	4	4	4	5	123
15	4	4	4	4	5	5	4	3	4	5	4	5	5	5	5	133
16	4	4	4	4	4	5	5	3	3	4	4	4	4	4	5	109
17	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	125
18	4	3	4	4	4	3	3	4	2	4	3	4	4	3	4	105
19	4	2	4	3	3	4	4	4	4	4	4	4	4	4	4	112
20	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	119
21	4	5	5	5	5	5	4	4	3	4	4	4	5	5	4	125
22	4	5	4	5	5	4	4	4	4	4	4	4	4	4	4	129
23	4	2	3	4	3	3	5	5	3	4	5	5	5	5	5	126
24	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	123
25	4	4	4	4	4	4	4	4	4	4	5	4	5	5	5	129
26	4	4	5	5	5	5	4	4	4	4	4	4	4	4	4	128
27	3	4	4	4	3	4	4	4	4	4	4	5	4	5	5	113
28	4	5	3	4	4	4	4	4	4	4	4	4	4	4	4	110
29	4	5	4	4	2	4	4	4	2	5	4	5	3	4	5	120
30	4	5	5	5	4	4	5	5	2	5	5	5	5	5	5	127

APPENDIX F COMMENCES ON FOLLOWING PAGE /...

APPENDIX F

RELIABILITY ANALYSIS SCALES

RELIABILITY ANALYSIS - SCALE (ALPHA)
Item-total Statistics Scale

Item No.	Scale Mean if item is deleted	Scale Variance if item is deleted	Corrected item total correlation	Alpha if item is deleted
QC1	41.2381	90.8905	.4500	.8441
QC2	41.0000	92.3000	.4520	.8435
QC3	40.3333	87.5333	.5823	.8360
QC4	40.5238	89.3619	.4529	.8449
QC5	40.2381	86.9905	.6370	.8327
QC6	40.1905	82.1619	.7763	.8229
QC7	40.2857	83.0143	.7271	.8261
QC8	41.6667	92.8333	.5655	.8387
QC9	41.5238	100.8619	.1447	.8558
QC10	41.1905	93.5619	.4916	.8417
QC11	41.2381	98.4905	.3015	.8497
QC12	41.8095	101.5619	.2111	.8522
QC13	39.8571	97.4286	.3329	.8486
QC14	41.5238	100.1619	.2030	.8533
QC15	40.0476	96.7476	.3183	.8496
QC16	40.1905	86.8619	.6874	.8301

Reliability Coefficients

N of Cases = 21.0

N of Items = 16

Alpha = .8508

RELIABILITY ANALYSIS - SCALE (ALPHA)

Item No.	Scale Mean if Item is deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item is Deleted
Q1.1	115.7778	113.4771	.4417	.7831
Q2.1	116.2778	105.9771	.6796	.7698
Q2.2	116.0556	118.0556	.1976	.7920
Q2.3	117.5000	116.3824	.1989	.7929
Q2.4	116.6667	114.1176	.3045	.7881
Q2.5	117.8333	113.3235	.3318	.7868
Q3.1	115.4444	117.2026	.2454	.7904
Q3.2	117.9444	115.8203	.1985	.7935
Q4.1	115.6667	125.7647	-.2756	.8059
Q4.2	115.7222	111.3889	.4692	.7809
Q4.3	116.0000	118.2353	.1023	.7980
Q4.4	117.3333	119.0588	.0205	.8081
Q5.1	117.3889	113.1928	.3510	.7859
Q5.2	116.2778	115.0359	.4673	.7841
Q5.3	118.0000	117.7647	.2027	.7919
Q5.4	117.3333	128.1176	-.2919	.8163
Q5.5	117.6667	113.1765	.2884	.7893
Q5.6	117.9444	116.6438	.2098	.7921
Q6.1	116.2778	111.6242	.5655	.7787
Q6.2	116.1667	114.1471	.2876	.7889
Q6.3	115.8889	117.7516	.2402	.7906
Q6.4	115.7778	116.4183	.3513	.7873
Q6.5	115.7778	116.7712	.3263	.7881
Q6.6	115.8333	117.3235	.2995	.7890
Q7.1	115.7222	123.6242	-.1414	.8018
Q7.2	116.1111	115.1634	.3211	.7875
Q7.3	116.6667	108.5882	.5341	.7768
Q7.4	115.8889	113.0458	.6472	.7794
Q7.5	115.8889	113.8693	.4442	.7834
Q7.6	116.0000	107.2941	.5833	.7741
Q7.7	115.8333	109.9118	.6709	.7748
Q7.9	115.7222	111.1536	.5689	.7781
Q7.10	115.3889	118.7222	.2819	.7903

Reliability Coefficients

N of Cases = 18.0

N of Items = 33

Alpha = .7939