The use of interactive technology for effective teaching and learning in open distance learning programmes

J Redelinghuys

Thesis submitted for the degree *Doctor Philosophiae* in Education Management at the Vaal Triangle Campus of the North-West University

Promotor: Prof AS Blignaut

Co-Promoter   Prof EJ Spamer

May 2017

It all starts here ™

Acknowledgements

I would like to thank my Heavenly Father for the strength, courage and grace. He has provided me with to complete this study. Without Him nothing is possible.

To my wife Linda and daughter Carla: Thank you for your support and encouragement throughout this study. I couldn't have done this without you.

Prof Seugnet Blignaut: Thank you for being my promotor for this study. Thank you for your help, guidance and encouragement throughout this journey. Without your expertise regarding all aspects of this study it would not have been possible. Your continued interest, advice and input were always of a high standard and I really appreciate it. Thank you for introducing me to and educating me in more aspects of research. I sincerely appreciate all you have done.

Prof Manie Spamer: Thank you for being my mentor at the UODL as well as for your inputs in this study as co-promotor. You have taught me everything I know regarding distance education and I will always be thankful to you for guiding me through this journey.

Dr Verona Leendertz: Thank you for your assistance with the data and the input you provided.
Dr Suria Ellis: Thank you for the data analysis and assistance in this regard.

Ms Hettie Sieberhagen: Thank you for your hard work with language editing and translations and for adhering to difficult timelines.

Dr Hennie Esterhuizen and mr Bram Schouwstra: Thank you for your valuable inputs and assistance.

Mr Jacques Pienaar: Thank you for your assistance with the technical aspects and developing the electronic version of the questionnaire.

Mr Phillip van Zyl and ms Lizelle Venter for your assistance with capturing the data received from respondents.

Ms Estie Theron for assisting with the index and administrative aspects.

To all staff members of the UODL for their support and encouragement and interest throughout this journey. It really meant a lot to me.

Abstract

Various learning technologies for learning are used by HEIs to deliver distance education programmes. Using technologies for learning in the delivery of distance education (DE) programmes enables students to access teaching, learning and resources. The purpose of this study is to investigate the use of learning technologies in developed and developing countries to foster interactivity and interactive technologies for effective student teaching and learning. The aim of this study was to investigate how the use of technologies can enhance the delivery of DE programmes at the UODL. The research question for this study was to identify which components a model would comprise to effectively integrate learning technologies into DE programmes at the UODL. Probability sampling was used during this study. Students enrolled for Education related DE programmes at the UODL (NWU) participated in the study. They resided in diverse geographical areas (rural and urban) and attended scheduled contact sessions at learning support centres (LSCs) close to them. The students taking part in this study were all practising educators registered for the BEd Honours, BEd Foundation phase, Grade R Diploma and ACE programmes. The research design for this study comprised a multi-mode bounded case study, and a fully mixed equal status sequential multi-mode design and methodology was followed. This study commenced with the qualitative research and was followed with quantitative strategies which took place between May to July 2016. The questions for the qualitative questionnaire were developed from the literature. Judgmental and snowball sampling strategies identified participants who were interviewed. All interviews were recorded and transcribed, and the researcher used Atlas ti™ to assist with the coding. A theory-driven approach culminated in 35 codes and were included in a codebook. Ward's minimum variance method and Pearson's r correlation clustered the constructs and determined the correlation between the constructs in the clusters. A convenient sampling strategy identified the respondents who completed the questionnaire. A total of 795 (522 electronic and 273 hard copies) completed questionnaires were returned. Descriptive statistics, factor analysis, effect sizes and Spearman's rank-order correlations indicated the statistical effects of the study. Sequential equation modelling (SEM) identified the components for the model on the use of interactivity in DE at the ODL. The components identified from the SEM were interactivity, infrastructure, TEL and flexibility. The results of the data reflected that infrastructure, interactivity and TEL had a definite influence on the degree of flexibility in the delivery of DE programmes. Flexibility in DE is improved when barriers are removed that influence access to resources, learning from anywhere and at any time. Improved flexibility will enable DE students to access academic and administrative support via various technologies available to them at a time convenient to them. The UODL should invest in and manage the infrastructure for the delivery of DE programmes, improve interactivity possibilities, promote TEL to improve flexibility, therefore improving the quality of DE teaching and learning. Without all aspects of support in this regard from the NWU, the UODL will not be able to improve flexibility in delivery of DE programmes.

Opsomming

Hoër Onderwysinstellings gebruik 'n verskeidenheid leertegnologieë in die aflewering van afstandsonderrig. Leertegnologieë stel studente in staat om toegang te verkry tot onderrig-en-leer en hulpbronne. Die doel met die studie was om indersoek in te stel hoe ontwikkelde of ontwikkelende lande leertegnologieë effektief kan gebruik gebruik om interaktiwiteit asook interaktiewe tegnologieë aan te wend om studente se leerervaring te verbeter. Die oogmerke was om ondersoek in te stel hoe leertegnologieë die aflewering van afstandsonderrig by die Eenheid vir Oopafstandleer (EOAL) kan verbeter ongeag waar student woonagtig is. Die navorsingsvraag was *Watter komponente kan geïdentifiseer word om 'n model te ontwikkel om interaktiewe tegnologieë effektief te integreer in die aflewering van afstandsonderrigprogramme en sodoende die kwaliteit van onderrig-en-leer te verbeter*. 'n Waarskynlikheidsteekproef is toegepas op die studie. Ingeskrewe afstandsonderrig-onderwysstudente het aan die program deelgeneem. Hierdie studente woon in 'n diverse geografiese omgewing (stedelik en platteland) en kon kontaksessies bywoon by enige van die leerderondersteuningsentrums die naaste aan hul. Slegs geregistreerde studente van die BEd Honneurs, BEd Grondslagfase, Graad R Diploma en Gevorderde Onderwyssertifikaat (GOS) het deelgeneem aan hierdie studie. Die navorsingsontwerp was 'n multi-modus begrensde gevallestudie. Die navorsingsmetodologie was 'n volle gemengde status sekwensiële multi-modus ontwerp en metodologie. Daar is begin met die kwalitatiewe navorsing wat direk opgevolg is met kwantitatiewe navorsing. Beide fases is voltooi tussen Mei en Julie 2016. Vrae vir die vraelys is geformuleer uit konsepte in die literatuur. Oordeelkundige steekproefneming asook sneeubal-steekproefneming is gebruik om deelnemers vir die onderhoude te identifiseer, en daar is met vyf deelnemers onderhoude gevoer. Alle onderhoude is opgeneem en getranskribeer, en Atlas ti™ is gebruik vir die kodering van die onderhoude. Die teoriegebaseerde benadering is gebruik om 35 kodes te identifiseer wat in die kodeboek opgeneem is. Ward se minimum variansiemetode en Pearson se r korrelasie is uitgevoer om die konstrukte te groepeer asook die korrelasie tussen die faktore binne elk van die groeperinge te bepaal. 'n Gerieflikheidsteekproef is gebruik by leerderondersteuningsentrums vir studente om die vraelyste te voltoi. 'n Totaal van 795 (522 elekronies en 273 hardekopie) respondente het die vraelyste voltooi. Beskrywende statistiek, faktoranalise, effekgroottes en Spearman se rangorde korrelasie is op die data uitgevoer. Die laaste analise wat gedoen is was die Sekwensiële Vergelykingsmodel (SEM) om die komponente van die model wat ontwikkel is te bepaal. Interaktiwiteit, infrastruktuur, tegnologie-versterkte leer (TEL) en buigsaamheid is as komponente geïndentifiseer. Die graad van buigsaamheid sal bepaal word deur die invloed van infrastruktuur, interaktiwiteit en tegnologie-versterkte leer (TEL). Buigsaamheid kan slegs verbeter word wanneer alle hindernisse soos enige tyd-leer, enige plek-leer, en toeganklikheid tot hulpbronne verbeter word. Verbeterde buigsaamheid sal afstandsonderrigstudente in staat tel om akademiese- en administratiewe ondersteuningsdienste meer geredelik te gebruik wanneer verkeie tegnologieë gebruik word. Die EOAL moet investeer in die bestuur van die totale infrastruktuur vir aflewering van afstandsonderrigprogramme, verbetering van alle interaktiwiteitsmoontlikhede en tegnologie-versterkte

leer aanmoedig om buigsaamheid te verbeter en sodoende die kwaliteit van onderrig-en-leer te verbeter. Sonder die volle ondersteuning van die NWU in die verband sal buigsaamheid in programaflewering nie realiseer nie.

Sleutelwoorde:

Interaktiwiteit
Afstandsonderrig
Oopafstandsleer
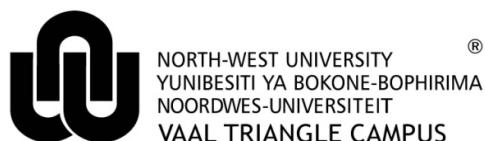Tegnologie versterkte leer
Infrastruktuur
Buigsaamheid
Toeganklikheid
Onderwyser-studente
Multi-modusnavorsing
Sekwensiële Vergelykingsmodel

Solemn Declaration of Authorship

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
VAAL TRIANGLE CAMPUS ®

ACADEMIC ADMINISTRATION
PO Box 1147
Vanderbijlpark 1911
Fax: 016 910-3116
http://www.nwu.ac.za
Enquiries: Mrs A. Smith
Tel: 016 910-3115
E-mail: Amanda,Smith@nwu.ac.za

SOLEMN DECLARATION

I declare herewith that the thesis:

The use of interactive technology for effective teaching and learning in open distance learning programmes

which I herewith submit to the North-West University as completion of the requirements set for the PhD (Education Management) degree, is my own work and has not previously been submitted to any other university.

I understand and accept that the copies that are submitted for examination are the property of the University.

Signature of candidate: _____

University number: 10476547

Signed at Potchefstroom on the day of .....December 2016.

Declared before me on this   day of _____   _____

Commissioner of Oaths: _____

vi

Certificate of Proof Reading

H C Sieberhagen
SATI no 1001489
Hettie.Sieberhagen@nwu.ac.za

Translator and Editor
082 3359846
018 2994554

CERTIFICATE

issued on 06 December 2016

I hereby declare that I have edited the language of the PhD thesis

The use of interactive technology for effective teaching and learning in open distance learning programmes

by Johan Redelinghuys

The responsibility to accept recommendations and effect changes remains with the author.

H C Sieberhagen
SATI no 1001489
ID 4504190077088

Ethics Clearance Certificate

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

Private Bag X6001, Potchefstroom
South Africa 2520

Tel: (018) 299-4900
Faks: (018) 299-4910
Web: http://www.nwu.ac.za

Ethics Committee
Tel +27 18 299 4849
Email Ethics@nwu.ac.za

ETHICS APPROVAL OF PROJECT

The North-West University Research Ethics Regulatory Committee (NWU-RERC) hereby approves your project as indicated below. This implies that the NWU-RERC grants its permission that provided the special conditions specified below are met and pending any other authorisation that may be necessary, the project may be initiated, using the ethics number below.

Project title: The use of interactive technology for effective teaching and learning in Open Distance Learning programmes at the NWU.

Project Leader: Prof. S. Blignaut
Student: Johan Redelinghuys

Ethics number:	N	W	U	-	HS	-	2	0	1	4	-	0	1	5	4
	Institution				Project Number					Year				Status

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Approval date: 2015-04-20   **Expiry date:** 2020-04-19

Special conditions of the approval (if any): None

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, please note the following:

- The project leader (principle investigator) must report in the prescribed format to the NWU-RERC:
  - annually (or as otherwise requested) on the progress of the project,
  - without any delay in case of any adverse event (or any matter that interrupts sound ethical principles) during the course of the project.
- The approval applies strictly to the protocol as stipulated in the application form. Would any changes to the protocol be deemed necessary during the course of the project, the project leader must apply for approval of these changes at the NWU-RERC. Would there be deviated from the project protocol without the necessary approval of such changes, the ethics approval is immediately and automatically forfeited.
- The date of approval indicates the first date that the project may be started. Would the project have to continue after the expiry date, a new application must be made to the NWU-RERC and new approval received before or on the expiry date.
- In the interest of ethical responsibility the NWU-RERC retains the right to:
  - request access to any information or data at any time during the course or after completion of the project;
  - withdraw or postpone approval if:
    · any unethical principles or practices of the project are revealed or suspected,
    · it becomes apparent that any relevant information was withheld from the NWU-RERC or that information has been false or misrepresented,
    · the required annual report and reporting of adverse events was not done timely and accurately,
    · new institutional rules, national legislation or international conventions deem it necessary.

The Ethics Committee would like to remain at your service as scientist and researcher, and wishes you well with your project. Please do not hesitate to contact the Ethics Committee for any further enquiries or requests for assistance.

Yours sincerely

Linda du Plessis

Digitally signed by Linda du Plessis
DN: cn=Linda du Plessis, o=NWU,
Vaal Triangle Campus, ou=Vice-
Rector: Academic,
email=linda.duplessis@nwu.ac.za,
c=US
Date: 2015.04.29 08:31:55 +02'00'

Prof Linda du Plessis
Chair NWU Research Ethics Regulatory Committee (RERC)

Table of Contents

Chapter One   Introduction to the Study, Basic Concepts and Methodologies Used

Chapter Two   Mapping the Research Design and Methodology

Chapter Five   Analysis of the Quantitative Constructs

**Chapter Six   Identifying Components for a Model for Effectively Integrating Interactive
                 Technologies into Distance Education Programmes**

List of Tables

List of Figures

List of Addenda

Addendum 2.1   Information letter to learner support centers

Addendum 2.2   Permission from the Executive Director of the UODL to conduct the research

Addendum 2.3   OPTENTIA checklist

Addendum 2.4   Permission letters to participants to conduct the interviews, correctness of the interviews and permission the use data from the interviews

Addendum 2.5   Permission to complete the qualitative questionnaire and the quantitative questionnaire

Addendum 2.6   Qualitative interview schedule

Addendum 2.7   Integrated hermeneutic unit of qualitative data

Addendum 3.1   Guidelines 2016: Arrangements and Information for Contact Sessions; South Africa and Namibia

Addendum 4.1   Translations of Afrikaans utterances from qualitative interviews

Addendum 5.1   Spreadsheet relating to descriptive statistics

Addendum 5.2   Spreadsheet relating to factor analysis

Addendum 5.3   Spreadsheet relating to Spearman rank-order data

Addendum 5.4   Analysis of Spearman rank-order data

The addenda are available on the CDROM at the back of the thesis.

Addendum 2.7 is available from http://distance.nwu.ac.za/JR10476547

List of Acronyms

ACE	Advanced Certificate in Education
AMOS	AMOS Development Company
AOU	Arab Open University
ASS	Academics Support Services
BYOD	To bring own devices
CAQDAS	Computer Assisted Qualitative Data Analysis Software
CCM	Constant Comparative Method
CFI	Comparative Fit Index
CMC	Computer-mediated Communication
CMIN/DF	Chi-square test statistic divided by its degrees of freedom
DE	Distance Education
DF	Degree of freedom
HE	Higher Education
HEIs	Higher Education Institutions
ICT	Information Communication Technology
IGNOU	Indira Ghandi National Open Learning University
IWBs	Interactive whiteboards
LMSs	Learner Management Systems
LT	Learning Technology
LSCs	Learner Support Centres
MEd	Master of Education
MOOCs	Massive Open Online Courses
NWU	North West University
ODeL	Open Distance e-learning
ODL	Open Distance Learning
OERs	Open Distance Resources
OLG	Open Learning Group
OU	Open University
OU of the UK	United Kingdom Open University
PC	Potchefstroom Campus
PLE	Personal Learning Environment
POK	Potchefstroom Teachers College
PP	PowerPoint
RMSEA	Root Mean Square Error of Approximation
SA	South Africa
SCTE	School for Continuing Teachers Education
SEM	Structural equation modelling

SMS	Short Message System
SPSS	Statistical Package for the Social Sciences
T&L	Teaching and Learning
TEL	Technology-enhanced Learning
TEL for DE	Technology-enhanced Learning for Distance Education
UKOU	United Kingdom Open University
UNISA	University of South Africa
UODL	Unit for Open Distance Learning
USA	United States of America
VLE	Virtual Learner Environment

Chapter One

Introduction to the Study, Basic Concepts and Methodologies Used

1.1   Introduction and rationale for the study

One of the post 1994 South Africa challenges was identifying and upgrading the qualifications of approximately 85 000 under qualified educators (Pandor, 2004). In 2005 the NWU responded to this challenge and embarked on delivering education programmes in order to address this shortfall through open distance learning (ODL) which could be defined as:

> A multi-dimensional concept aimed at bridging the time, geographical, economic, social, educational and communication distance between student and institution, student and academics, student and courseware and student and peers. Open distance learning focuses on removing barriers to access learning, flexibility of learning provision, student-centredness, supporting students and constructing learning programmes with the expectation that students can succeed UNISA (2008, p. 2).

The strategies and structures for delivering distance education (DE) programmes vary amongst institutions and countries. This study aims to investigate different modes of delivery used at a variety of institutions in order to identify best practices to enhance student interactivity at the Unit for Open Distance Learning (UODL) at the Potchefstroom Campus (PC) of the North-West University (NWU).

Simonson, Smaldino, Albright, and Zvacek (2009) and Burgess and Russel (2003) describe DE as the transmission of self-instructional programmes to students dispersed over wide geographical areas. To transfer information to students, they need to engage with some learning technology (LT) in order to disseminate information and learning materials. Engagement can therefore be defined as when there is involvement with someone or something, including technologies, in order to enhance learning (Dede, 2009). DE students wish to engage with teaching and learning at any time and at any place as they are physically separated from their facilitators, learning content and their peers (McIsaac & Gunawardena, 2001). Various satisfaction indicators contribute towards the engagement of DE students. These include technological aspects, instructor issues, communication modes, course management, course web sites, navigational components, level of interactivity and general information (Bollinger & Martindale, 2004; Mdakane, 2011). The use of LTs in the delivery of DE programmes could enhance interactivity and the engagement of students during teaching and learning (Mdakane, 2011).

Delivery of DE programmes makes use of an array of LTs, including printed media, mobile devices, tablets, interactive whiteboards (IWBs) etc. to facilitate teaching and learning. Development in information communication technology (ICT) enables further possibilities to support, assist and enhance teaching and learning especially in diverse geographical environments where DE students find themselves. ODL requires from higher education institutions (HEIs) and involved role players to identify and evaluate new and improved modes of ICTs available to them. Implementation of ICTs in

ODL at HEIs is gradually growing to be either the primary or supplementary source in delivery of programmes (Fozdar & Kumar, 2007).

Figure 1.1 constitutes the outline and the organization of this chapter.

```
┌─────────────────────────────────────────────────┐
│   ┌───────────────────────────────────────┐     │
│   │   Introduction and rationale for this study │
│   └───────────────────────────────────────┘     │
│                      │                           │
│                      ▼                           │
│   ┌───────────────────────────────────────┐     │
│   │        Purpose, aims and objectives    │     │
│   └───────────────────────────────────────┘     │
│                      │                           │
│                      ▼                           │
│   ┌───────────────────────────────────────┐     │
│   │            Research questions          │     │
│   └───────────────────────────────────────┘     │
│                      │                           │
│                      ▼                           │
│   ┌───────────────────────────────────────┐     │
│   │             Literature Review          │     │
│   └───────────────────────────────────────┘     │
│                      │                           │
│                      ▼                           │
│   ┌───────────────────────────────────────┐     │
│   │      Research design and methodology   │     │
│   └───────────────────────────────────────┘     │
│                      │                           │
│                      ▼                           │
│   ┌───────────────────────────────────────┐     │
│   │          Ethical considerations        │     │
│   └───────────────────────────────────────┘     │
│                      │                           │
│                      ▼                           │
│   ┌───────────────────────────────────────┐     │
│   │         Contribution of the studv      │     │
│   └───────────────────────────────────────┘     │
│                      │                           │
│                      ▼                           │
│   ┌───────────────────────────────────────┐     │
│   │             Chapter division           │     │
│   └───────────────────────────────────────┘     │
└─────────────────────────────────────────────────┘
```
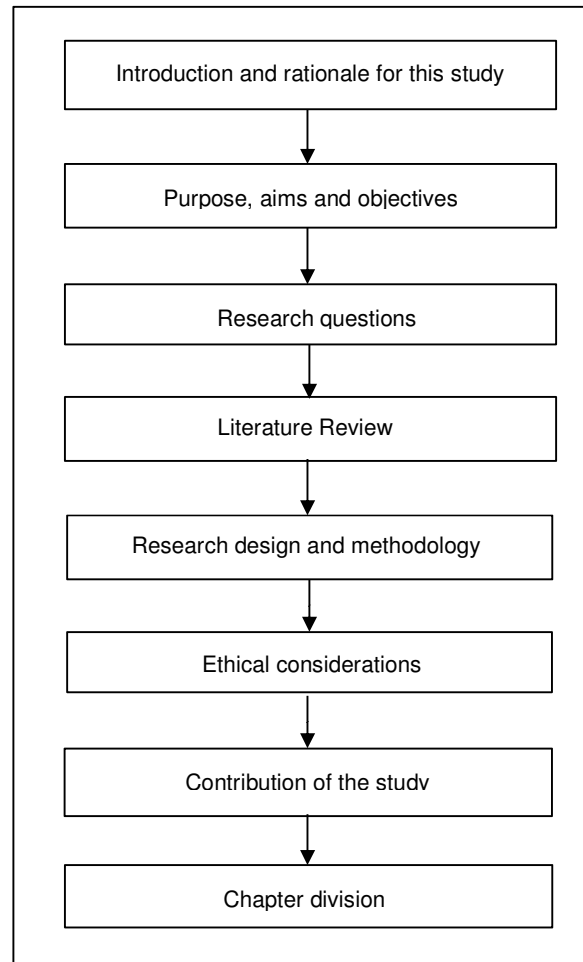
Figure 1.1   Outline and structure of the study

The researcher explores the characteristics of interactivity and LTs improving interactivity between students and facilitators during live IWB sessions at learner support centres managed by the UODL, who aims to improve the quality of learning, the social interaction amongst students, interaction between students and facilitators, as well as other role players who contribute towards the quality of teaching and learning delivered through DE programmes. Other aspects that also come into play relate to the technology expertise of facilitators at tuition centres who assist the facilitation of the lecture during the live interactive whiteboard sessions (Rabe & Sieberhagen, 2013).

Introducing interactivity into the delivery of DE programmes could contribute towards the eradication of the *barriers* of students not able to engage with their teaching and learning. An aspect which should be developed is social interaction in order to improve interaction and interactivity. Tu and McIsaac

(2002) state that improving (i) informal relationships, (ii) the quality and effectiveness of technical support, and (iii) creating trust amongst all individuals involved in ODL in general, would improve interactivity in online programmes. Interactivity with ICT-based LTs differs from traditional teaching and learning (Jensen, 1998). Optimal use of interactive technologies could improve efficiency of teaching and learning and provide more opportunities for interactivity than in traditional delivery modes. The study therefore considers and compares interactive technologies used in developed and developing countries which contribute towards the value of DE programme delivery at the UODL. The quality of teaching and learning remains priority when deciding which interactive technologies would be more effective for the UODL at the NWU.

Students are expected to interact with the institution for possible administrative and academic support in order to enhance their teaching and learning experience. Mdakane (2011) states that students continuously rely on interaction between themselves and the HEI, and that such interaction has a definite influence on the satisfaction students experience. Developing a framework for planning and implementing interactive technologies in DE could be advantageous for the selection and use of LTs in the delivery of quality DE programmes.

Implementing new LTs in DE should be approached cautiously, keeping in mind students' needs and their available infrastructure (KOTUR, 2006). Global aspects regarding implementation of LTs should be taken into consideration in order to identify and implement a suitable infrastructure for using LTs in the delivery of DE programmes at the UODL. The infrastructure, support, content quality of assessment, designing of ODL and delivery methods will have an influence on the experience students have of DE programmes and their delivery (Fraser & Killen, 2005; Mdakane, 2011). Irrespective of mode of delivery, investigation of interactive technologies and needs analysis of the perceptions of students and role players involved in delivery of DE programmes, should be conducted to determine the approach to be followed during implementation of interactive technologies for the delivery of DE programmes (Areti & Bousiou-Makridou, 2006; Isman, Dabaj, Altinay, & Altinay, 2003).

A need exists at the UODL for interactive technologies to be implemented on a much larger scale, as new and improved communication technologies are currently available. Before LTs can be expanded at the UODL, a framework for implementation and management has to be developed from data obtained from this study. Within this framework, definite management guidelines will be developed and implemented in order to effectively manage the use of LTs in the delivery of DE programmes at the UODL.

1.2   Purpose, aims and objectives

1.2.1 Purpose of this study

By investigating the use of learning technologies in developed and developing countries, the researcher will establish how interactivity and interactive technologies could effectively improve students' learning experiences. Effective planning, leading, organization and control over the teaching and learning environment could assist in this task. Using and applying effective planning of a technologically enriched learning environment, leading, organization and control of LTs in the teaching and learning environment in delivering DE programmes enabled the researcher to explore more technologies to further enrich the process and quality of DE teaching and learning.

1.2.2 Aim of this study

The aim of this study is to investigate how the use of LTs could enhance the delivery of DE programmes at the UODL for geographically diverse students enrolled at the NWU for DE programmes.

1.2.3 Objectives of this study

This study has two main objectives. To do:
(i)   a literature study describing the current state of the literature on the use of interactive technologies for delivering DE programmes
(ii)   an empirical investigation into the effect of interactive technologies on the quality of teaching and learning in delivery of distance education programmes.

Effective planning and assessment of infrastructure for implementing LTs for improved interactivity in delivering DE programmes could improve the researcher's ability to manage and organize an improved teaching and learning environment at all learner support centres, utilizing and implementing a more effective model for usage of interactive teaching and learning technologies in DE programmes at the UODL. This will enable the researcher to organize and improve more effective administrative and academic support to students enrolled for DE programmes. Effective organization will improve management structures within the structure to deliver DE programmes.

1.3   Research question

1.3.1 Central research question

After a fundamental review of the literature it is evident that the integration of interactive technologies could improve access, anywhere and anytime learning. The overall quality of teaching and learning in

delivery of distance education programmes could improve. The following research question was formulated as a framework for this study:

Which components would a model comprise; effectively integrating interactive learning technologies into distance education programmes at the UODL, improving the quality of teaching and learning?

1.3.2   Additional research questions

Based on the central research question, the following sub questions were formulated and further contribute towards addressing the main research question:

- What are the characteristics of learning technologies in delivering distance education programmes?
- What are the requirements and aspects an infrastructure at the UODL must adhere to for success in distance education programme delivery?
- How can interactive technologies contribute towards the delivery of distance education programmes at the UODL?
- What are the aspects of effective use of interactive technologies in delivering of distance education programmes at the UODL?
- What will the influence be of the management tasks in utilizing learning technologies at the UODL?

1.4   Literature study

The literature study is a systematic, explicit and reproducible process for identifying, evaluating and synthesising the existing body of recorded work created by researchers and practitioners (Punch, 2009). A comprehensive literature study of relevant primary and secondary sources was performed in order to compile a conceptual framework for the effective implementation and management of interactivity and interactive teaching and LTs as part of an ODL model.

The following databases were explored: Scopus, ERIC, EBSCOhost, JSTOR, ScienceDirect Google Scholar, the Internet and education and management indexes were searched for research-related information. Keywords and phrases that were used in the database searches were: *Learning technologies, Interactivity, Interactive technologies, Distance education, Open Distance Learning, Management.*

1.4.1   Concept clarification

Concepts related to the study and that related to interaction and interactive technologies are listed in Table 1.1.

Table 1.1   Conceptual clarification

Concept	Explanation and clarification
Learning technologies	Digital technologies used to assist during teaching and learning are defined as LTs, and includes educational and assistive technologies (Hersh, 2014). Varao-Sousa and Kingstone (2015) state that by deploying various factors and methods influencing the environment in which learning occur, one can separate and identify which of these factors and methods could have an influence on the cognitive aspects of the learning environment.
Interactivity	Bezjian-Avery, Calder, and Iacobucci (1998) and Steuer (1992) define interactivity as the extent to which users participate in and modify their environments in real time and modify dialogue between individuals not previously possible. Interactivity can also further be viewed as interactivity between users themselves, users and machines and users with the message that is conveyed (Liu & Shrum, 2002). Chou, Peng, and Chang (2010) distinguish between learner-instructor interaction, learner-interface interaction, learner-self interaction and learner-content interaction. Interactivity is not only an action between a modern communication device and a student.
Interactive technologies	Interactive technologies create perceived face-to-face modes of interaction for distance education students and role players involved in distance education (Andersson & Hatakka, 2010). Modern communication technologies are accessible to students and role players to participate in teaching and learning and further enhance teaching and learning.
Distance education	DE takes place through printed and electronic media, enabling students to collaborate in teaching and learning irrespective of time and place (Gunawardena & McIsaac, 2004). Students are not residential students and are therefore reliant on effective communication in order to assist them with timely and effective administrative and academic support. Karpenko (2008) defines distance to include technical innovations and social interaction aiming to improve the educational process.
Open distance learning	ODL focuses on removing barriers of access to learning, allowing students to take control of their learning. Enabling students control of their learning, makes it possible for students to set their objectives, structures and systems for learning at any place and time (Keegan, 1996). ODL aims to remove all barriers that prevent effective delivery of teaching and learning to distance education and aims to ad flexibility and accessibility to distance education students.
Technology-enhanced Learning	Manouselis, Drachsler, Vuorikari, Hummel, and Koper (2011) explain technology-enhanced learning (TEL) as all technologies available that could support any form of teaching and learning activity. TEL could broaden the total support structure on all levels for students enrolled for DE programmes. In a TEL environment, connectivity among students themselves, between students and lecturers and between students and resources is evident and viewed as a process of intervening in teaching and learning (Zitter, De Bruijn, Simons, & Cate, 2012)
Management of interactive learning technologies	Van der Westhuizen (2009) describes four basic main management tasks that regulate the teaching and learning process: planning, organising, leading and controlling constitute the core aspects of the management process. Setting up an infrastructure and implementing the management tasks within this structure for interactivity at tuition centres could form the basis to initialise interactivity between students and role players.

1.5   Research design and methodology

From a functionalist paradigm with the aim to provide solutions to a problem, a multi-modal approach will be used in this study to investigate how interactive learning technologies can effectively be integrated in the delivery of DE programmes to enhance teaching and learning at the UODL.

1.5.1   Research design: Multi mode bounded case study

1.5.1.1 Research design

De Leeuw (2005) describes multi-mode as using different modes for collection of data where there is no main mode, but all modes are equal. Using only a single method in this case would not have provided a comprehensive account of the phenomenon under investigation (Torrance, 2012). This study was bounded as only UODL students that used or were exposed to interactive technologies during teaching and learning. A bounded study sets boundaries around the context of the phenomenon that is studied within a specific time frame (Ivankova, Creswell, & Stick, 2006; Merriam & Tisdell, 2016; Miles, Huberman, & Saldana, 2014). Studying a case or a bounded system over time using detailed in-depth data collection and information from various sources which is rich in context are defined as a case study (Merriam, 1998).

1.5.1.2 Research methodology

The UODL is based on the Potchefstroom Campus of the NWU, situated in the North-West province in South Africa. The NWU is a dual-mode university offering programmes on-campus (contact teaching) and through distance education. The UODL does not own any programmes but serves as a vehicle for faculties to deliver programmes at 65 Learner Support Centres (LSCs) throughout South Africa. Facilities used for LSCs are schools, colleges, churches and in some **cases** government buildings. The UODL does not own any of these facilities and rent them from the relevant authorities. LSCs are established in areas where large groups of students are registered. Irrespective of the location of the identified centre, the UODL ensures that a full technological and support infrastructure is established at each of these centres.

The UODL has ±35 000 students enrolled for various programmes. Registered students of the UODL reside in rural and urban areas throughout South Africa. A typical UODL student is a full-time educator employed by one of the various Provincial Education Departments. In most cases these students do not have their own transport and rely on public transport or taxis to attend scheduled contact sessions at LSCs, which could be costly to them. Contact sessions at LSCs are scheduled over weekends and during afternoons to accommodate those students travelling far distances to sessions. All students therefore are not able to attend all sessions regularly because of the distances they have to travel. All distance education programmes are facilitated at all of the 65 LSCs throughout South Africa, and students are not bound to a specific LSC. Students may attend the session at the LSC closest to them. Contact session attendance is not compulsory and students may also watch live contact sessions using their own devices from any location.

Students have the choice to attend live whiteboard sessions at LSCs, or for those not able to attend these sessions, recordings are made available to download. All LSCs are equipped with an ADSL line in order to connect IWBs to scheduled contact sessions. Students are able to interact with lecturers during live sessions should they have any academic queries. Facilitators at LSCs must also assist in

this regard. Free Wi-Fi connectivity is available at all LSCs to all enrolled students to access resources or download recorded sessions that were facilitated on the IWBs. One must understand that some students do not have internet access at all and rely on the internet at LSCs to connect to the internet for access to resources and recorded sessions. A resource centre is available at all LSCs and is stocked with various media, text books and additional material students could use. At each LSC a resource centre assistant is appointed to assist students to connect through Wi-Fi, should they need to download resources or previously recorded sessions. Staff at resource centres assist students on how to use the various resources available, and they also help them to use the internet to access resources. Many of these students bring external drives and flash drives to contact sessions and download all the resources they might need. An infrastructure for support at each LSC has been established, assisting and supporting students with academic and administrative matters. The UODL focuses on affording all enrolled students equal access to live sessions, recorded sessions, resources and support from any location and at any time, as students are not always able to attend live scheduled sessions at any of the LSCs.

Various platforms are made available to students to access resources and download information. These platforms include the UODL website, OLG website, Facebook, SMS, Moodle, eFundi or contacting the NWU call centre or OLG helpdesk for support. LSCs are equipped to assist students in this regard. With academic queries, students are referred to the relevant academic staff. These platforms afford students equal access to communication and resources, removing barriers normally associated with delivering DE programmes.

Contracted accredited facilitators from faculty assist students during scheduled sessions should they have any academic queries. A centre manager is appointed at each LSC to manage and assist with contact sessions and overall functioning of the centre. The UODL aims to integrate more interactive technologies at LSCs, improving the quality of teaching and learning, improving communication between all role players and establishing effective infrastructure for administrative and academic support. The UODL is continuously exploring more relevant communication technologies that might improve the quality of teaching and learning in the delivery of distance education programmes.

This study is classified as a multi-mode bounded case study research design and methodology—a fully mixed equal status sequential multi-mode design and methodology (Leech & Onwuegbuzie, 2009). The researcher aims using this methodology to create a comprehensive account of perceptions and understanding of interactive technologies in delivering DE programmes. The data collected by the researcher in this study were all equally important and the qualitative data were used by the researcher to develop the quantitative measuring instrument. The researcher commenced with a qualitative approach and used the findings from the qualitative data to identify aspects which were included in a quantitative questionnaire (Dabney, Chakraverty, & Tai, 2013; Venkatesh, Brown, & Bala, 2013). The quantitative research immediately followed the qualitative research within a specific timeframe. Multi-modal research relates to combining the qualitative and quantitative methods

(Creswell, 2009; Johnson, Onwuegbuzie, & Turner, 2007; Leech & Onwuegbuzie, 2009; Maree, 2009). By combining qualitative and quantitative methods the use of numerical data and textual data provides real answers to real questions (Cohen, Manion, & Morrison, 2011a). This research took the form of a phenomenological study. A phenomenological study aims to understand a person's perception of an event and the meaning the person gives to it, rather than just looking at what the external viewpoint of this issue is to the respondent (De Vos, Strydom, Fouche, & Delport, 2011). In this case the phenomenon that was studied was the use of interactive technologies in delivering quality teaching and learning with distance education students. Creswell (2009) defines a phenomenological study as a strategy to understand the essence of human experiences as it will normally be described by participants.

Affording the entire student population the opportunity to form part of this research, the researcher employed probability sampling whereby everyone had an equal opportunity to be included as part of this research (Creswell, 2009; Gall, Gall, & Borg, 2007). This purposeful sample was drawn with the assistance of the Department of Statistical Analysis and Support of the NWU. Both groups that formed part of this study attended contact sessions at learner support centres of the UODL and were all registered students of the UODL. Interviews the researcher conducted with participants were done without choosing a pre-determined number of respondents. The researcher applied judgemental and snowball sampling as the researcher identified participants that were knowledgeable about the various technologies used by the UODL to take part in the interviews. These interviews were conducted with participants until data saturation was achieved. A theory-driven approach (DeCuir-Gunby et al., 2011) was used to identify the codes (constructs). The researcher performed a constant comparative method for coding to specifically discover patterns that stand out in the research by discerning conceptual similarities in the research (Tesch, 2013). Before the researcher could determine if data saturation was achieved the researcher used a quantizing strategy to convert qualitative data into quantitative data (Miles et al., 2014). The point when the same thoughts, actions, responses and perspectives are heard from respondents, so that no additional participants are needed, is known as data saturation (Gray, Mills, & Airasian, 2011). The researcher was primarily involved in all aspects of the quantitative and qualitative methods of the study. The researcher assessed the inter-rater reliability by performing Cohen's Kappa (Pace et al., 2012).

During the quantitative data collection the researcher applied convenience sampling enabling all enrolled students who were easily accessible and who were willing to take part the opportunity to complete the questionnaire (Teddlie & Yu, 2007). The questionnaires for the qualitative and quantitative research focused on four concepts, namely DE, interactivity, interactive technologies and the quality of teaching and learning during interactivity. To meaningfully organize and summarize numerical data using frequencies, percentages, distribution, mean, median, modus and deviancies, the researcher used descriptive statistics (Burke Johnson & Christensen, 2014). After using descriptive statistics, the researcher applied inferential statistics about a sample of the data drawn from a subset of the population used in the study (Burke Johnson & Christensen, 2014). A factor

analysis was used with data collected form the quantitative data where all variables were scaled down and combined in order to calculate how these variables correlate with one another (Onwuegbuzie & Leech, 2005). The researcher used structural equation modelling (SEM) to develop a model for clearer conceptualization of the study (Byrne, 2013).

The value of any research is linked to the generalizability of the results and the testing of these results that will increase the trustworthiness and validity of the research (Bashir, Afzal, & Azeem, 2008). Rolfe (2006) and Maree (2016) classify trustworthiness into credibility (internal validation), dependability (reliability), transferability (external validity and confirmability (how data is presented)). Validity of any research is when the measuring instrument used, measures that which was intended to be measured (Briggs & Coleman, 2009; Cohen et al., 2011a). Data collected for this research during the quantitative and qualitative phases must adhere to internal and external validity. Reliability of research is determined by the degree that a test measures constantly that which it is supposed to measure (Abowitz & Toole, 2010; Gray et al., 2011; Pace et al., 2012; Pluye, Gagnon, Griffiths, & Johnson-Lafleur, 2009).

1.6   Ethical considerations

Ethical measures as stipulated by the NWU ethical committee were adhered to as is set out in the NWU ethical code. Gray et al. (2011) and Maree (2016) clearly state that all participants taking part in any study must be protected, kept clear of any harm and may only take part in any research if they voluntarily agree to take part. Data and information collected from participants and respondents, as well as their identities, which were not disclosed to anyone, were treated with great confidentiality. The identities of respondents and participants were known to the researcher. Should the identity of participants and respondents be hidden from the researcher a degree of anonymity is maintained in a study (Gray et al., 2011).

None of the participants and respondents who attended the contact sessions at any of the learner support centres of the UODL were at risk at any time during the research process, and an informed consent form was signed by all participants and respondents for their permission to take part in this research. No participants, at any time, should be put at risk and their vulnerability must be protected (Creswell, 2009). The required ethical clearance was approved by the NWU Ethical Committee. The ethical number obtained by the researcher for this study is NWU-HS-2014-0154.

1.7   Contribution of the study

This research determined how interactive technologies could be integrated in the delivery of DE programmes of the UODL to improve the quality of teaching and learning. Stoner (1996) states that

investigating emerging technologies (mobile devices, interactive whiteboards, etc.), analysing the needs for delivering programmes, designing and integrating new technologies for learning, and implementing these technologies in delivering programmes through ODL could make a positive difference in the learning experiences of students. This study is valuable as it will provide a framework to assist the UODL to integrate these technologies and improve the quality of teaching and learning.

UODL students are distributed over a wide geographical area and access to teaching, learning and resources could be a challenge. Access to resources and also to all aspects of teaching and learning will add flexibility to DE programme delivery when introducing other means of communication (Commonwealth of Learning, 2000). This study aims to identify components that would address the effective integration of technologies in DE programme delivery. These components will form part of a valid and tested framework that will serve as guideline for implementation.

1.8   Chapter division of the study

The conducted research is presented according to the following chapters:

Chapter One: Chapter One provided an orientation of the study. An outline was developed and provides a clear framework for integrating interactive technologies into distance education programmes at the UODL to improve the quality of teaching and learning.

Chapter Two: Chapter Two focused on the research design and methodology of this study. Both the qualitative and quantitative research methods were discussed and motivation provided why this research approach was undertaken. Data collection and analysis procedures were discussed and explained. All aspects regarding trustworthiness of this study were presented. Ethical considerations and limitations were discussed in detail.

Chapter Three: In this chapter the researcher identified concepts that have an influence on the use and integration of interactive technologies in the delivery of distance education programmes at the UODL. Each of the identified concepts was explained and its contribution in delivery of DE programmes clarified. The concepts that were identified were: (i) role of technology-enhanced learning (TEL) for DE; (ii) ODL for developing contexts; (iii) interactivity; (iv) technologies for learning; and (v) case studies serving as examples of interactivity across contexts. These concepts then formed the basis in establishing the effective use of these technologies in the delivery of DE programmes.

Chapter Four: This chapter provided details and analysis of the data collected from the interviews using the qualitative questionnaires. Transcribed interviews were imported into Atlas ti™ upon which coding was done to identify the constructs that were used. Codes were identified from the literature

using a theory-driven approach (DeCuir-Gunby et al., 2011). The data collected from interviews were discussed, analysed and evaluated. Data saturation was achieved upon which cluster factor analysis was done to ascertain the strength of the variables in order to assist with the development of the quantitative questionnaire (Onwuegbuzie & Leech, 2005).

Chapter Five: The data collected with the quantitative questionnaire were analysed and discussed. Descriptive and inferential analysis was performed with data collected from respondents. Data collected enabled the researcher to understand the respondents' perceptions and understanding of interactive technologies in delivering teaching and learning in DE.

Chapter Six: This chapter provided a conclusions and overview of the inquiry. Furthermore this chapter provided a description of the contribution of the study regarding the integrating of interactive technologies at the UODL to improve the quality of teaching and learning. The central research question and the additional research questions were addressed in this chapter. Limitations and the journey the researcher embarked on in this study were discussed.

Chapter Two

Mapping the Research Design and Methodology

2.1   Introduction

Chapter One provides an overview of the study. Chapter Two presents an in-depth description of the research design and methodology, as well as the limitations of this study. Figure 2.1 outlines the framework for the research design and methodology, as well as detail of the research strategies followed during the study.

2.2   Research question

The research question which underpins this study was formulated in Chapter One (§1.2) and it is repeated here for the convenience of the reader:

> Which components would a model comprise; effectively integrating learning technologies into distance education programmes at the UODL, improving the quality of teaching and learning?

2.3   Worldview for this study

As part of social theory, Burrel and Morgan (1979) distinguish between four distinct paradigms of organisations. They classify four assumptions about the nature of social science as the assumption of ontological nature, epistemological nature, human nature and methodological nature. The resulting, subjective-objective and regulation-radical change dimension structure comprises four paradigms: the interpretive, radical Humanist, radical structuralist, and functionalist paradigm scheme for the analysis of social theory (Figure 2.2).

The *interpretive* paradigm views the social world as emerging social processes. The Interpretive paradigm seeks explanation within the realm of individual consciousness and subjectivity, within the frame of reference of the contributor as opposed to the observer of action. It has a tendency to be nominalist, anti-positivist, voluntarist and ideographic (Burrel & Morgan, 1979). The *Radical Humanist* paradigm's approach to social science has much in common with the interpretivist paradigm in the sense that it is also a world view from a nominalist, anti-positivist, voluntarist and ideographic view. In the radical humanist paradigm, people's consciousness is dominated by the ideological superstructures with which they interact, and ideological superstructures drive a cognitive wedge between them and their true consciousness. In this paradigm emphasis is placed on radical change,
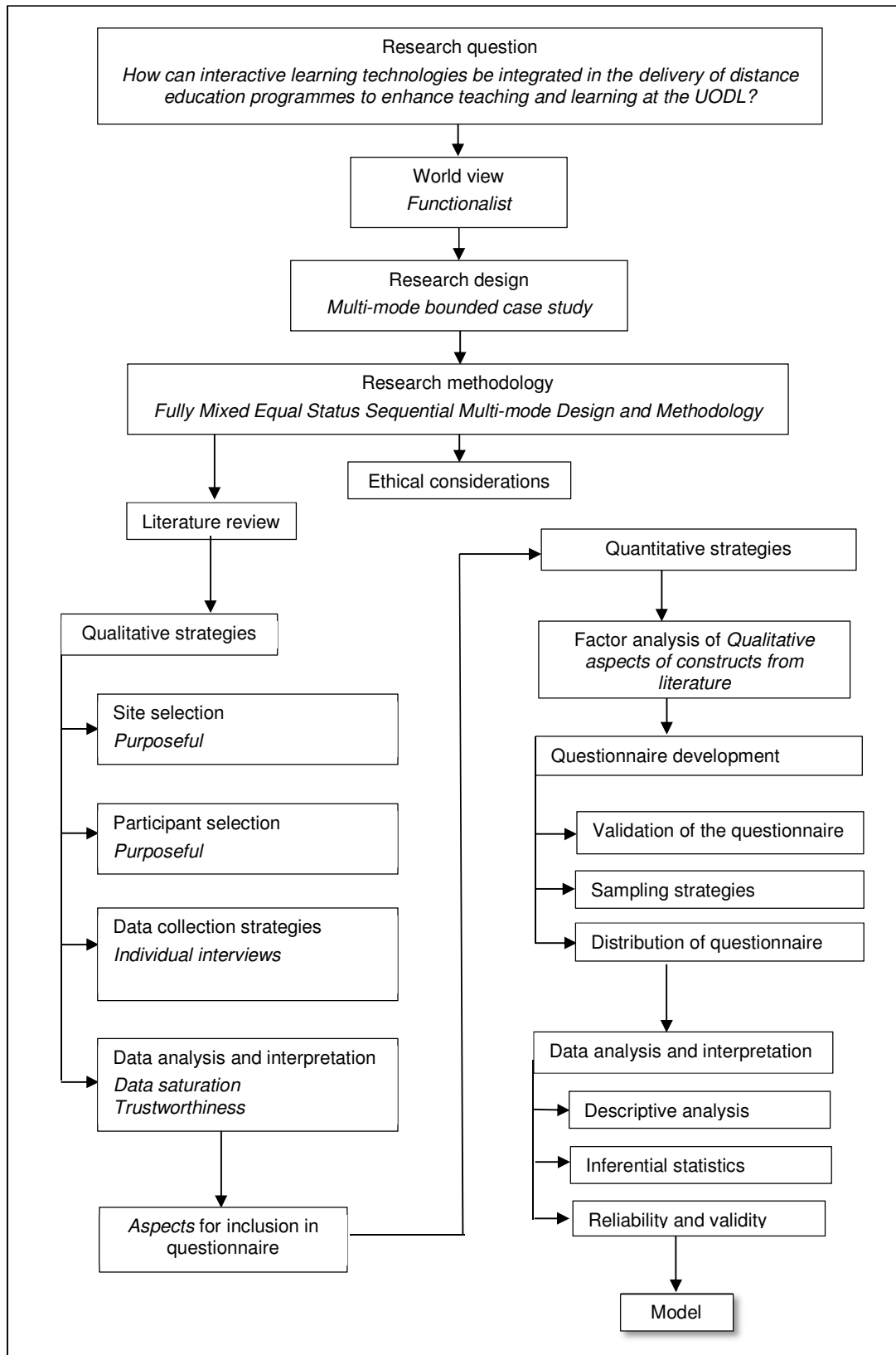
Figure 2.1:   Research design and methodology followed during this study
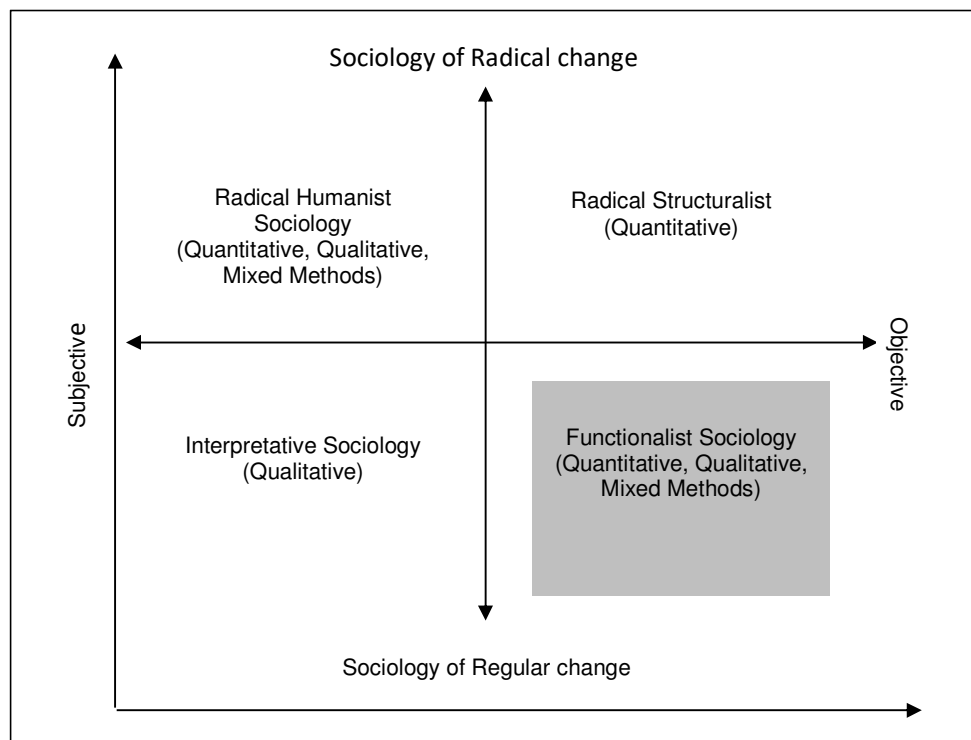
Figure 2.2   Research paradigms for social research (Burrel & Morgan, 1979)

modes of domination, emancipation, deprivation and potentiality (Burrel & Morgan, 1979). The
Radical Structuralist paradigm's viewpoint is objectivistic and advocates sociology of radical change.
This paradigm is committed to radical change, emancipation and potentiality, in an analysis which
emphasizes structural conflict, modes of domination, contradiction and deprivation. The radical
structuralism focuses on structural relationships within a realist social world, and emphasizes that
radical change is built into the very nature and structure of contemporary society, and seeks to provide
explanations of the basic interrelationships within the context of total social formations (Burrel &
Morgan, 1979).

The *Functionalist* paradigm is characterised by a concern for providing explanations of the status quo,
social order, consensus, social integration, solidarity, need satisfaction and actuality. It approaches
these general sociological concerns from a standpoint which tends to be realist, positivist, determinist
and nomothetic. In its overall approach it seeks to provide essentially rational explanations of social
affairs. It is a perspective which is highly pragmatic in orientation, is concerned to understand society
in a way which generates knowledge which can be put to use. It is often problem-orientated in
approach, and concerned to provide practical solutions to practical problems (Burrel & Morgan, 1979).
The functionalist paradigm is problem-orientated in its approach and was used in this study as it
focuses on realistic, real world issues and objectively evaluative research that maintains the realistic
and objectivity within organization structure; all issues in this study could be measured, evaluated and

monitored (Burke, 2007). The functionalist paradigm treats society in which the study takes place as an existing, actual and physical world with a universal and complete character and furthermore also focuses on the effectiveness of systems encountered in the real world (Dunnion & Knox, 2004; Koerten, 2008).

During this study, information and data about the knowledge and perceptions of interactive learning technologies and using and applying LTs in teaching and learning have been collected to evaluate the effectiveness thereof. The interactive teaching and learning technologies were subsequently applied into practice, which corresponds with the pragmatic approach (Burrel & Morgan, 1979). Creswell (2014) is of the opinion that multimodal research relates to a pragmatic world view which forms part of the functionalist approach where a researcher should employ more than one strategy to understand a research problem. Collier and Adcock (1999) define pragmatism as the way that an individual understands and operationalizes a concept. Pragmatism in research context is viewed and defined as problem solving (Newby, 2014). Pragmatism is viewed and regarded as one of the paramount philosophical partners and a guiding tool that assists in multimodal research (Denscombe, 2008).

This study aimed to determine the perceptions, attitudes and emotions of distance education students pertaining to the use of interactive teaching and learning at the UODL; and their interaction with tangible objects such as mobile devices. Using and evaluating tangible objects within a study relates to the epistemology used during the study. Epistemological assumption refers to the base of knowledge, whether it is "hard, real and tangible versus the anti-positivist view that is softer or more spiritual and needs to be personally experienced" (Cohen et al., 2011a, p. 6).

2.4   Research design: Multi-mode bounded case study

Research design relates to the entire process from conceptualization of the research problem to the formulation of the research question, data collection strategies and the analysis of data (Bodgan & Taylor, 1975). Research design presents us with the full picture of the phenomenon under study (Zachariadis, Scott, & Bearret, 2013). The research design explains and encompasses all research action from the use of approaches, data collection and strategies (McMillian & Schumacher, 2001).

A case study is a study within a specific setting and environment whereby specific descriptions, information and details are set (Cohen et al., 2011a). In a case study in-depth data collection occurs over time using multiple sources (Cresswell, 1998). A bounded case study occurs within a specific timeframe and with a specific population (Ivankova et al., 2006; Williams, 2011). Merriam (1998) explains a bounded case study as a study done over a specific time period where multiple sources of information and rich in content are used for in-depth data collection. Data collection in this research only involved registered students enrolled for education programmes delivered through distance education at the UODL. Data could be collected during a specific time period in the qualitative and

quantitative stages of the research. A multi-mode refers to various methods for collecting the data (Ilieva, Baron, & Healey, 2002). The researcher used interviews, hard copies and electronic questionnaires that could be completed.

2.5 Research methodology: fully mixed equal status sequential multi-modal design and methodology

Caracelli and Greene (1993) and Bazeley (2006) discuss various strategies for integration in the multi-modal analysis:

- One set of data is transformed into another form for further analysis. The data collected from the qualitative questionnaires regarding interactivity, interactive technologies and its use in delivery of DE programmes were used to develop the quantitative questionnaire.
- A typology development where classification of concepts studied is performed and categories identified and applied to another approach.
- The outliers and outstanding results are identified and investigated and alternative data or methods then applied to integrate into the research.
- For future reference and analysis, the data collected from both the qualitative and quantitative sections of this research could be used separately as well as combined to improve the delivery of DE programmes at the UODL and at various other ODL institutions.

Leech and Onwuegbuzie (2009) define fully mixed method design as a design that embodies the utmost degree of mixing qualitative, quantitative research methods and research paradigm characteristics. This relates to sequential mixed methods whereby a concept is measured and then quantitative methods provide the detail to the investigation relating to a few cases or individuals (Creswell, 2009; Leech & Onwuegbuzie, 2009). Time orientated dimensions furthermore distinguish if qualitative and quantitative research are performed concurrently or sequentially (Leech & Onwuegbuzie, 2009). The researcher conducted the research within a specific timeframe when scheduled contact sessions took place at LSCs. Various strategies exist for integration in the mixed-method analysis.

2.5.1 Rationale for using a multi-mode approach

By combining qualitative and quantitative methods, the use of numerical data and textual data provides real answers to real questions (Cohen et al., 2011a; Terrel, 2012). Greene, Caracelli, and Graham (1989) are of the opinion that a study should adhere to at least one of five broad reasons in order to qualify as a multi-mode design:

- **Triangulation:** Whereby the researcher seeks corroboration and conversion of data collected from the qualitative and quantitative data when a single phenomenon is studied.
- **Complementary:** The results emanating from data collected overlap with the different components of the study.

- **Development:** When the researcher uses data obtained from one method to supplement or inform the other method of research.
- **Initiation:** The discovery of paradoxes and contradictions which furnish the researcher with different perspectives that could lead to reframing of research questions or the results from the research.
- **Expansion:** The researcher aims to expand that which already exists on that which is investigated about the different components under study. Qualitative research could be used to investigate and expand on some of the aspects that form part of the inquiry, while quantitative research is used to expand on another concept which forms part of the inquiry.

Venkatesh et al. (2013) and Zachariadis et al. (2013) provide the following reasons for the use of a multi-modal approach:
- To gain complementary views on interactive technologies and their use in delivering DE programmes.
- To obtain a complete and bigger picture of interactive technologies and their use in delivering DE programmes.
- Questions developed for a specific questionnaire relied on the information received from a previous questionnaire
- To assess the credibility of inferences from another strand of questions posed to participants
- To expand and to understand interactive technologies in DE, a multi-mode approach was used. This expansion and understanding were obtained from the qualitative questionnaire given to participants to complete.
- Multi-modal design enables compensating for the weaknesses of one approach by using the other. The qualitative research was followed by the quantitative research to ensure that all possible weaknesses and gaps in the research were identified and addressed.
- Multi-modal design was used for this study to obtain divergent views about the same phenomenon, in this case interactive technologies and the utilization thereof in delivery of DE programmes.

The researcher investigated interactive technologies and their influence on the quality of teaching and learning in the delivery of DE programmes. Quality is evaluated in conditions of absolute limits that have to be surpassed to obtain a quality grade, for example where the output has to meet a pre-set national standard (Harvey & Green, 1993). This corresponds with phenomenological research as the essence of human experiences on a certain phenomenon (interactivity, interactive technologies, ODL and teaching-and-learning) as described by participants (Burke Johnson & Christensen, 2014; Creswell, 2009; Finlay, 2009; Giorgi, 2006). Creswell (2009) describes phenomenology as a strategy to understand the essence of human experiences.

2.5.2   Strengths of multi-mode research

Johnson and Onwuegbuzie (2004) mention the following strengths and weaknesses of mixed method research:

- Grounded theory can be tested and is known as generating a theory to better understand and elucidate a social process, actions undertaken and the interaction taking place (Petty, Thomson, & Stew, 2012).
- During mixed method research the researcher is not confined to a single method or approach. Because of this a broader and more complete range of research questions can be formulated.
- The strength of one method of research, be it qualitative or quantitative research, can be utilised and applied to overcome the weakness of the other method (Burke Johnson & Christensen, 2014).
- It can provide stronger evidence for a conclusion through convergence and corroboration of findings and a more complete investigation of the issue/topic can be executed (McMillan & Schumacher, 2014).
- Insights and understanding can be added that are missed when using only one method (Burke Johnson & Christensen, 2014).
- Mixed method research can be used to increase the generalizability of the results (Terrel, 2012).
- When combining qualitative and quantitative research, the researcher has to be well-informed about the knowledge in the social system that is necessary in order to inform the theory and practice (Johnson & Onwuegbuzie, 2004).

2.5.4   Weaknesses of multi-modal research

In order to consider all aspects of a mixed method research, the researcher also studied the weaknesses of this method in order to see and consider possible barriers and pitfalls that could be encountered in the research. Johnson and Onwuegbuzie (2004) identify the following weaknesses of mixed methods:

- Multi-modal research is expensive to conduct due to use of multi-mode methods. Many individuals or helpers are used to assist with the collection of data. In this study the researcher himself conducted all interviews and did not make use of individuals to assist (Creswell, 2009).
- It is a time consuming process as data for both qualitative and quantitative research have to be obtained at different times and the researcher in some cases has to return to the study population to collect more data. With this study the researcher collected data within a very short timeframe as the qualitative and quantitative data collections were staged directly after each other.
- Methodological purists contend that one should always work within either a qualitative or a quantitative paradigm. The researcher chose to use mixed method research in this study to strengthen this study and gain more insight in interactivity, LTs used in delivery of DE programmes and the effectivity which they are used with (Creswell, 2009).
- Researchers have to have a good grip on both qualitative and quantitative research methods and must understand how to mix them appropriately.

- Sometimes one researcher will not be able to handle both qualitative and quantitative aspects, and a team approach could be more lucrative. In this study the researcher himself undertook the individual interviews with participants. Quantitative data were collected electronically and through hard copies of the questionnaire. Centre managers assisted at LSCs where respondents completed the quantitative questionnaires.

2.6 Ethical considerations during this study

Ethics should be the primary concern of any study (Miller & Salkind, 2002). Professional organisations have developed the guidelines and principles used to guide any research practice, and furthermore elucidated the line between ethical and unethical behaviour (Neuman, 2014). Silverman (2011) defines some main issues to be considered in Western research, namely codes and consent whereby the subjects used for the research must give their consent; they must be informed of the nature of the study; individuals must have the right to withdraw at any time; confidentiality has to be ensured whereby the group's identities and the location of research are protected, and lastly the trust between the researcher and the groups taking part in the research must be established in order not to spoil the field of research, so that individuals may not become reluctant to take part in any future research in similar specific fields of research. Fraenkel, Wallen, and Hyun (2012) and Merriam and Tisdell (2016) furthermore state that no one taking part in the research must be harmed in any way. The researcher should take cognisance of all mentioned aspects well before embarking on the research. Ethics is the moral accuracy that might have implications in the research to be undertaken, and that must be adhered to by the researcher when meeting participants and respondents and when interacting with these two groups. The moral aspects of research are adhered to when referring to the ethics of research (Mertler & Charles, 2011). All ethical principles were adhered to during interviews undertaken, distribution of quantitative questionnaires, and at such time that the electronic versions of the quantitative questionnaire that respondents completed were made available on any of their devices. The electronic questionnaire included a permission option that students had to give before moving on to the rest of the questions included in the questionnaire.

The researcher considered the following concerns regarding ethics as indicated by Terrel (2012) and Cohen et al. (2011a):
- All students voluntarily took part in this study (Cohen et al., 2011a; Teddlie & Tashakkodi, 2009). Individuals could withdraw at any time (Creswell, 2009; Gray et al., 2011). This aspect was explained in communication sent to LSCs (Addendum 2.1).
- The purpose of and the procedures to be followed by this research were explained to all groups (Teddlie & Tashakkodi, 2009) (Addendum 2.1). This was performed to prevent deception and to ensure that all that took part in this study were fully aware of the purpose and aims of the study.
- No individual taking part in this study was harmed in any way (Creswell, 2009; Gray et al., 2011).

- The researcher informed everyone that he/she had the right to request the results of this study (Teddlie & Tashakkodi, 2009) (Addendum 2.1).

- The possible and potential benefits of the study as well as the privacy of both groups in this study were clarified (Addendum 2.1).

- Quantitative and qualitative questionnaires were administered during scheduled contact sessions at LSCs. The researcher and centre managers ensured that no contact sessions and facilitation sessions were disturbed when interviews were undertaken with participants and when respondents completed the quantitative questionnaire.

- Anonymity of individuals was maintained during data analysis and data collection for a reasonable period of time (Teddlie & Tashakkodi, 2009).

- Bias regarding age, ethnicity, gender, race sexual orientation, etc. was avoided.

- Details of this study were clearly discussed and reported as to allow all readers to judge the ethical aspects of this study.

- No individual or group was rewarded in any way for taking part in any phase of this study.

The researcher obtained permission (Addendum 2.2) from the Executive Director of the UODL to conduct this study. The students that participated in this study were registered students of the UODL who attended regular contact sessions at the LSC of their choice. These students were registered for the BEd Honours, Advanced Certificate in Education (ACE), Grade R Diploma and the BEd Foundation phase. Ethical clearance for this study was applied for and approved by the North-West University's (NWU) Ethical Committee. The NWU ethical committee's regulation and guidelines ensure that all research undertaken was performed within the ethical measures and guidelines prescribed by the university's ethical code. Ethical clearance for this study was obtained before the researcher performed any fieldwork.

The researcher was part of the OPTENTIA Research Programme during this study. The OPTENTIA Research Focus Area assists to develop and organise knowledge for the optimal expression of the individual and furthermore assists with obtaining social and institutional potential from the viewpoint of positive social science (Rothman, 2014). A checklist (Addendum 2.3) was submitted to the OPTENTIA Research Focus Area Research Committee with all requirements this study adhered to. The researcher obtained an ethics number (NWU-HS-2014-0154) from the NWU ethics committee for the research to be undertaken.

The researcher conducted all interviews with participants himself and informed the centre managers of the interviews that were to take place. After providing the researcher with permission to collect data from both groups (Addendum 2.4 and 2.5), the instruments (Addendum 2.5 and 2.6) were administered. Maree (2016) contends that the more frequently the researcher is involved with all aspects of a study, the better the study will be understood.

Centre managers at each LSC were supplied with a document imparting all information to respondents taking part in the quantitative research in order to provide respondents with the aim and purpose of this study (Addendum 2.1). The electronic questionnaire completed by respondents was of the same format as the hard copy sent to LSCs. The electronic questionnaires could be accessed on any mobile device, laptop or desktop computer. The students of the group that completed the quantitative questionnaire are not easily traceable and anonymity was comfortably adhered to.

2.7 Literature review

A literature review was performed in Chapter Three to identify aspects which formed the basis of the questions for the interviews conducted with participants in this study. These aspects provided the researcher with a theoretical outline that formed the basis of this study. The researcher ensured that all identified aspects were addressed during the qualitative research through to the quantitative research that was conducted.

2.8 Qualitative strategies

Qualitative strategies refer to the collection of data through interviews, document analysis and observations in order to understand the case under study (Petty et al., 2012; Zachariadis et al., 2013). Creswell (2009) outlines qualitative research as describing, exploring and understanding the views of participants from the collected data. Malina, Norreklit, and Selto (2010) state that through qualitative research a phenomenological platform is formed and shaped through data collected, furthermore assisting with the construction of concepts for existing theories. The qualitative research for this study was based on a phenomenological (§2.5.1) theoretical underpinning.

2.8.1 Site selection

The UODL at the NWU has 65 LSCs at which programmes from various faculties and schools are offered through the use of LTs that assist with administrative support and academic support. Students registered at the UODL attend contact sessions at LSCs of their choice. Contact sessions for these respective programmes are offered at LSCs throughout the year through facilitation and interactive whiteboard sessions broadcast from the main campus in Potchefstroom. IWB sessions and facilitation sessions by accredited facilitators at each LSC are the primary means of communication to students during contact sessions. LSCs are equipped with two to four IWBs where students can connect to live sessions of modules and programmes broadcast from the UODL. A resource centre with two to four computers connected to the Internet allows students to download resources, and free Wi-Fi enables students to download resources and access the support infrastructure on their own digital devices. The researcher used these LSCs to conduct qualitative interviews and submit quantitative surveys to

students attending sessions, and who are familiar with technologies used in the delivery of DE programmes.

2.8.2 Participant selection

Through the qualitative section of this study the researcher aspired to understand the complexity of the LTs through the view of the students as participants in the teaching and learning in delivery of DE programmes at the UODL. Sound judgement was applied to identify participants for this research. Choosing participants believed to be representative of the study population and target group is known as judgement sampling (Gray et al., 2011; Talib, Rubin, & Zhengyi, 2013). The researcher stipulated the criteria for participants to participate in the qualitative research. They had to:
• be enrolled students for any education programme of the NWU UODL
• familiar with the interactive technologies used by the NWU UODL at any of the LSCs
• have attended some whiteboard sessions at any of the LSCs
• be familiar with downloading resources and sessions from any of the platforms made available by the UODL.

Selecting participants that adhered to the criteria for selection and furthermore was familiar with technologies at LSCs would provide the researcher with ample evidence of difficulties and challenges exists for delivering DE programmes utilizing various technologies. Students as participants in this study were primary sources of data as they attended contact sessions where interactive technologies were used. The researcher furthermore enquired from students attending contact sessions at the Potchefstroom centre to identify more possible participants who attended contact sessions on a regular basis, as they would have sufficient experience in the use of interactivity and interactive whiteboards installed at LSCs. The researcher applied snowball sampling to ensure that suitable participants were chosen to take part in the interviews. Cohen et al. (2011a) explain snowball sampling as the process whereby a small number of individuals that are knowledgeable and have the characteristics of that which is studied, recommend others who meet the requirements as well, and they in turn recommend similar others. Merriam and Tisdell (2016) suggest that, in order to have a holistic approach of the programmes delivered, participants involved in the programme as well as participants referred by others be used in a study.

At the NWU UODL, about 35 000 students are enrolled for various DE programmes. Participant selection refers to the process to select a well-informed section of the students as role players to inform the study on issues relating to their perceptions and lived experiences of interactive learning technologies (Creswell, 2005; Maree, 2009; Sarantakos, 2005). The researcher targeted these participants in order to understand participants' views on DE and LTs, and also their views on the use of these aspects to deliver programmes. To ensure that sufficient and reliable data are collected, the researcher specifically identifies a small group of willing participants and individuals that have the required characteristics of that which the researcher is investigating to ensure that sufficient and

reliable data are collected (Burke Johnson & Christensen, 2014; Cohen et al., 2011a; Creswell, 2014; Gray et al., 2011). The researcher also ensured that sampling bias was not evident in this study. Mugo (2011) defines sampling bias as a tendency that occurs in study or during data collection particularly when certain participants and their characteristics are favoured.

2.8.3 Data collection and strategies

Participants were selected and interviews were performed with participants during scheduled contact sessions. The researcher himself conducted interviews with all the participants that took part in this study. Participants that regularly attended contact sessions and were familiar with technologies at LSCs were interviewed.

2.8.3.1 Interview schedule

The interview schedule (Addendum 2.6) was developed from the concepts identified from the literature review (Chapter Three). The researcher ensured that all concepts were covered in questions that were asked to participants. TEL for DE, ODL for developing contexts, interactivity and Learning technologies (LTs) were covered by all questions in the questionnaire. The questionnaire used during the qualitative research stage was submitted to the NWU Ethics Committee for approval.

2.8.3.2 Individual interviews

All questions in the interviews (Addendum 2.6) were open-ended questions whereby participants were asked to share their perceptions and experiences of interactive learning technologies. Cohen et al. (2011a) and Teddlie and Tashakkodi (2009) refer to this type of questioning where questions and wording thereof are predetermined, and the same questions are posed to all participants as custom open-ended interviews involving aspects relating to the literature review. The exact wording of the standardized open-ended interviews was determined in advance.

Newby (2014) focuses on three aspects which should be considered during the collecting and capturing of interview data:
- The physical environment as well as circumstances before, during and after interviews formed part of the context data that were collected. The researcher should ensure that nothing in the environment could have an influence on the utterances of the participant. The interviews took place at the contact sessions at the LSCs which the students knew well as they regularly attended the sessions there.
- Non-verbal communication of the participant such as gestures, eye movements and hand movements were not recorded as the researcher was interested in the content of the interviews only and was not going to perform a narrative analysis. The researcher did, however, take note of all gestures when participants seemed uncomfortable with the situation.

- All verbal interaction between the researcher and respondents was recorded in order to capture an accurate version of the interview.

The researcher made use of a voice recorder to record all interviews according to the guidelines of Creswell (2013):

- Adequate recording equipment was used during the interviews.
- A place with no distractions or noise was selected to conduct the interviews, for example a vacant classroom at the LSCs.
- Written consent was obtained from all participants taking part in this study. The students were informed about the study and they were assured that the study was anonymous and voluntary.
- The researcher was bound by the interview schedule, but could pose additional prompts to ensure he understood the students correctly.

2.8.4 Data analysis and interpretation

The researcher conducted various interviews and each interview was transcribed according to the questions and responses of participants in the qualitative interview schedule (Addendum 2.6). This method of transcribing and coding of text is known as structural coding (MacQueen, McLellan, Kay, & Milstein, 1998).

Exploration of the data is the first step in the analysis of data in qualitative research (Creswell, 2014). Exploration of data is presented through coding. Coding is the organizing, classifying, labelling and indexing of data enabling the researcher to narrow data down to themes and topics (Cohen et al., 2011a; Creswell, 2014; McMillan & Schumacher, 2014; Patton, 2002; Saldana, 2009). The researcher used Atlas ti™ to code each interview. Atlas.ti™ is a computer assisted qualitative data analysis software (CAQDAS) programme (Friese, 2014; Saldana, 2013). Codes were also identified from the literature as part of a theory-driven approach.

The researcher ensured that the criteria for coding had been established before any coding was staged in this study. Saldana (2009) states the following criteria that coding should be adhered to while coding:

- Establish if the coding structure matches the conceptual and theoretical framework of the study. The literature review (Chapter Three) was used as a guideline to identify possible codes (constructs). Obtaining codes from the literature is referred to as theory-driven data (DeCuir-Gunby et al., 2011).
- Relate the coding structure to the research question to be addressed.
- Ensure that the coding method is suited to the study and that the researcher feels comfortable with the coding process. Constructs identified for this phase of the research were familiar to ODL.
- Match the data to the coding method.
- Use simple coding structures and avoid unnecessary complexity.

- Guide research on the analytical pathway.

The researcher made use of the constant comparative method (CCM) of coding (structural coding), as more than one participant took part and interviews were undertaken with a number of participants until such time that data saturation had been obtained. Through CCM the researcher decides which data are to be collected next, finding it through provisional theoretical ideas, and this could be repeated several times in the process (Boeije, 2002). The researcher analysed each interview and determined what new aspects were to be added in the next interview to be undertaken. Researchers must be able to give a well-defined analysis in any research that is undertaken. A well-defined analysis can be executed by comparing aspects in the research with one another. Tesch (2013) states that the main goal of the constant comparative method of coding is to specifically discover patterns that stand out in the research by discerning conceptual similarities in the research, categorizing, and furthermore determining and discovering the patterns that are evident. A theory must be developed in any research that is executed. Theories can only be developed inductively when categorizing, coding of data collected, and defining and outlining categories occur and are connected (Boeije, 2002).

Qualitative analysis requires the researcher to organize the data into categories and relationships between these categories. Additional patterns within these categories should be identified in order to synthesize meaning from the data (McMillan & Schumacher, 2014; Newby, 2014). Keywords and themes were used to categorise data. To understand, prepare, organize and interpret data, coding of the qualitative data was performed. Coding refers to the codes that emerged from data gathered from the research and databases obtained from participants, or which had been pre-determined and categorized before interviews with participants occurred (Briggs & Coleman, 2009; Creswell, 2013). DeCuir-Gunby et al. (2011) explain coding as the allocation of codes to raw data that were either data driven or theory driven. The foundation on which any researcher's arguments rest when analysing any data is shaped by codes that form the building blocks for the theory or model that is developed (MacQueen et al., 1998). "A code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (Saldana, 2009, p. 3).

The researcher remained objective throughout all stages of data collection, data analysis and interpretation of the data. Remaining objective towards the research and the data collected in this study, particularly during the qualitative research process, enabled the researcher to create a more detailed meaning of the participants' perceptions and understanding. Giorgi (2006) and Williams (2007) define one aspect of qualitative research as the meaning of the data collected through the objectivity of the researcher.

2.8.4.1 Data saturation

During interviews the researcher conducted with participants the researcher could only determine if data saturation was achieved when no new information surfaced during the interviews. The researcher did not conduct any further interviews after it was evident that data saturation had been achieved. Only when no new information surfaces from interviews conducted with participants has data saturation been achieved. When the same thoughts, actions, responses and perspectives are heard from participants, no additional participants are needed are as data saturation has been achieved (Boeije, 2002; Gray et al., 2011).

2.8.4.2 Role of the researcher in qualitative research

Since 2004 the researcher has been employed by the NWU with the specific task to assist and develop an infrastructure to deliver DE programmes at various LSCs of the then School of Continuous Teacher Education (SCTE) at the NWU. The researcher was appointed as manager for LSCs at the UODL from January 2013. This entailed the management, operational and logistical support of all established LSCs. The researcher was involved in establishing a technology infrastructure at LSCs, affording students enrolled with the UODL to access resources and live sessions at all LSCs. The researcher completed a MEd degree in Education Management where management guidelines for the use of mobile learning in the delivering of DE programmes through ODL were developed. The researcher aims to achieve and fully employ aspects such as anywhere and anytime learning completely in the delivery of ODL programmes. Educating and exposing students to various LTs could possibly assist the researcher to achieve this goal. The researcher is, continuously and on a daily basis, involved with aspects of improving programme delivery and support of programmes at all LSCs of the UODL. This process includes exploring various avenues such as LTs, improved communication technologies and various other means to effectively support students at LSCs throughout SA and Namibia. The technologies refer to interactive whiteboards and internet connectivity at all LSCs enabling students to communicate and be interactive with the lecturers presenting sessions. The students could also use these facilities to download resources and recorded sessions of previous broadcasts that were missed. The researcher was of the opinion that, because of his background and experience in DE, he had enough authority to conduct this study, which could make a valuable contribution in this field.

Ensuring validity, reliability and trustworthiness the researcher furthermore addressed the following aspects that could lead to potential bias and tension between the researcher and participants:

- There were no affinity or personal relationships between any of the participants and the researcher that would influence responses.
- Participant's responses to questions during interviews were not influenced by the researcher's knowledge about interactive technologies and DE. The researcher at no point influenced participants in their responses.

- Questions posed in interviews were straight to the point only addressing aspects relevant to the study allowing participants to stay focussed on the aspects at hand. Participants thus could not deviate in their answers to questions.

2.8.4.3 Trustworthiness

Rolfe (2006) and Graneheim and Lundman (2004) divide trustworthiness into credibility (relates to internal validity), dependability (related to reliability), transferability (a form of external validity) and confirmability which relates to a large extent to presentation. Validity and reliability are two important concepts in qualitative research and could influence the credibility of research. Bashir et al. (2008) and Golafshani (2003) state that validity and reliability are two concepts that cannot be viewed separately in qualitative research, and that the terminology that embodies both validity and reliability is trustworthiness, credibility and transferability.

2.8.4.4 Validity

In this research, construct validity was evident as the researcher recognized the constructs that existed within the field rather than imposing new theories or constructs to the respondents or within the context (Creswell, 2007). The researcher thus used the data collected and applied these data to further enhance the use of learning LTs in the delivery of ODL programmes.

Validity is determined if that which is measured will consistently measure the same over time (Gray et al., 2011). With the development of the qualitative research interview schedule, the questions used in this study asked about the phenomenon which it was supposed to measure. Cohen et al. (2011a) and Burke Johnson and Christensen (2014) state that the questions used during interviews should ascertain what they say they aim to achieve. The aspects that were identified were interactivity, interactive technologies (LTs) and the effectiveness of teaching and learning in delivering ODL programmes. Validity of the questionnaire reflected issues and viewpoints regarding interactivity, interactive technologies (LTs) and DE of participants experienced during contact sessions at LSCs. McMillan and Schumacher (2014) explain validity as the degree to which scientific explanations of the phenomena investigated in this study correspond with what happens in reality.

Data collected during the qualitative phase adhered to internal and external validity. Internal validity confirms that the topic being studied is supported, correlates with the data collected and furthermore is sustained by the data collected (Cohen et al., 2011a; Zachariadis et al., 2013). McMillan and Schumacher (2014) state that, if the findings can be generalized to people and organizations outside the environment where the initial research was staged, external validity has been obtained. The researcher structured the qualitative interview instruments in such a way as to ensure that the data obtained and the findings from the data could possibly be applied to other DE institutions delivering programmes via ODL. Furthermore, the qualitative interview schedules were compiled, taking into

consideration global tendencies in the delivery of DE programmes utilizing various interactive LTs and communication technologies as well as the literature (Chapter Three). The findings in this study are applicable to situations beyond the study itself, and the conclusions drawn from data collected could be generalized to other situations or studies (Cohen et al., 2011a; Zachariadis et al., 2013). The data collected and results of the data after analysed could be applied in other ODL systems where interactivity is evident and interactive technologies are utilised. McMillan and Schumacher (2014) propose possible strategies to enhance validity in qualitative research. The researcher strictly adhered to these guidelines to ensure validity in this study:

- Continuous and persistent exploration whereby the researcher aimed to find a match between data collected from participants and reality.
- The researcher allowed for various strategies such as triangulation during the collection and analysis of data.
- Statements or responses from participants must represent the exact viewpoint of participants. All participants gave written consent that all transcriptions were exact representations of interviews and gave permission that their interviews and data collected from the interviews could be used in this study (Addendum 2.4).
- Recordings must be precise and reliable recording devices must be used.
- Participants checked transcripts (Addendum 2.3) for correctness as a form of member checking. Requesting members to validate correctness of transcripts from interviews is also known as respondent validation (Robson, 2011; Torrance, 2012) (Addendum 2.4). Torrance (2012) and Carlson (2010) state that by performing member checking, the trustworthiness of the research is increased as the transcripts of interviews, data collected and observations are checked by the participants for accuracy.
- Participants are to review researcher's synthesis of interviews.
- Negative data must be checked for their influence on patterns formed by data collected.

2.8.4.5 Reliability

Reliability is when the data obtained during interviews measure that which they are supposed to measure, and specifically in qualitative research where reliability relates to the techniques used to gather data (Gray et al., 2011; Newman, 2007). Creswell (2014) states that reliability is determined when the scores obtained from an instrument are stable and consistent. Maree (2007) and Gray et al. (2011) state that reliability is evident if the same results are obtained if the measuring instrument is repeated with the same group of participants.

The researcher ensured that inter-rater as well as intra-rater reliability was adhered to in this study. Consistency between different codes performed as well as reliability within the codes themselves was in order. High regularity and constancy between codes is known as inter-rater reliability, and if there is a high consistency within every code, intra-rater reliability is evident (Burke Johnson & Christensen, 2014). Qualitative research is more valid when multiple codes are used. The researcher made use of

multiple codes to ensure that a high inter- as well as-intra-rater reliability was achieved. Teddlie and Tashakkodi (2009) define interrater as the consistency of the ratings of two or more raters after all information has been gathered. The researcher used Cohan's Kappa to determine the coefficient of agreement between raters (Kimberlin & Winterstein, 2008).

2.9 Aspects for inclusion in the questionnaire

Interviews were conducted with five participants. The selection criteria for choosing participants were that they had to be students that regularly attended whiteboard sessions and were familiar with the technologies they were exposed to at the LSC, and furthermore used various technologies enabling them to access various resources available, supporting them in their studies.

A codebook was compiled by the researcher in order to clarify and define codes that were used and applied to transcribed interviews. The codebook gives a brief definition of each code used, where the code can be used, where or in which cases the codes cannot be used, and lastly examples where the code is used (MacQueen et al., 1998). The researcher in this study developed the codebook by only providing as description of each code as it is defined in the literature, and gave an example of each code obtained from the analysis (Table 2.1) (DeCuir-Gunby et al., 2011). Codes (constructs) identified by the researcher were checked by another staff member in order to validate the transcriptions as well as the codes that were used. This action was performed to verify if coding and transcribing were presented correctly. The colleague who was consulted to assist with checking of the codes used in the transcriptions also had a copy of the codebook developed by the researcher to check if the definitions and aspects of codes used in the codebook correspond with the meaning of codes used in the text.

A total of 35 codes were identified. All codes were identified and allocated to each interview that was transcribed. The code book is a collection of all the codes identified, each code's description and a brief data example for reference purposes (Saldana, 2013). An example of a code as it appears in the code book and the explanation of the code is provided in Table 2.1.

Table 2.1   Example of the explanation of codes in the code book (Figure 4.2)

Code	Description from literature	Example from the analysis
Interactivity	Interactivity relates to the interaction between humans in the social action theory which refers to interpersonal communication be it face-to-face or by using various technologies (Quiring & Schweiger, 2008).	• The moment I attend a class/session students are interactive from other locations[i] (P2:14-14). • Communication it is communication from both sides and all the parties involved, that is interactive (P6:13-13). • I understand interactivity that both parties say that the lecturer and the students are interactive with each other (P6:13-13).

The qualitative data were quantitized in an Excel™ spreadsheet and was analysed by NWU Statistical Consultation Services. Quantitizing is the process whereby the qualitative data are converted into quantitative data for further statistical manipulation in order to ascertain the strengths between aspects from the qualitative analysis (Sandelowski, Voils, & Knafl, 2009; Teddlie & Tashakkodi, 2009). Saldana (2009) refers to and explains quantitizing as the process where data collected from qualitative data were transformed into quantitative data for analysis with SPSS (Statistical Package for the Social Science). Three levels exist whereby the linkage from qualitative to quantitative information can be performed (Miles et al., 2014). The first level is where qualitative information that was collected is transformed into quantitative data and rating scales using quantitizing. The second level is the process of comparing qualitative information with numerical data linking this information, and the third level is used when a combination of case studies, surveys, unobtrusive-measures and experiments are used in the multi-modal approach. In this study the researcher specifically focused on level one where the information gathered in the qualitative research was converted into numerical data in order to develop the quantitative measuring instrument. Quantitizing assisted the researcher to interpret the data from more than one view. Mixed method (multi-modal) research refers to the mixing or combining of qualitative and quantitative research methods to better understand your research problem (Burke Johnson & Christensen, 2014; Creswell, 2005, 2009, 2014; Johnson et al., 2007; Leech & Onwuegbuzie, 2009; Maree, 2009). Johnson et al. (2007, p. 120) state that mixed mode research is the method of research where quantitative and qualitative research techniques, approach, concepts or language are combined or mixed into a single study or set of related studies."

Quantitizing the qualitative data assisted the researcher to determine if data saturation was obtained. The point of saturation was achieved as no new thoughts, actions, responses perspectives regarding the questions posed to the participants were identified. The NWU Statistical services conducted the analysis of the qualitative data into a format to be used in the quantitative section for this study. Ward's minimum variance method and Pearson's *r* correlation was applied to the data obtained to establish the clusters as well as the correlation between the constructs. These aspects formed the basis for the development of the quantitative questionnaire during the quantitative research strategies for the next phase of research in this study.

2.10   Quantitative research strategies

Maree (2016, p. 162) defines quantitative research as "a process that is systematic and objective in its ways of using numerical data from only a subgroup of a universe (or population) to generalize the findings to the universe that is being studied." Quantitative research aims to amplify impartiality and repeatability and simplifying findings which are specifically interested in projections from the collected data (Harwell, 2011).

Muijs (2011) is of the opinion that quantitative research as a process where numerical data from respondents are collected in order to explain a specific phenomenon. The phenomenon of interactivity and DE formed the basis for this study. Creswell (2009) explains quantitative research as the testing of objective theories and exploring the relationship which could exist amongst variables. The researcher used quantitative research strategies to measure the perceptions and experiences of the respondents in order to form a comprehensive understanding of the variables of interactivity and interactive technologies used in the delivery of DE programmes. The understanding of these variables was obtained through the data collected by the questionnaires. Quantitative research assists the researcher to seek for relationship amongst these constructs (McMillan & Schumacher, 2014). Onwuegbuzi and Leech (2006) maintain that qualitative results relate to descriptive, comparative and relationship categories. Descriptive statistics aim to meaningfully organise and summarize numerical data using frequencies, percentages, distribution, mean, median, modus and deviancies (Burke Johnson & Christensen, 2014; Joubert, Hartell, & Lombard, 2016). Inferential statistics were applied to analyse the data collected from respondents. Inferential statistics researchers moves outside or beyond the data that was collected and makes inferences about a sample data, a subset drawn from a population that used in a study (Burke Johnson & Christensen, 2014).

The researcher compiled a quantitative questionnaire (Addendum 2.5) and collected data from a representative sample of DE students at the LSCs of the UODL where registered students attended scheduled IWB sessions. Fraenkel and Wallen (2008) and Mouton (2001) define a questionnaire as a means to provide insight into a sample of a larger population. Additionally, a questionnaire assists with the gathering of large-scale data in order to make generalizations (Cohen et al., 2011a). The researcher took guidance from McCusker and Gunaydin (2015) to clarify why the quantitative research method was used. The perceptions of respondents and their understanding of interactivity, LTs and teaching and learning in DE had to be fully understood by measuring the variables. Hypothesis testing and theory testing form the core of quantitative research (Burke Johnson & Christensen, 2014). McCusker and Gunaydin (2015) posit the following features of quantitative research:

- The researcher should be sure what he/she is looking for before research commences.
- All aspects of the study should be carefully considered and decided upon before data collection.
- Different modes could be used to collect data from respondents (hard copy prints or electronic versions of the questionnaires).
- Numerical data are collected from respondents.
- Hypotheses could be formulated and tested, utilizing quantitative research if the research questions lend themselves to it.
- Qualitative research could fill in the gaps of missing information.
- The researcher should remain objectively separated from the subject matter and the research process.

2.11   Factor analysis of the qualitative aspects

The researcher used the quantitized data collected from the interviews and performed a factor analysis to obtain information that was used in the development of the quantitative questionnaire. The researcher performed an exploratory factor analysis to determine the clusters in which the different variables were grouped together. An exploratory factor analysis explores the grouping or clustering of variables to identify underlying patterns (Cohen et al., 2011a). Gall et al. (2007) explain that factor analysis is a system that forms the empirical basis whereby variables are scaled down to only a few factors by combining variables that are in any way correlate to a moderate or high extend with one another. The four clusters identified through the factor analysis formed the four themes used in the quantitative questionnaire.

2.12   Questionnaire development

The researcher ensured that the 35 codes (constructs) that were identified through the Atlas ti™ analysis and the form the literature (theory-driven approach) were included in the quantitative questionnaire. These constructs were grouped together during the facto analysis. The four themes identified to be included in the questionnaire were infrastructure (Section A), learning environment (Section C), success in DE (Section D) and technologies for learning (Section E). The biographical information (Section A) was included in the questionnaire in order to determine the age, gender, devices they use, etc. A total of 48 questions were included in the questionnaire. These were more than the number of codes identified. In some instances the researcher formulated more than one question for a specific code (construct). This was done as some constructs needed more information to better understand all aspects of the specific construct.

2.12.1   Validity of the questionnaire

Validity in social science concerns itself with the meaningfulness of different components in research and the behaviour of respondents must correspond with that which was supposed to be measured (Drost, 2011). Face validity as well as content validity was used to validate the quantitative questionnaire. Face validity determines if the instrument that is developed measures that which it is supposed to measure and content validity ensures that the constructs that are identified cover all the content it is set out to measure (Maree, 2016).

The researcher consulted with UODL management and staff from the Faculty of Education Science to test the face validity and content validity of the questionnaire. These peers with seniority in the UODL critically evaluated all aspects of the questionnaire before it was finalised. Valid recommendations were addressed and changes made in the questionnaire to accommodate these recommendations. The questionnaire was only finalised when all valid recommendations had been incorporated.

2.12.2 Sampling strategies

The researcher performed convenience sampling as all students had the opportunity to complete the quantitative instrument at any of the LSCs. Mugo (2011) defines convenient sampling as the method of sampling where more convenient units and respondents are employed, chosen from a population for observation. Teddlie and Yu (2007) explain convenience sampling as the method of sampling whereby samples are drawn from a population that is easily accessible and willing to participate in completing the instrument.

The researcher selected the largest possible sample from the population in order to prevent sample error. Sample error occurs when there is a difference between the sample mean and the population mean, and this is evident when the sample chosen from the population has been to small (Cohen et al., 2011a). The researcher therefore chose a group of respondents believed to be representative of the study population (twenty to thirty participants per LSC). Mertler and Charles (2011), Creswell (2014), Cohen et al. (2011a) and McMillan and Schumacher (2014) distinguish between probability and non-probability sampling as methods to be used in the data collection phase of quantitative research. Probability sampling is the data collection method where participants are representative of the study population and non-probability sampling is the data collection method where no assurance is given that the participants taking part in this study may not be representative of the study population. Probability sampling was used in this study as all respondents were representative of DE students attending contact sessions at LSCs of the UODL.

2.12.3 Distribution of the questionnaire

The UODL has direct access to staff and students attending contact sessions at LSCs. Centre managers were informed by the researcher (Addendum 2.1) of the study that was undertaken, and they were informed that these questionnaires were to be distributed and collected by them, without remuneration.

Each package sent to LSCs was accompanied by a cover letter (Addendum 2.1) in which centre managers were asked to assist with the distribution and completion of the quantitative questionnaires. After completion of the questionnaires the centre managers couriered all completed questionnaires back to the UODL. The electronic version made available was exactly the same format as the hard copies distributed at LSCs. A link of this questionnaire was created using "Google docs" and sent via text message to students that were enrolled for DE programmes at the UODL. By sending an electronic version (link) of the questionnaire to students enabled students to access the questionnaire from anywhere and at any location from the device of their choice. The researcher informed students that they were to complete one of the versions only for this study in order to prevent duplications from one student. A total of 522 (n=522) responses from the electronic questionnaire and 273 (n=273) responses from the hard copy the researcher sent to the students at the LSCs were received.

2.13   Data analysis and interpretation

Descriptive analysis was used to analyse the data collected from the quantitative research questionnaire. Furthermore, analysis of variance (ANOVA) was used as students enrolled in four programmes at the UODL were used in collecting data from the questionnaires and from the link sent to these groups via short message service (SMS).

In the next section the researcher elaborates on and discusses descriptive analysis of the data, inferential statistics that was used and lastly the reliability and validity of the quantitative aspects of this study

2.13.1   Descriptive analysis

Descriptive analysis organizes and analyses the collected data. Descriptive analysis enabled researcher to transform numerical data into indicators that could clearly be described and portrayed by the researcher (Cohen et al., 2011a; McMillan & Schumacher, 2014). The NWU Statistical Consultation Services were used to oversee the statistical methods and software requirements for appropriate capturing and processing of data. Quantitative data were analysed using SPSS™ (IBM, 2016). Descriptive statistics include frequencies, standard deviation, mean cross tabulations and standardized scores (Cohen et al., 2011a). The researcher used descriptive statistics to present the biographical information using frequencies, mean and standard deviation.

2.13.2   Inferential statistics

Inferential statistics use numbers, concepts and terms in different statistical procedures to precisely determine the probability of something (McMillan & Schumacher, 2014). Inferential statistics enabled the researcher to make inferences using various procedures about the wider population that was studied (Cohen et al., 2011a). The researcher used (i) factor analysis; (ii) Kaiser-Meyer-Olkin KMO with the Oblimin rotation method; (iii) Spearman's rank-order correlation and the (iv) structural equation modelling (SEM) to make inferences about the wider population in this study.

The researcher, with the help of a NWU statistician, performed a factor analysis of the data collected from the quantitative phase of this study to determine how the underlying constructs had influenced the responses of the number of variables that were measured (DeCoster, 1998). The factor analysis grouped the variables with communalities together and enabled the researcher to reduce the variables into a smaller number of underlying factors (Cohen et al., 2011a). Jacobs, Sorensen, and Walker (2014) state that factor analysis investigates and determines if the variables used in data collection really reflect a smaller number of underlying variables. The researcher used the factor analysis to determine which variables addressed the same statistical constructs, and an exploratory factor analysis to explore the grouping or clustering of variables to identify underlying patterns (Cohen et al.,

2011a). The KMO was used to determine sample adequacy (Cohen et al., 2011a) and the Oblimin rotation method where factors were allowed to correlate with one another.

The Spearman rank-order (*rho*) correlation coefficient determines the relationship between two variables that are normally distributed (Cramer & Howitt, 2004). Spearman's rank-order is a non-parametric calculation between variables assessing how justly a random monotonic function can explain and describe the association between two variables without making any postulations about the occurrence of the distribution of variables (Bolboaca & Jäntschi, 2006). A ranking r_s value of +1 will be an indication that there is a perfect association of variables while an r_s of 0 is an indication that there is no correlation between variables, and a r_s of -1 indicates a perfect negative correlation of variables. The closer r_s is to zero, the weaker the correlation which exists between the ranks.

Structural equation modelling (SEM) is a causal process and is either presented by a series of structural equations or by pictorially modelling these structural relationships for a clearer conceptualization of the theory under study (Byrne, 2013). The researcher used the SEM to determine the essential relationship that existed between the identified components in the questionnaire.

2.13.3 Reliability and validity of all quantitative aspects of the study

The instrument used measured interactivity, interactive technologies and the effectiveness of teaching and learning in delivering DE programmes by using these LTs. All constructs for this study were covered in the instruments developed and the measuring instrument measured that which it was supposed to measure. The researcher consulted the criteria as set out by Creswell (2014) to ensure if the instrument used was a good and valid instrument to be used:

- Outdated and older measuring instruments were steered away from. Only recent authors and researchers' instruments were taken into consideration when developing this instrument.
- The researcher ensured that the instrument and its content were cited by well-known researchers
- Published reviews of instruments used by well-established researchers were taken into consideration in the development of the measuring instrument.
- The reliability and validity of well-established researchers' instruments were checked.
- The researcher in this study ensured that the data that were recorded were actually fit for this study.
- Accepted scales of measurement were used in the instrument.

Kimberlin and Winterstein (2008) provide guidelines on the compilation of questionnaires in order to determine the validity and reliability of the measuring instrument, such as: Have measuring instruments been utilized in the past that measured the same constructs as is the case in this study? Various authors (Andersson & Hatakka, 2010; Evans & Gibbons, 2007; Kanuka & Conrad, 2003;

McMillan, 2005; Milojević, Kleut, & Ninković, 2013; Oprea, 2014) supplied the researcher with guidelines to develop the qualitative research questionnaire for this study. Do the constructs to be measured in the questionnaire correspond with the constructs mentioned in the study?

Reliability and validity must be determined. Equivalent reliability and internal reliability are applicable to this study. Data collected for this study during the quantitative and qualitative phases adhered to internal and external validity. Internal validity confirms that the topic being studied is supported, correlates with the data collected and furthermore is sustained by the data collected (Cohen et al., 2011a; Zachariadis et al., 2013). McMillan and Schumacher (2014) state that if the results of research can be generalized to people and organizations outside the environment where the initial research was executed, external validity is evident. The researcher aimed to use the results from the data collected regarding interactivity, LTs and effective teaching and learning to be applied to other models of DE at other institutions. Is the instrument available in the public domain? The measuring instrument was not available in the public domain as the researcher for this study developed his own qualitative questionnaire, utilizing expert information for the different constructs to develop the questionnaires (Kimberlin & Winterstein, 2008). The quantitative measuring instrument that followed the qualitative research was developed by the researcher from data collected during interviews with participants. Various types of validity exist in research.

2.13.3.1   Types of validity

Zachariadis et al. (2013) distinguish between design validity, measurement validity and inferential validity. All three types of validity can be applied to qualitative and quantitative research.

Design validity: Refers to internal and external validity. Maree (2007), Zachariadis et al. (2013) and Drost (2011) explain internal validity as the control on the variables in this study: interactive technologies (LTs) and interactivity did have a causal influence in the dependant variables (students and teaching and learning). Maree (2007), Zachariadis et al. (2013) and Drost (2011) explain external validity as the action or degree whereby the results of the research can be generalized to the entire population. The results and recommendations of this study would assist and be useful to apply at various other DE institutions in delivering programmes using interactivity and interactive technologies.
Measurement validity: Refers to the accuracy of the data collected and if the ideas were meaningfully captured in the corresponding concepts. The researcher ensured that data collected were related to the concepts interactivity and interactive technology (LTs) as to ensure no error in data or results (Adcock, 2001).
Inferential validity: The process whereby the researcher ensured that conclusions being made from data that were collected were truly based on the statistics that were collected from the data, and that the conclusions that were drawn were correct in order to make inferences (Donoghue, 2000).
Reliability: Reliability of a study is determined by the degree that a test constantly measures that which it is supposed to measure (Abowitz & Toole, 2010; Gray et al., 2011; Pace et al., 2012; Pluye et

al., 2009). The researcher designed the questionnaire for the quantitative research in such a way that similar data will yield from participants should this questionnaire again be applied at a different time with the same participants. Reliability can be determined as consistent and stable, ensuring that if the instrument was to be administered multiple times, the scores would remain the same (Creswell, 2014). Should the same data yield from this study over time the reliability will be seen as stable (Cohen et al., 2011a; Gray et al., 2011). The quantitative questionnaire was distributed at tuition centres throughout SA and therefore the researcher developed the questionnaire in such a way that the data yielded from the questionnaire were similar and applicable to the respondents in the different areas who took part in this study. The various circumstances in the different geographical locations of students as well as their access to interactivity and LTs were aspects taken in consideration when developing this research.

2.14   The model: Sequential equation modelling

The model the researcher developed after completion of this research will enable DE institutions delivering various programmes to understand the importance of the use of technology in the delivery of programmes and will clarify and identify aspects influencing one another that could improve quality of teaching and learning of DE programmes. The model that was developed will assist the UODL to integrate and manage interactivity effectively, improving the quality of teaching and learning. The relationships as well as the influences between aspects identified in this study that will improve technologies of learning will provide institutions with a framework to successfully implement technologies more effectively in delivering DE programmes.

2.15   Limitations

The researcher identified certain limitations that possibly had an influence on this study. These limitations were addressed in both stages of the research in this study. The researcher specifically included these limitations in the questionnaires in both stages to be addressed.
- Participants' hesitance to use interactive technologies. This could be attributed to the fact that, especially in the rural areas, these types of technologies were (still are) not promoted to a large extent.
- Conceptualizing the concept interactivity and LTs amongst respondents in rural areas.
- Participants' access to LTs remains an issue for students to interact with learning material.
- Availability of technologies for learning to all students enrolled for DE programmes

2.16 Chapter summary

The researcher employed a multi-modal research design as an appropriate approach to gather valid, reliable and relevant information for this study. Using a multi-modal research design the researcher ensured that all data collected were valid and reliable. A functionalism paradigm formed the philosophical underpinning as research framework for this study. This corresponds with phenomenological research as the essence of human experiences on a certain phenomenon (interactivity, interactive technologies, ODL and teaching-and learning) was investigated. The researcher aimed to find real solutions to real problems regarding the use of technologies for learning in the delivery of DE programmes as it was experienced by students. The types of questionnaires used as measuring instrument were discussed and validated to ensure that true and relevant data were collected from both groups that formed part of this research. The format and process for this research was described in this chapter, including the different role players that formed part of the study population for this research. The researcher set out all requirements for reliability and validity and principles which formed the basis for statistical analysis were described and motivated in this chapter.

Chapter Three presents the literature review for this study where all concepts were defined, addressed and discussed.

Chapter Three

Examining the Literature on Interactivity

3.1   Introduction

This literature review culminates in a theoretical conceptual framework for the effective use of interactive learning technologies in ODL at the NWU. It is important to conceptualise the research and establish a sound theoretical base in order to compare the findings of this study with others. Clarification of related concepts such as DE, ODL, interactivity, interactive learning technologies, the management of teaching and learning aspects is addressed in this chapter. The researcher aims to link these themes to DE in order to unpack the use of interactive learning technologies in DE. Investigating the mode, means and successes of interactive learning technology used in delivering DE programmes in developed and developing HEIs will enable the researcher to develop a fitting framework for the effective implementation of learning technologies at the UODL in order to enhance the quality of DE programmes. This technological framework can only be established after evaluating the technological framework of the geographical area students reside in (Council on Higher Education, 2014). ODL refers to learning where few or no barriers are evident; the absence of these which improves accessibility to learning (Kanwar & Mishra, 2016).

In order to understand the concept of interactivity in ODL, one has to follow the footsteps of its origins. DE originated in the early 1900s when the geographical distance and location of students created a need for distance education in Australia. The first institution in Australia that embarked on delivering DE programmes was the University of Queensland in 1911, followed by the Royal Melbourne Institute of Technology in 1919, and the University of Western Australia in 1921 (Mitchell, 2009).

India has become a major role player in the field of ODL during the early 1950s because of the rapid growth of the population, and high demand for qualified human resources in the private and public sectors (Tripathi & Mukerji, 2008). The majority of the population of India reside in the rural areas and it is projected that by 2030, seventy per cent of the population will reside in rural areas (Kumar, Chaudhary, & Shankar, 2008). The imbalances of the population are most evident in the rural areas where the poor and the wealthy live adjacent to one another (Kumar et al., 2008). The primary goal of the Indian education strategy is to provide education to the entire population, irrespective of creed, stance and caste (Bordoloi, 2012). This would only be possible through DE, as traditional Indian universities do not meet the demands for quality higher education. The Dr B.R. Ambekar Open University in Hyderabad was established in 1982; the Indira Ghandi Open University in 1985; and the Kota Open University in 1987 (Sharma, 2005). There are currently more than fourteen open universities situated throughout India to cater for the large education imbalances in the country.

Turkey embarked on the delivery of DE programmes in the 1950s (Geray, 2007). During 1954 and 1975 respectively, correspondence DE programmes started in Turkey as paper-based programmes. The main reason why Turkey decided to implement DE was the huge discrepancies in education levels between people in the different regions in Turkey. During 1982 the Ministry of Education of Turkey established the first ODL programme at the Anadolu University and the Radio and Television Institution of Turkey supported the delivery of the programme. The use of technologies for mass communication and also the availability of the internet now afford many individuals access to DE (Geray, 2007).

UNISA is the oldest higher DE institution in South Africa, and it was established as the University of Good Hope approximately 130 years ago, with its main purpose to serve as an examination body. In 1916, the institution was renamed the University of South Africa (Ngengebule, 2003; UNISA, 2009) with the task to deliver various DE programmes and courses. UNISA is currently the largest provider of higher DE in SA.

Visser, Visser, Amirault, and Simonson (2012) describe the development of DE in Mozambique in three phases, namely the pre-independence (of limited scope and irrelevant to the development needs of the country at that stage), the initial stage (printed, self-study materials and radio were used through DE to do teacher training) and the post-independence stage (growing interest for the use of DE to upgrade teacher qualifications through public and higher education institutions). In Mozambique, the development of these phases stretched over two decades. Pre-independence DE in Mozambique was available to only a few privileged students of Portuguese origin as Portuguese correspondence courses. During 1977, after independence, more DE institutions were established as an extension of secondary, higher and technical education.

DE in Uganda originated in the early 1960s at the Makarere University as correspondence mode of delivery and focused on improving teacher education. Radio and television were introduced in the facilitation of DE programmes throughout the country (Juliana & John, 2005).

Various factors contribute towards the establishing of DE in various countries. These factors include the need to access further education at higher education institutions (HEIs), and the need to improve the level of education due to economic and political discrepancies. The use of technology in the delivery of DE depends on the availability of technology in a specific country. It is evident that all countries now involved in DE have gone through the various phases of distance education (Taylor, 2001). With the development of technologies for learning and the relating advantageous aspects such as interaction among the content, students, and lecturers who use these technologies, interactivity has become an added dimension on which institutions now depend during the delivery of DE programmes (Figure 3.1).
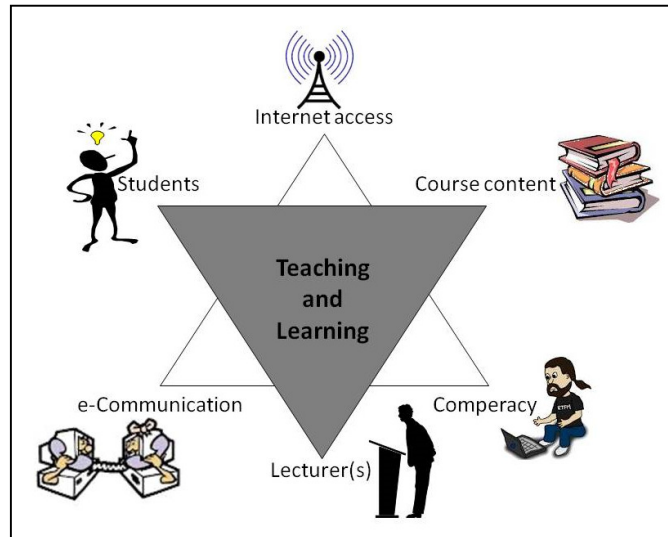
Figure 3.1   **The relationship between lecturers, students and course content against the backdrop or technological aspects** (Van Deventer & Blignaut, 2013)

In the next section, Figure 3.2 provides an outline for organising this chapter during the clarification and exploration of concepts addressed in this study. The discussion in the literature review will mainly focus on the role of technology-enhanced learning (TEL), ODL for developing contexts, interactivity and technologies for learning (LT), as well as case studies serving as examples of interactivity across contexts. These will all contribute towards the framework for the literature review in this study.

Open Distance Learning for developing contexts

```
TEL for DE ──────────► Defining TEL for ODL

                       Rationale for using TEL in DE

                       Characteristics of DE

                       Generations of DE

                       Trends in DE


ODL for developing contexts ──► Defining ODL

                       Modes of DE delivery

                       Models of DE delivery

                       Multi-modal learning


Interactivity ─────────► Defining interactivity

                       Types of interactivity

                       Rationale for interactivity


Learning technologies ──► Defining learning technologies

                       Rationale for LTs

                       Use of LTs


Examples and case studies of interactivity across contexts
```

Figure 3.2: The Conceptual Framework for the Literature Review

3.2   Technology-enhanced learning for distance education

Various technologies that assist in the delivery of DE programmes are available to students and institutions. The use of and implementation of various technologies in delivery of DE programmes could improve the quality of learning, affording all role players with more opportunities that could provide students with support and possibly improve the quality of learning. Manouselis et al. (2011) state that technology-enhanced learning (TEL) cover all technologies that could support any form of teaching and learning activity.

3.2.1   Defining technology-enhanced learning for distance education

Quality of teaching and learning and to meet students' expectations are two drivers that could encourage investment of new technologies in institutions (Palme, 2009). Manouselis et al. (2011) opine that, in order to support and augment learning practices of students and organisations, the objective of TEL should be to design, develop and evaluate sociotechnical innovations. Palme (2009) defines TEL as teaching and learning enhanced through the use of technology. In a TEL environment, connectivity among students themselves, between students and lecturers and between students and resources is evident and viewed as a process of intervening in teaching and learning (Zitter et al., 2012) (Figure 3.1). Intervening in teaching and learning could include implementation of LTs to assist and possibly enhance teaching and learning. TEL interventions could counteract the barriers of time and location that influence teaching and learning within DE programmes. TEL is also defined as online resource innovation that directly influences the support of teaching and learning for the benefit of individuals and organisations (Jenkins, Brown, Walker, & Hewitt, 2011; Manouselis et al., 2011).

3.2.2   Rationale for using technology-enhanced learning

Use of technology in the delivery of DE programmes could eradicate barriers to learning such as time and distance constraints. Students could at any time connect with one another, or gain access to resources available to them via an array of technologies. Furthermore, the communication between all role players involved in delivery of programmes could be enhanced. Communication is globally viewed as an essential determinant in the delivery of distance education (Redelinghuys, 2012). Dohmen (1967) states that communication in DE becomes possible through printed media, electronic media and other electronic devices. Communication and communication media technologies have evolved over time, and one could expect an increase in the means to communicate and assist students in DE.

Through implementing technology in delivering DE programmes, students are enabled to physically and digitally experience teaching and learning first hand (Zitter et al., 2012). Manouselis et al. (2011) identify TEL systems as formal and informal settings:

- Formally structured programmes and curricula that HEIs offer where students are accredited in obtaining a qualification. In the majority of cases the delivery of DE in accredited institutions falls within this category.
- Students that form part of an informal learning community learning at their own pace and in their own time relate to informal settings.

DE delivery via TEL comprises synchronous and asynchronous learning (Manouselis et al., 2011). Structured as well as non-structured learning experiences are linked to these two modes of learning. Emerging technologies for learning enables students to engage with devices of their choice to participate in the teaching and learning. TEL is associated with multi-modal learning (blended learning) as a mode for delivering DE programmes where classroom or traditional activities are combined with online activities. Picciano (2009) states that the multi-modal model recognises students from different generations and personality types; strategies for learning which include different learning styles; and it identifies various approaches used during face-to-face and online interaction that addresses the learning needs of students. Various instructional methods and strategies are employed in the delivery of programmes within multi-modal learning.

3.2.3   Characteristics of distance education

A defining feature of DE is that the student, the lecturer and the learning content are separated (Figure 3.1). The Council on Higher Education (2014) views DE as an assortment of methods and modes of provision which find ways of communicating the curriculum to students without the lecturers and students all being at the same place at the same time. DE adds flexibility, as learners can study at their own pace (Visser et al., 2012). Various media and technologies for learning can be used in the two-way communication between students and the lecturer (Heydenrych & Prinsloo, 2010; Venkatesh & Carswell, 2002; Wang, 2014). DE is also a vehicle for teaching and learning (Casey, 2008). Fägersten and Dalarna (2013) state that DE is not limited to prescribed spaces and geographical areas or borders, but that DE can be delivered over distance, as students are separated from lecturers in time and space. DE could be regarded as a community of learning where students are not able to engage with face-to-face teaching and learning (Beldarrain, 2006; Gunawardena & McIsaac, 2004; Haller, 2014; Heydenrych & Prinsloo, 2010; Keegan, 1996; Khodamoradi & Abedi, 2011; Schlosser & Simonson, 2009; Simonson, Schlosser, & Orellana, 2011). Redelinghuys (2012, p. 19) defines DE as:

> The teaching and learning process over distance whereby an assortment of situation-specific media, correspondence techniques, programmes, support and management structures are utilised to establish and improve communication and feedback between skilled experts from institutions and students over a wide geographical area irrespective of time, space and location.

Flexibility in DE enables students to use technologies for learning and models for instruction to improve delivery of DE programmes. DE provides students with options to effectively take part in teaching and learning at their own pace, in their own time and at any place. Csikszentmihalyi and Wong (2014) explain that in order to be academically motivated, two aspects are required, namely

motivation that is based on long-term rewards and motivation based on ongoing experiences. They can structure their learning according to their needs pertaining to time, place and pace. DE should furthermore motivate and enable them to achieve success as well as the desired outcomes.

3.2.3.1 Flexibility in distance education

Kember (2007) defines flexibility in learning as comprising three modes: (i) face-to-face tuition, (ii) DE, and (iii) the use of learning technologies as part of online learning. These modes contribute to enable students to participate in teaching and learning in spite of being geographically dispersed. Delivering DE programmes to students in diverse geographical areas, adhering to the concepts any time and any place, adds flexibility to the delivery of programmes (Visser et al., 2012). Because of students' diverse locations, asynchronous learning should be available to students in order for them to access the learning content, teaching-and-learning tools, and processes (Haller, 2014). Reiter, Lakoff, Trueger, and Shah (2013) define asynchronous as when individual students can learn at their own pace and time. Technologies for learning applied in asynchronous learning enable students to actively engage in their learning content, their peers and the lecturer. Asynchronous learning offers support to students with more than one learning style, as students can make use of more than one way to access content or technology for learning (Reiter et al., 2013). Synchronous learning is evident when teaching and learning take place in real time. As interactive communication technologies evolve, interactivity between students and their teaching and learning also increase. Synchronous e-learning and asynchronous e-learning, when provided side-by-side, serve different needs of different learning communities (Shahabadi & Uplane, 2015).

Flexibility is the most important beneficial aspect in the delivery of DE programmes (Kanuka & Conrad, 2003; Wang, 2014). Improving flexibility in the delivery of DE programmes encourages course development and student support (Rafiq, Shoaib, & Arshad, 2014). Communication and interactivity between role players are pivotal to the successful delivery of DE programmes (Areti & Bousiou-Makridou, 2006; Isman et al., 2003; Redelinghuys, 2012). The use of ICTs in the delivery of DE will improve flexibility in DE programmes and assist students and HEIs to intersect with geographically diverse students (Anderson & Simpson, 2012; Kumar et al., 2008; Lindberg & Olofsson, 2006). Creating flexibility and interactivity in DE will make it easier for students to access learning resources, and diminish barriers like time, distance and location (Commonwealth of Learning, 2011; UNESCO, 2002). Accessibility therefore also contributes towards the quality of teaching and learning of DE programmes by improving communication between students and lecturers. This is a process which requires much development as indicated in the case of the then Potchefstroom Teachers' College (PCE).

During the initial stages of delivering DE programmes through the PCE, a correspondence mode was the main means of delivering content to students at study centres. During 2004 the School for Continuing Teacher Education (SCTE) used television and satellite broadcasts to augment the

delivery of teaching and learning through DE (Rabe & Sieberhagen, 2013). This was the first stage of adding flexibility in delivering DE at the SCTE, which enabled students to choose how they could access teaching and learning. One of the objectives of delivering DE programmes via the PCE, SCTE and UODL was to afford students with more opportunities to access resources in DE programmes, as working students have limited time to search for resources. Using learning technologies to deliver DE programmes added more flexibility as students were given the opportunity to choose how they want to access their teaching and learning

In summary, flexibility as well as interactivity used in the delivery of DE programmes can be enhanced through the use of emerging communication and communication devices. ICTs are now more frequently used in teaching and learning. Location and time for students in various geographical areas become irrelevant as they now have additional options and means to access resources through various technologies. An asynchronous mode for delivering content and resources can be established for communication among students and between students and institutions through emerging communication technologies with interactive capabilities. Access to resources can be enhanced through flexibility and interactivity, while accessibility as a barrier to DE is diminished.

3.2.3.2 Accessibility

Redelinghuys (2012) indicates that improved accessibility improves and enhances interactivity in DE programmes. Accessibility forms an integral part of DE as it assists with bridging intellectual, geographical and cultural gaps (Simonson et al., 2011). The quality of teaching and learning in delivery of DE can improve if students and role players have access to relevant resources. DE students are generally geographically separated from their institutions and they need a vehicle to access resources. In this context, the vehicle refers to the availability of communication technologies and devices (Flemming & Hiple, 2004). Communication devices and technologies for learning assist in the delivery of DE programmes. Students can manage their teaching and learning and environment, acquiring information when, how and where they prefer, and making use of a variety of means and devices to access information (Abrioux, 2008). The challenge therefore is to utilise all possible means for students to access all aspects of their teaching and learning. Accessibility should take into consideration the needs of the student, as well as the ease with which the digital resources can be used to contribute towards an effective learning environment (Green, Jones, Pearson, & Gkatzidou, 2006). The use of technology enables students to create a community of learning which collectively enhances their interaction with resources and communication with lecturers (McIsaac & Gunawardena, 2001). Potter (2013) states that success in DE can only be achieved when sufficient support is provided to students once situational and institutional barriers have been removed. By removing situational and institutional barriers, students have seamless access to resources that could result in enhanced quality of teaching and learning. Barriers can only be reduced when access to all resources is afforded, using a plethora of available technologies.

Lusted (1986) defines pedagogy as the science of teaching and includes the different methods and teaching styles used in teaching. It can be deduced that the pedagogy to be used in DE will be determined by the use of technologies for learning available to students. Having determined the extent of available technologies for learning, institutions are able to establish how such technologies could be implemented and used during the delivery of DE programmes. The researcher concludes that the pedagogy on which a DE institution decides is dependent on communication technologies and infrastructure available to students and lecturers. Affording students more access to participate in DE through modern communication technologies and access to resources will add more transparency to the delivery of DE programmes. Improved use of communication technologies could create a learning culture amongst students and furthermore increase the level of interactivity (Andersson & Hatakka, 2010).

Anderson and Dron (2012) and Rodriguez (2012) argue that *connectivism* relates to autonomy, diversity, openness and interactivity in teaching and learning. Connectivism is one of three generations of TEL (the others being behaviourism and the social constructivism). A constructivist approach demands a close connection between people, digital artefacts and content (Anderson & Dron, 2012; Rodriguez, 2012). Using various technologies for learning, and applying technologies for learning in teaching and learning, enable the student to create and influence his/her learning environment. Factors influencing the learning environment like interaction, engagement, participation, cultural and social issues and the construction and adaption of the learning environment are evaluated and form the basis of constructivism (Duke, Harper, & Johnston, 2013). In DE the various options and technologies used to deliver programmes over wide geographical areas assisted the researcher to investigate more effective means of programme delivery that would benefit teaching and learning. Connectivism forms an important aspect of this study as technologies for learning used are continuously evaluated to determine effective teaching and learning in DE programmes. In the connectivist model, the technology determines the type of pedagogy used (Anderson & Dron, 2012; Duke et al., 2013).

3.2.4   Generations of DE

Models and modes of delivering DE programmes of Abid, Jabbar, Saeed, Akhtar, and Iqbal (2013) and Burns (2011) correspond to a large extent with the five generations of DE described by Taylor (2001). Taylor (2001) describes five generations of DE which have evolved over time as:

a) **1st Generation**: A correspondence model for delivering teaching and learning developed after the advent of the printing press (Heydenrych & Prinsloo, 2010; Timeline Beta, 2011; Wang, 2014). Correspondence between students and the institution occurs primarily through printing media and later the limited use of film. All correspondence is via postal services.

b) **2nd Generation**: Printed media, audio (radio) and video are used to deliver DE programmes. Radio, television and satellite transmissions assist students during the delivery of DE

programmes. This is also known as the multimedia model in DE (Gunawardena & McIsaac, 2004; Heydenrych & Prinsloo, 2010; Wang, 2014).

c) **3rd Generation**: Communication technologies are used to enhance synchronous communication between students and institutions. The 3rd generation is generally referred to as the tele-learning model (Heydenrych & Prinsloo, 2010). Abid et al. (2013) state that the internet is used for the delivery of content as web pages for additional support to students who have access to the internet.

d) **4th Generation**: This generation relates to the flexible learning model whereby programmes are delivered online through the internet (Heydenrych & Prinsloo, 2010). Abid et al. (2013) describe the development of LMSs where students and lecturers connect inter alia through social media, blogs, interactive whiteboards etc.

e) **5th Generation**: This mode refers to the intelligent flexible learning model where intelligent technologies are used in learning environments; lectures are recorded and at a later stage viewed by role players (Heydenrych & Prinsloo, 2010). Courses can be online or through computer mediation.

Council on Higher Education (2014) states that the early adopters of implementing new technologies in delivering DE programmes are DE service providers as seen in the five generations that evolved over time. These DE providers have furthermore accentuated that diverse technologies and system requirements will provide structure and encourage dialogue and effective support systems in DE programme delivery.

The subsequent generations of DE are depicted in Figure 3.3. The development of the different generations of DE, as well as the differences and characteristics of these generations, are outlined.

Models of Distance Education and Associated Delivery Technologies	Characteristics of Delivery Technologies					
	Flexibility			Highly Refined Materials	Advanced Interactive Delivery	Institutional Variable Costs Approaching Zero
	Time	Place	Pace			
FIRST GENERATION **The Correspondence Model**						
• Print	Yes	Yes	Yes	Yes	No	No
SECOND GENERATION **The Multimedia Model**						
• Print	Yes	Yes	Yes	Yes	No	No
• Audiotape	Yes	Yes	Yes	Yes	No	No
• Videotape	Yes	Yes	Yes	Yes	No	No
• Computer-based learning (e.g. CML/CAL/IMM)	Yes	Yes	Yes	Yes	Yes	No
• Interactive video (disk and tape)	Yes	Yes	Yes	Yes	Yes	No
THIRD GENERATION **The Telelearning Model**						
• Audio tele-conferencing	No	No	No	No	Yes	No
• Video-conferencing	No	No	No	No	Yes	No
• Audiographic Communication	No	No	No	Yes	Yes	No
• Broadcast TV/Radio and audio-teleconferencing	No	No	No	Yes	Yes	No
FOURTH GENERATION **The Flexible Learning Model**						
• Interactive multimedia (IMM) online	Yes	Yes	Yes	Yes	Yes	Yes
• Internet-based access to WWW resources	Yes	Yes	Yes	Yes	Yes	Yes
• Computer-mediated communication	Yes	Yes	Yes	Yes	Yes	No
FIFTH GENERATION **The Intelligent Flexible Learning Model**						
• Interactive multimedia (IMM) online	Yes	Yes	Yes	Yes	Yes	Yes
• Internet-based access to WWW resources	Yes	Yes	Yes	Yes	Yes	Yes
• Computer-mediated communication, using automated response systems	Yes	Yes	Yes	Yes	Yes	Yes
• Campus portal access to institutional processes and resources	Yes	Yes	Yes	Yes	Yes	Yes

Figure 3.3: **Five Generations of the Evolution of Technological Innovation in Distance Education** (Taylor, 2001)

Lim, Morris, and Kupritz (2014) describe the evolvement of DE into four generations as:

- *Instruction* via the printed media only, such as books, tutorials, periodicals, etc.
- *Systems* whereby instruction takes place, using broadcast media such as television and radio which was the only medium available in early years of DE.
- *Online instruction* whereby instruction takes place via a computer and the Internet.
- *Web-based teleconferencing* whereby interaction occurs between the student and the institution via mobile phones, interactive whiteboards and various other modern communication devices which enables direct dialogue.

The five generations DE model of (Taylor, 2001) and (Lim et al., 2014) correspond to the phases of the cycle of implementing learning technologies into certain environments. With the progress of delivery options for DE programmes, certain strategies have to be followed during the implementation of LT. Stoner (1996) identifies a series of actions within each of the phases in the cycle for

implementing learning technologies. The life cycle for LTs could be used to determine in which phase an institution finds itself at a given moment in time.
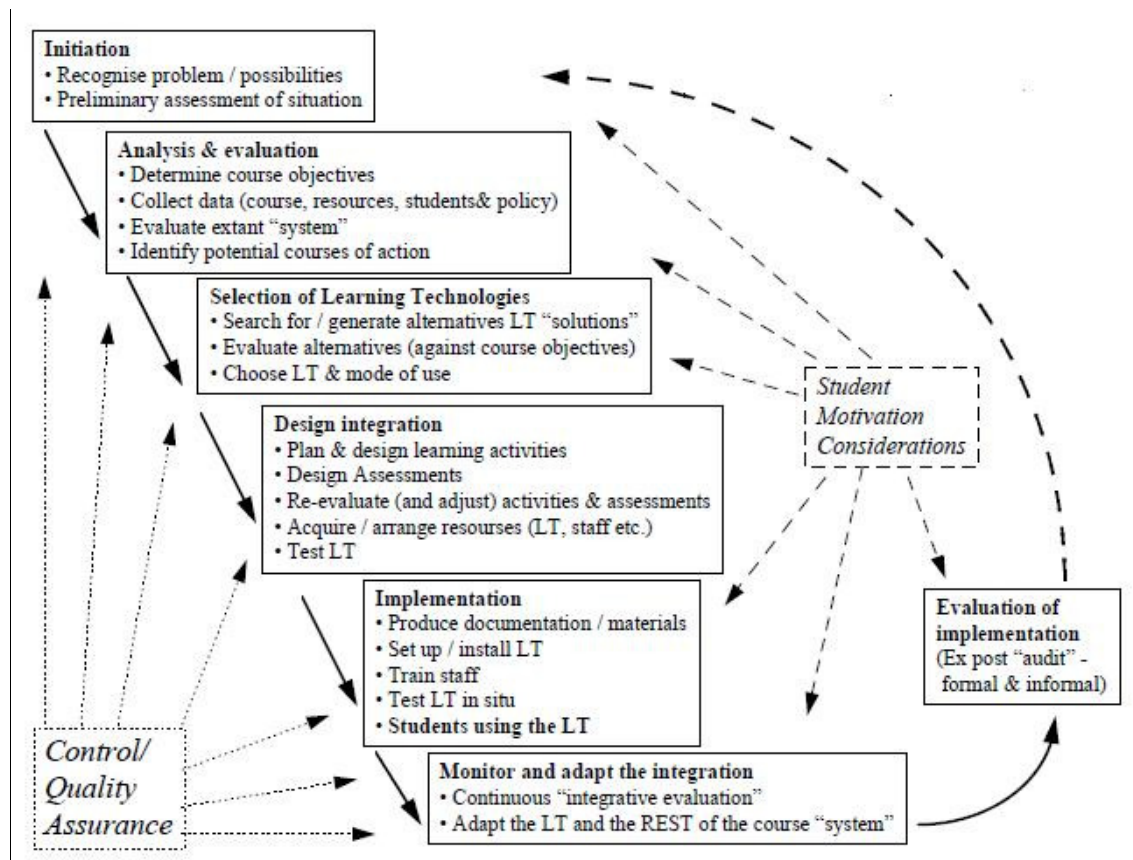
Figure 3.4:   A life cycle model of technologies for learning integration (Stoner, 1996)

Before the researcher elaborates on technologies for learning which could be used in delivering DE programmes at an HEI, the reasons and trends for the use of technologies in HEI should be understood. The *NMC Horizon Report: 2015 Higher Education Edition* identifies six long, medium and short-term trends that form key elements in the adoption of technology in HE (Johnson, Adams Becker, Estrada, & Freeman, 2015):

- Advancing cultures of change and innovation (long-term) whereby the printing media is gradually transformed to digital media. Changing printing media to digital media will assist students to explore new and innovative ideas on how to use technology more effective in HE.
- Combining resources and sharing them amongst various institutions as part of improving and increasing cross-institutional (long-term) collaboration. Combining resources of different institutions will assist them to work towards common goals, strategies and innovations regarding the use of technologies for learning in HE. An example of such collaboration is the use of open education resources (OERs).
- Measured learning on what will influence decision making in the next three to five years regarding technology planning for delivery of programmes at institutions. Learning analytics

could be used in order to improve pedagogies and to support and encourage students to actively take part in learning process.

- Proliferating OERs (mid-term) that could more effectively be distributed in order for barriers to be lowered regarding the access to resources and enabling more students to use OERs.
- Increasingly making use of multi-modal learning (short-term). It was previously indicated how multi-modal learning (blended learning) links up with TEL (§3.2.2) (Picciano, 2009).
- Re-designing learning spaces (short-term). Students could explore improved learning spaces and learning innovations outside traditional classrooms. New technologies for learning could contribute towards the development of learning spaces (Johnson et al., 2015).

Stoner (1996) established a life cycle framework for the integration of technologies for learning which also constitutes the framework for this study:

- **Initiation.** The challenges and possibilities of how to address challenges such as general awareness and monitoring of a course, formal course reviews, exposure to LT material, LT implementation, external initiatives, or pressure of integrating must be investigated. In this study, the geographical diversity of students enrolled for DE programmes at the UODL was explored. Technologies and technological infrastructure that would enable students' access to resources/content, as well as the cost implication of such implementation, should be included during this phase.
- **Analysis and evaluation.** Course objects, evaluation of the system and potential course of actions for the implementation of technologies for learning during the delivery of DE programmes should be analysed. Data relating to the route of implementation of LTs should be used to understand the needs of the system. Students' perceptions and understanding of LT in the delivery of DE should be accessed and communicated to all role players. Qualitative and quantitative measures should be used in order to determine the demands and needs for the use of LTs in the delivery of DE programmes. A further consideration should be whether students and other role players have the skills to use technologies for learning in their various forms during teaching and learning.
- **Selection of technologies for learning**. It should be determined whether the proposed technologies for learning are suited to the teaching and learning environment where they would be implemented. Alternative technologies for learning should also be investigated as country specifics influence the type of LTs to be selected. Technological infrastructure suitable for the specific environment should be taken into consideration in order for students to benefit from the implementation.
- **Design integration.** This aspect considers teaching and learning activities, assessment and resources to be used in conjunction with the technologies for learning, as well as the testing for the effect of technologies for learning on students' learning. Testing should also be performed to determine if teaching, learning and assessment could be adapted to the use of the proposed technologies for learning.

- **Implementation.** Implementation relates to the phase where all actions relating to documentation, staff training, testing of technologies for learning, and the proposed mode of use of the technologies for learning are performed. Students could start to use the available technologies for learning. After assessment of the technological infrastructure and what is required to successfully implement technologies for learning, the institution can commence to implement technologies for learning on a minor scale in order to familiarise students with this new learning environment. It is important to also promote these technologies for learning to large groups of students for them to become familiar to the LTs and consequently enrich their learning experiences (Fulford & Zhang, 1993).

  The UODL implemented whiteboard technology at all of its study centres during 2011-2012, integrating and exposing large numbers of students to interactive technologies. During 2014 the UODL encouraged students to individually connect to sessions with their own devices (laptops, computers etc.) in order for them to connect to live whiteboard sessions irrespective of their locations. Free Wi-Fi access was also made available during 2015 at all learner support centres to enable students to access learning resources. Students attending scheduled whiteboard sessions have experienced that the interactive technologies support for their teaching and learning and they favour having access to various resources at all times. The majority of respondents (80.2%) that completed the online questionnaire (2272 respondents) reported that they had a positive experience while attending interactive whiteboard sessions at the learner support centres. About half of the respondents (54,8%) indicated that they used the internet to obtain learning resources (Combrinck, 2016).

- **Monitor and adapt the integration.** Through continuous evaluation and adaptation of courses and technologies, the use of technologies for learning devices should be monitored for their impact. Monitoring the access to resources would supply the researcher with information on how the integration of technologies for learning impacts on the quality of teaching and learning in the delivery of DE programmes.

- **Evaluation of implementation.** Evaluation and implementation is a continuous process and challenges are to be expected. Adjustments are then required and the cycle could then again move to the initiation phase in order to assess possibilities and problems. Continuous monitoring of technologies for learning at study centres, as well as the frequency of students' access to resources will supply the UODL with information on the strategies they should follow to expand the use of technologies for learning.

Dede (1989) states that issues like technology, demography, economical forces, political forces and pedagogical forces have played and will play a fundamental role in changing the DE landscape. The different DE development phases include many similarities. During 2001 LMSs were added to the mix of interactive technologies for learning (Abid et al., 2013). Stickler and Hampel (2010) explain that virtual learning environments (VLE), e.g. learning management systems (LMSs), were initially designed as repositories where content could be placed for students to access. Currently LMSs are

used as online collaboration tools for student centredness. One can deduce that, as communication technologies evolve, more options will become available to enhance the delivery of DE programmes. Use of the internet and web-based technologies is a starting point for the delivery of programmes (Marson, 1997; Timeline Beta, 2011). DE has thus evolved to the fourth generation of DE delivery. A further generation could be added with technological developments to enhance flexibility in the global delivery of DE programmes.

In summary, Karpenko (2008) and Beldarrain (2006) state that different technologies could be used in the delivery of DE programmes. Gunawardena and McIsaac (2004) indicate that institutions which offer DE have to investigate which communication technologies should be used in the delivery of their DE programmes. Investigation of the implementation of LTs relate to the life cycle for implementation of LT whereby different steps are taken to assess when and how technologies for learning could be implemented (Stoner, 1996). Institutions should continuously assess students' needs regarding teaching and learning, as well as the technologies for learning to be used in the delivery of DE programmes.

3.2.5   Trends in distance education

Student support has always been a major concern in DE. With the advance of TEL, a shift has taken place in die mode of support to DE students. Visser et al. (2012) identify five trends for student support during DE:

- Knowledge should be available to all role players across spatial, time and cultural boundaries and/or barriers.
- Learning is the primary indicator of how effectively students learn.
- Teaching and learning resources should be accessible to and suitable for all students and not only a selected few.
- All students should be reached during delivery of DE.
- Students can engage with teaching and learning through media and well-designed learning experiences.

The United Nation's Educational, Scientific and Cultural Organisation posits that DE should employ various resources, types of instruction, and media with students in order to facilitate teaching and learning over wide geographical areas (Wang, 2014). The majority of students enrolled for DE programmes are distributed over dispersed geographical areas. Students are generally far from their institutions and should therefore be encouraged to use the technologies and support mechanisms available to them to overcome the distance between lecturers and students. LTs could assist students to not become alienated from the institution they are associated with (Mdakane, 2011). Shenton (2004) makes the statement that distance is dark and lonely. It seems that *distance* in DE is dying due to the increasing number of institutions that use the internet and other modern communication technologies to overcome the alienating effects of distance between students and the institution

(Taylor, 1998). Implementing and encouraging the use of technologies for learning with the ability to connect to the internet enables students to access resources and teaching and learning opportunities more easily. Technologies for learning and accessibility to internet have thus reduced, but not eliminated the distance between the student and the institution.

In summary, technologies for learning could assist in the effective delivery of DE programmes irrespective of the location of students (Parsons & Ryu, 2006). DE evolved through different phases over time because of geographical and student diversity. DE was identified at the PCE in 1993 when a need arose from teachers in the North-West province to improve their qualifications. This was before the amalgamation of the three campuses of the NWU, and the only possible means for them to obtain a qualification was through DE (Rabe & Sieberhagen, 2013). It was evident that due to unavailability of other technologies, correspondence (text-based learning) formed the core of programme delivering. Correspondence by means of delivering DE programmes is categorised as the first generation of DE development (Abid et al., 2013; Taylor, 2001). According to the Stoner (1996) model, the constraint that the PCE identified on the continued professional development of teachers was that tuition could only take place after hours and correspondence was a convenient means of content delivery at the time. However, new technologies have emerged and should be taken into consideration.

3.3   Open distance learning

DE has progressed over the years in many ways, away from traditional DE to the use of emerging technologies in the delivery of DE programmes through ODL. Over the years, various models have evolved with the development of communication technologies and interactive technologies.

3.3.1   Definition of open distance learning

In ODL the learner is separated from the lecturer, and the challenge is to create a larger dimension of openness, accessibility and flexibility (Ghosh, Nath, Agarwal, & Nath, 2012). Open learning (OL) and DE complement each other. In both cases the lecturer and student are separated in time and space when they use technology to communicate with each other (Kanwar & Mishra, 2016). Towobola and Raimi (2011) and Dzakiria and Christopher (2010) state that the success of ODL is determined by the various types of technologies used to enable interaction and communication, either through real time (synchronous) or in delayed time (asynchronous).

ODL combines DE and OL (Kanwar & Mishra, 2016) to make learning affordable for students and provide access to students in HEIs (Garrett, 2016). Kember (2007) states that students prefer to select courses and programmes with open registry; to study anywhere and at any time; to have flexibility in their learning; and to enjoy a high degree of openness. ODL is regarded as a student-

centred approach where resources are available through innovative media and to all role players in order to remove the barriers obstructing teaching and learning (Msweli, 2012; Towobola & Raimi, 2011). Kanuka and Conrad (2003) define ODL as learner-centred learning where students at remote locations could access teaching and learning at any time. Kanuka and Conrad (2003) define ODL as a flexible mode of learning to remove restrictions and barriers which could hinder the provision and delivery of DE programmes (Dixon, 1987; Perraton, 2007; Rowntree, 1996). In order to understand the essence of ODL, one should identify its characteristics (Mbwesa, 2011):

- Providing flexible access to education as well as to resources that assist students in teaching and learning;
- Providing virtual access to lecturers at the HEI;
- Implementing new and innovative pedagogical techniques to provide enhanced opportunities for learning;
- Implementing interactive, active and collaborative learning whereby students and institutions are actively involved in learning;
- Providing students with various means to access so students are less reliant on lecturers;
- Sharing resources with a learning community creating various linkages to institutions.

Ghosh et al. (2012) state that ODL is used for upgrading of teachers' qualifications, general education for in-school and out-of-school programmes, vocational and continuing education and non-formal education. Using a plethora of media and emerging communication technologies could assist students to interactively communicate with institutions regarding their teaching and learning and administrative issues. ODL is evolving with increased sophistication of technologies for learning (Belawati & Baggaley, 2010). Belawati and Baggaley (2010) define ODL as a system of education whereby all individuals with limited restrictions have access to teaching and learning. At the UODL at the NWU, the issue of access to resources became more important as more technologies for learning were implemented at the various study centres. Enabling ubiquitous access to an education system relates to the removing of barriers to learning, and it offers increased flexibility in the delivering of DE programmes. Mikropoulos (2011) argues that ODL is propelled by technology and the development of emerging communication technologies in order to enhance teaching and learning in the delivery of DE programmes. Accessibility, flexibility and affordability constitute the basis for ODL to be effectively implemented.

Emerging communication technologies and ICT applications could further assist with increased flexibility in the delivery of DE programmes as more options are made available to students and role players to communicate and convey learning content. Open Distance e-Learning (ODeL) refers to various new forms of DE and is typified by the merging of an open learning philosophy, the DE pedagogies and e-learning technologies available (Arinto, 2016; Muyinda, Mayende, & Kizito, 2015). The ODeL mode of delivering DE programmes improves accessibility to resources as a vast amount of digital libraries and resources are added (Njoroge, Wambiri, & Ogeta, 2015). Dzakiria and Christopher (2010) state that improved interactivity and communication at institutions involved in DE afford

students separated by distance to communicate in real time (synchronously), as well as in delayed time (asynchronously).

With the establishment of the SCTE in 2004, and the UODL in 2013 at the NWU, students could enrol for education programmes at any time of the academic year. This diminished barriers to learning, provided adaptability to their learning, and offered continuous support to remote students (Rabe & Sieberhagen, 2013). Stoner (1996) describes design integration as actions whereby programmes and resources are adapted and processes like registration of students are made more accessible. New technologies for learning are acquired and piloted in order to determine how these technologies could contribute towards improved teaching and learning practices. With the progression of the UODL from the SCTE, the aim was to determine how accessibility and flexibility could be further enhanced to support students and provide access to resources by evolving from a traditional synchronous mode of delivery to the asynchronous delivery of programmes, and augmenting various interactive technologies for learning to create a more open access. Stoner (1996) proclaims that investigating emerging technologies (mobile devices, interactive whiteboards, etc.), analysing the needs for delivering programmes, designing and integrating new technologies for learning, and implementing these technologies in delivering programmes through ODL could make a positive difference in the learning experiences of students.

3.3.2   Modes of distance education delivery

Ascough (2002) states that traditional correspondence courses and two-way audio-visual mode of DE delivery are combined in DE. Two-way audio-visual delivery includes interactive technologies (various emerging communication devices). The delivery of DE programmes differs from institution to institution. The Commonwealth of Learning (CoL) (2000) distinguishes between three modes of delivery for open distance learning systems, namely single mode, dual mode and mixed mode. Universities and institutions themselves decide which mode is more suitable for their programme delivery of DE programmes.

3.3.2.1 Single-mode programme delivery

Single mode DE universities provide educational programmes either through face-to-face or through DE (Hope, 2006). A single mode institution selects only one mode to deliver their programmes. Some of their programmes are delivered through face-to-face (classroom-based), interactive teaching and learning which are augmented with print, audio, video, computer and online technologies (Commonwealth of Learning, 2000.). An institution in which teaching, learning and administrative systems are strategized and dedicated to the provision of ODL, can be categorised as a single mode DE institution. Abrioux (2006) and Conrad, Mackintosh, McGreal, Murphy, and Witthaus (2013) explain single mode of delivery institutions as dedicated to the mode of delivery they select. Should the institution choose DE as its only mode of delivery, administrative, teaching, learning and support

structures will be developed to support the DE mode of delivery. Online devices could include any number of interactive communication devices. Students enrolled in a single mode of programme delivery are assumed to be highly motivated and self-directed students. Students enrolled through single-mode institutions should furthermore show a great sense of self-discipline and self-control within the teaching and learning environment. UNISA and the United Kingdom Open University (UKOU) are examples of single-mode institutions delivering DE programmes.

3.3.2.2 Dual mode programme delivery

Institutions classified as dual mode institutions offer the traditional campus face-to-face method of delivering programmes as well as DE (Abrioux, 2008; Abrioux, 2006; Aguti, Au, & Brown, 2009; Daniel, 2012; Hope, 2006). Students attending a dual mode institution find themselves at an institution that offer face-to-face programmes to residential on-campus students, as well as programmes that are offered via DE. All face-to-face programmes are not automatically offered through DE programme delivery. Increasingly more universities embark on becoming dual mode institutions to satisfy the demand for ODL to address the urgent national needs of students, extend university education and to provide tuition to students who are not be able to attend full-time courses at the university. This is also known as a consortium model of DE delivery (Muyinda, 2012).

3.3.2.3 Mixed mode programme delivery

Mixed mode programme delivery, multi-modal delivery and hybrid delivery of DE all refer to the integration of learning delivery methods and offer the opportunity to exploit the efficacy of present-day teaching and learning and form a combination of face-to-face and online learning (Huang, Lin, & Huang, 2012; Moskal, Dziuban, & Hartman, 2013; So & Brush, 2008). Multi-modal learning includes the use of synchronous and asynchronous learning technologies such as mobile devices, satellite television channels and various emerging digital media (Huang et al., 2012). Integrating interactive technologies for learning with face-to-face teaching thus forms the basis of a multi-modal approach. According to Bonk and Graham (2006) multi-modal delivery aims to:

- **Improve pedagogy as it could assist to improve the quality of teaching and learning**. Adding more options such as LTs to teaching and learning could assist students to understand content better, and the technologies could augment teaching and learning.
- **Increase access and flexibility.** Using various devices, students will be able to access teaching and learning at any time and from any place.
- **Increase cost effectiveness.** Students do not have to travel distances to sessions or classes. Using their own devices, they will be able to download resources at a low cost at a fraction of the time required to travel to student learning centres.

Combining various modes of learning offers flexibility and undemanding accessibility in ODL as time and place are not barriers to learning. Students are able to access a variety of resources that could

enhance their learning. Flexibility in learning is established by improving the means of communication and offering more options for students to gain access to teaching and learning resources, as well as to HEIs (Commonwealth of Learning, 2000).

3.3.3 Multi-modal learning

A multi-modal model of learning makes use of an array of approaches to meet the needs of students and enable them to experience teaching and learning in a way that is comfortable to them. This model also creates opportunities to challenge students and create new and more creative means of learning (Picciano, 2009). By using various approaches, students may develop their own learning environment in which they are comfortable and can contribute to.

Beebe (2004), Cavage (2012) and Picciano (2009) describe multi-modal learning as the combination of various learning styles, a variety of learning experiences which are all accommodated by using face-to-face and online technologies to meet the needs of students in a conducive teaching and learning environment (Banados, 2006; James, 2012; Kaur, 2013; Lim et al., 2014; Owston, York, & Murtha, 2013). Multi-modal learning thus uses the same teaching and learning strategies to achieve the desired learning outcomes. It also provides flexibility to learning as students have more options to access their learning. Bonk and Graham (2006) and Klímová (2008) describe multi-modal learning as the concept that could improve pedagogy while it provides access and flexibility to students and cost-effectiveness to the institution.

3.3.3.1 Characteristics of a multimodal delivery of distance education

Singh and Reed (2001) and Shannon, Francis, and Torpey (2012) list the advantages of multimodal learning:
- **Learning is expanded and enhanced as learning outcomes are achieved**. Learning outcomes are achieved as the delivery of learning and teaching is adapted according to the need of the students (Lim et al., 2014).
- **More students are reached through multi-modal learning.** Multi-modal learning offers many students access to education (James, 2012). Anybody can take part in teaching and learning as they are not limited to time and/or physical location of the course (Cavage, 2012).
- **Optimising of development cost and time**. The combination of strategies for course delivery contributes towards achieving education outcomes (Singh & Reed, 2001).
- Shannon, Francis, and Torpey (2012)Shannon, Francis, and Torpey (2012)Shannon, Francis, and Torpey (2012)Shannon, Francis, and Torpey (2012)Shannon, Francis, and Torpey (2012)Shannon, Francis, and Torpey (2012)Shannon, Francis, and Torpey (2012)Shannon, Francis, and Torpey (2012) refer to **technical glitches** with technology and devices which could make communication between the lecturer and students difficult (Shannon et al., 2012).

- **Increased workload of lecturers** hampers the development of online content. Developing methods to assess students' assignments online could relieve the workload (Gibbs & Gosper, 2012).
- **Personal relationships between students and lecturers** could weaken as technology is increasingly used during course facilitation (Shannon et al., 2012)

From the list of characteristics of DE the researcher concludes that, in the long run, the advantages of multi-modal learning benefit students and institutions due to the affordability of programmes delivered through DE, accessibility to resources and teaching and learning, and because outcomes become more achievable through multi-modal learning. One of the contributing factors why many developing countries have embarked on delivering DE programmes is lower costs, affording more people the opportunity to join the global information economy (Visser et al., 2012). Technology glitches will be limited if devices and technology used in delivery of DE programmes are relevant to the development of the specific context. Continuous support and training of participants with the learning technologies could stimulate more frequent communication between students and the institution.

So and Bonk (2010) advise that multi-modal learning should be linked to pedagogical considerations. Picciano (2009) proposes various pedagogical objectives which should be considered in relation to the diversity and the context of the students:

- A primary driver of instruction is **content**. Content can be delivered through direct instruction or through online strategies. The visual stimulation on how processes are explained to students is dependent on the subject being taught through either of these strategies.
- **Social and emotional support** is an important aspect, especially with young and unsophisticated students. It is important that institutions pay attention to students' emotional support, irrespective whether programmes are presented face-to-face or online with technologies for learning.
- **Dialectic and questioning activities** should be stimulated amongst students in order for them to develop enquiring minds and to stimulate critical thinking. This can be fostered when lecturers ask the right questions and stimulate students to discuss and elaborate on the content. Dialogue among students, and between students and lecturers should be encouraged.
- **Reflection** is an important objective in the pedagogical process of multi-modal learning as the more reflections are shared with one another, the richer the reflection will become. Reflection is personal, and the sharing of one's reflections could be beneficial to learning.
- **Collaborative learning** is possible in a face-to-face situation, but it generates much documentation. During online learning, both interactivity and collaborative learning become more accessible and ideas are shared and analysed much more easily. Programmes such as business administration, education, and health require collaboration and dialogue during teaching and learning.

- **Synthesis, evaluating and assessment** of learning is the last pedagogical aspect where students' work is assessed electronically.

At the UODL, these pedagogical objectives are considered during the planning of DE programme delivery. Content which includes PowerPoint presentations, as well as recording of live sessions, is made available to students who were not able to attend live contact sessions. Social and emotional support is available to students enrolled at the UODL as a helpline for students who suffer emotional and social distress. Interaction between students attending live sessions at the student learning centres, irrespective of the programme they are enrolled for, is encouraged, and students generally actively take part in this process. They are encouraged to ask questions and share information, which encourages interactivity. Students are given opportunities to reflect on all aspects of their teaching and learning during and after sessions. Facilitation sessions after IWB sessions at study centres are platforms students use to reflect. Collaborative ideas are shared during whiteboard sessions broadcast to student learning centres during scheduled contact sessions. Students and facilitators have the opportunity to interact and reflect during non-scheduled sessions as the need arises. The UODL focuses on electronic assessment and evaluation, and the submission of electronic assignments and portfolios is currently investigated (UODL, 2016).

In summary, institutions adapt the use of the technologies for learning available to them according to the pedagogical frameworks used at the institution. The needs of the students regarding accessibility of resources for teaching and learning in DE are also considered before interventions are constructed to serve students across diverse geographical areas.

3.4   Interactivity

Interactivity has a wide variety of applications in different situations, as well as numerous meanings and explanations according to different contexts and environments (Evans & Gibbons, 2007).

3.4.1   Defining interactivity

Domagk, Schwartz, and Plass (2010) state there is not a single definition to explain interactivity as a plethora of devices and technologies contribute to applications in different contexts. These devices add to interactivity in many different ways. Interactivity relates to the interaction between humans in the social action theory which refers to interpersonal communication, be it face-to-face or using various technologies (Quiring & Schweiger, 2008). Northrup (2006) defines interactivity as opportunities for students and lecturers to communicate with one another and share ideas either synchronously or asynchronously throughout an online course. The involved technologies include mobile devices like smartphones, tablets, computers, IWBs or other technologies for learning. An added benefit of the use of interactive devices in the delivery of DE is that students asynchronously

interact with the institution, the content and with one another (Maboe, 2013). Asynchronous learning offers students the opportunity to interact according to more than one learning style—something not possible with synchronous learning where only one learning style is embedded (Reiter et al., 2013). With asynchronous learning, interactivity is not dependent on time and place.

Interactivity is increased with exposure, implementation or availability of communication technologies for learning. These devices add to interactivity in many different ways (Fulford & Zhang, 1993; Redelinghuys, 2012). The various explanations of interactivity show how different devices offer different types of interactivity to enhance communication between students and stakeholders that use these devices during teaching and learning (Andersson & Hatakka, 2010; Hoffman & Nova, 1996). Jensen (1998) and Steuer (1992) define interactivity as a factor of technologies for learning which enable the user to contribute towards the content or the mediated communication. Fortin and Dholakia (2005) define interactivity as a system of communication whereby a number of senders and receivers communicate with one another through digital devices. With the continuous development of communication technologies for learning and devices, interactivity plays a considerable role in the quality of teaching and learning during the delivery of DE programmes. It provides students with an array of possibilities to connect to their HEI. Technologies for learning could further assist students to access and interact with resources, and connect with role players involved in delivery of DE. Technologies used in DE aim to create two-way communication and high levels of interactivity which will best meet students' instructional needs (Ellis & Mathis, 1985; Hackman & Walker, 1990).

Lecturers encourage students to interact with them, the content and their peers. This creates experiences of improved interaction, and lecturers find it easier to interact with their students (Ellis & Mathis, 1985; Hackman & Walker, 1990). Fulford and Zhang (1993) report that student satisfaction in learning is improved when the interaction is group-based, rather than personal interaction. Students therefore will more actively take part in group sessions than when they are approached as individuals to interact in a learning environment. Fulford and Zhang (1993)As students become experienced in the use of technology, their interactivity becomes a predictor of their satisfaction in the learning environment. The more DE students are exposed to technologies for learning and are encouraged to use them, the more interactivity, which will increase the quality of their teaching and learning.

Emerging technologies for learning offer students the opportunity to use communication in a way that will enable them to increase interactivity between users and the media. Emerging technologies for learning enable users to personalise these emerging communication technologies for their own use, connect with others and enable the user to control how these technologies are used (Reinhard, 2011). Therefore, digital environments afford students with various methods and techniques to access information from anywhere and at any time, enabling the student to obtain information and interact with online resources (McNeil, Robin, & Miller, 2000).

To understand how interactivity can be employed, both the pedagogical and technical aspects should be understood (Beauchamp & Kennewell, 2010). Pedagogy concerns itself with the aims of education, as well as the goals to be achieved (Dictionary.com, 2014). (Schlosser & Anderson, 1994) states that the pedagogy of face-to-face teaching should not differ from methods employed in DE. Interactivity and interactive technologies used during teaching and learning should be able to conform to these aims and goals in order for objectives to be achieved (Fortin & Dholakia, 2005; Quiring & Schweiger, 2008; Yacci, 2000). Using interaction in different ways confirms that interactivity is a wide concept, and in order to better understand interactivity, the views of different authors should be considered.

DE is a global phenomenon on which a growing number of institutions are embarking on. Aspects such as geographical diversity, time, and access to resources are some of the reasons that institutions implement DE. Densely populated areas and regions often have different levels of quality of education, even in the same country or region. In order to ensure quality of teaching and learning, DE and specifically ODL could improve the general quality of teaching and learning due to its providing of access to all. Interactive technologies for learning could enhance content delivery and improve overall communication between students and lecturers. Sundar, Xu, and Bellur (2010) support this statement and state that interactivity and increased bandwidth could enable students to select content of their choice and even customize content to suit their needs. Technologies for learning and communication are used to create openness in delivery of ODL programmes. Wagner (1994) states that lecturers and administrators rate interactivity as a crucial attribute for current DE.

During 2013 the UODL was established at the NWU to afford students with more openness while enrolling for DE programmes (Rabe & Sieberhagen, 2013). Different technologies for learning which would be better suited to ODL students had to be evaluated in order to be established. IWBs were installed at all tuition centres where students could attend direct broadcasts of contact sessions from studios at the UODL. Students could also watch recorded lecture sessions if they were not able to attend direct broadcasts. This created more openness as they are able to ask question and explanations during the teaching and learning process. Contact sessions are not compulsory and various options and the LMS support students to directly communicate with the institution. The UODL is currently in the implementation phase of setting up technologies for learning, adapting of learning material, and training of staff, and the testing of various other technologies for learning, and encouraging students to interact with different technologies for learning (Stoner, 1996). Lecturers are adapting their learning material according to the needs of DE students; facilitators and staff at study centres are continuously undergoing training in order to operate equipment at study centres, and support students attending the live broadcast sessions (Addendum 3.1, Guidelines 2016: Arrangements and Information for Contact Sessions; South Africa and Namibia).

In countries where DE had previously been implemented, paper-based correspondence formed the initial base for delivery of DE programmes. The Stoner phases are evident in all countries where DE

was implemented (Abid et al., 2013; Taylor, 2001). The increased and dedicated use of technologies in the delivery of DE programmes enables students and role players to become interactive with each other, the institution, and the resources available to them. Interaction is an element of delivering DE programmes that could increase the use of technologies for learning and media in DE programmes. Interaction can also be increased if more students are encouraged to use new technologies for learning (Wei, Peng, & Chou, 2015). Visser et al. (2012) state that the trademarks of DE are accessibility, availability and convenience.

3.4.2   Types and levels of interactivity

Authors describe the types and levels of interactivity:

- Beauchamp and Kennewell (2010) mention three categories of interactivity: (i) physical interactivity, (ii) technological interactivity, and (iii) conceptual interactivity. Using interactivity in its various configurations could have a positive effect in the delivery of DE programmes.

- Hoffman and Novak (1996) distinguish between person interactivity and machine interactivity. Person interactivity occurs through a medium between humans, such as face-to-face communication or interaction, while machine interactivity occurs between humans and a machine for use, *inter alia* in during the teaching and learning process. Person-to-person interactivity is typical of synchronous learning where scheduled learning takes place in the traditional way in classrooms without the use of any technologies for learning. Using technologies for learning in classrooms could augment teaching and learning within a classroom as more options for interactivity occur between role players in the teaching and learning process.

- Jensen (1998) differentiates between four types of interactivity, namely *transmissional*, *consultational*, *conversational* and *registrational* interactivity. While *transmissional* interactivity makes use of different types of media to assist during the facilitation process, *consultational* interactivity makes use of existing material used during two way communication with modern technologies for learning (Jensen, 1998). The difference between *consultational* and *conversational* interactivity is mainly the content used during interaction with students or facilitators. *Consultational* interactivity uses the facilitator's own material, while *registrational* interactivity demonstrates the potential of the media's ability to register and adapt the user information to their needs. Ease of accessibility to the relating subject through interactive technologies could change students' attitudes toward teaching and learning with technologies for learning in terms of their willingness to use the technologies for learning in the future.

- McMillan (2005) identifies three types of interactivity, namely human-to-human, human-to-computer and human-to-content interactivity. Human-to-human interactivity depends on the communication between people and manifests as email and text messaging. Human-to-computer interactivity enables humans to find certain content on search engines while human-to-content interactivity enables humans to develop personalised content or material and apply it on different online platforms.

- Glover, Miller, Averis, and Door (2005) distinguish between three stages of technological fluency:

- **Supported pedagogy.** The lecturer uses the IWB as a visual aid and not for conceptual development. No internet connectivity is required during this stage. The lecturer uses the IWB to introduce new technologies for learning to the students and to assist them to develop confidence in using the new technologies for learning technologies.
- **Interactivity.** The interactive whiteboard constitutes the interface for attention and to test, illustrate and develop various discrete concepts.
- **Enhanced interactivity.** Interactivity forms an integral part of all learning, as well as to integrate conceptual and cognitive development in a way to further exploit the interactive means of technology.

- Song and Zinkhan (2008), Liu and Shrum (2002) and Voorveld, Neijens, and Smit (2011) distinguish between actual interactivity and perceived interactivity. Actual interactivity is the number or types of interactivity on a website; perceived interactivity is when students or consumers are asked about their perceptions and experiences on the site.
- Domagk et al. (2010) identify five types of interactivity:
  - **Dialoguing:** Feedback and answers are given to students.
  - **Controlling:** The speed or pace or progress of students is monitored.
  - **Manipulating:** The type or control one has over a presentation used during teaching and learning.
  - **Searching:** Selecting options during searches on webpages as well as entering queries.
  - **Navigating:** The option of selecting sources from which information is gathered.
- Milojević et al. (2013) label interactivity as:
  - **Social interactivity,** where interactivity only happens between users. In this situation there is interaction between users without the use of technology. Social interactivity can also be seen as face-to-face communication between student and lecturer.
  - **Textual interactivity,** which is the interaction between users and documentation. Lecturers interact and make use of written documentation to communicate with students and other role players. No technology is used.
  - **Technical interactivity,** which is interaction between a user and a system. Technology is used and the student uses the technologies for learning to communicate with others.
- Oprea (2014) states that a certain degree of interactivity in modern learning techniques should be present; including information on how to adapt the media to be used. Adapting media used in teaching and learning could enhance interactivity and possibly improve the quality of teaching and learning in delivery of programmes.
- Kennedy-Eden and Gretzel (2012) define interactivity as the degree or level of control that users have on several aspects of applications such as content, display format, etc.
- Liu and Shrum (2002) and De Vries, Gensler, and Leeflang (2012) explain interactivity as the extent to which different role players act on one another by means of a communication.
- Cho and Kim (2013) posit that positive experiences in an online learning environment are achieved through interactivity.

- Northrup (2006) and Moore (1989) state that during interaction, students interact with the lecturer, with the content and with peers in order to share ideas and information in a synchronous or asynchronous mode.
- Kale (2008) defines the following levels of interaction:
    - The lecturer interacts with the class, sharing information. The lecturer requests the students to provide information or ideas pertaining to a specific topic. Presenting and responding form the main part of this level of interaction.
    - The lecturer interacts with the student. The class now responds to the questions and they may ask the lecturer further questions for better understanding. This is also known as reciprocating (Anderson, 2003).
    - The lecturer interacts with a group of students or with individual students.
    - Students interact with students in the class environment. This could relate to the sharing of information, content and new questions.
    - Students interact with information and documents supplied to them. This leads to reading and understanding of topic at hand (Anderson, 2003).
    - Students interact with a tool or environment, using computers, laptops, screens, etc. in a classroom. The teacher uses these tools to present content to the class.

Van Ryneveld (2005) and Vrasidas (2000) summarise the different types of interaction in column one of Table 3.3. The researcher added other authors to column 2 as an expansion of the table.

Table 3.3   Types of interaction between students, the learning content, the learning environment and graphical interfaces (Van Ryneveld, 2005)

Types of interaction	Author
Student-content interaction	Moore (1989)
Student-instructor interaction	Anderson (2003)
Student-student interaction	
Student-interface interaction	Hillman, Willis, and Gunawardena (1994)
Student-environment interaction	Burnham and Walden (1997)
Teacher-teacher interaction	Anderson and Garrison (1998)
Teacher-content interaction	
Content-content interaction	
Student-context interaction	Gibson (1998)

Anderson (2003) and Conrad et al. (2013) define three modes of interactivity namely student to student interactivity, student-lecturer interactivity and student-content interactivity. These authors state that if there is a high level of interaction in any one or more of these three modes, the learning experience will be fruitful. The three modes of interactivity correspond with the different types of interactivity mentioned in Table 2.3. The numerous definitions for interactivity are understandable, as it is applied in a different ways and situations. Interactivity as well as the adoption of interactivity depend on the situation and/or the environment it is used in. No single definition adequately describes interactivity (Domagk et al., 2010). Jensen (1998) mentions that interactivity is both a concept and a tool which are widely used, but that the term is still not fully understood due to its many uses or applications in practice. For this study the research defines interactivity as two-way communication

between all role-players using technologies for learning in order to effectively foster the downloading of resources, accessing teaching and learn and attaining academic and administrative support to enhance open distance teaching and learning.

Advances in modern communications technologies in delivery of DE programmes could improve communication between all role players (Redelinghuys, 2012). The next phase of interactivity in delivering DE programmes is the interaction between the user and technologies for learning to obtain learning material or to interact by means of technologies for learning (Beauchamp & Kennewell, 2010; De Vries et al., 2012; Hoffman & Nova, 1996; Jensen, 1998; McMillan, 2005; Milojević et al., 2013). Any form of interactivity is preceded by the interaction between the user and documentation only, and thereafter with technologies for learning to enhance interactivity between the student and a device. Rosé and Torrey (2005) state that the more interactivity is encouraged by exposing students to emerging technologies, the more teaching and learning will focus on the student. The five types of interactivity (dialoguing, controlling, manipulating, searching and navigation) will then become evident as the students interact with the technologies for learning (Domagk et al., 2010).

From the literature one can deduce that interactivity is situation specific, dependent on the available infrastructure and the advancement of technologies for learning in the learning environment. Role players will interact effectively with users and teaching and learning when there is a realisation of what phase they find themselves in, and their knowledge of the phase as previously described (Figure 3.4). The phases of interactivity are determined by the level of students' exposure to technologies for learning. Initially interactivity will transpire only between the user and documentation. Interaction between user and documentation is known as social and textual interactivity (Milojević et al., 2013). Students' feedback on documentation relates to dialoguing and interactivity (Domagk et al., 2010). During dialoguing the speed of students' progress is monitored. When technologies for learning are used in the teaching and learning process in delivery of DE programmes, interactivity transpires between users and devices. Manipulating, searching and navigation (Domagk et al., 2010) will enable enhanced interactivity as it will be possible for students to explore web pages, presentations and study material. The final phase of complete interactivity will be evident when all types of interactivity are possible within the teaching and learning environment and various resources and support structures are available to students (Figure 3.4).

A sense of *presence* could influence the success of interactivity in delivering DE programmes. The presence of the lecturer and the students influence the creating of a supportive learning environment, irrespective of the phase or level of interactivity taking place. As learning is a social interaction act, students should feel *present* in the learning environment. DE students should feel one with the presence to interact and communicate with fellow students in social learning settings to actively participate in group activities (Picciano, 2002). Lombard and Ditton (1997) identify six aspects to be considered during fostering of teaching and learning presence to promote interactivity:

- **Social richness:** It involves the media accommodating other users in terms of sociability, warmth, personality, closeness and sensitivity during a mediated communication situation.
- **Presence as reality**. Users of media are assisted to make non-existing events, people and sounds feel real.
- **Presence of transportation**. Individuals can transcend the boundaries of their realities.
- **Presence of immersion**. Through the use of technical devices, user feels that he/she is in another world. This can be experienced by the use of virtual devices enabling the student to be involved in another world and situation.
- **Presence as a social actor**. Where students communicate with an actor on television as if he or she is real.
- **Presence as a social actor**. Students respond to a social medium and not to the characters they view on the medium. For example, even knowledgeable computer users treat a computer as a social actor as it uses a natural language similar to human speaking, allowing for real-time interaction, and playing a social role equal to that of a bank teller or a teacher.

Another aspect that could influence effective interaction and interactivity is *telepresence*. Shin (2002) defines telepresence as interaction between human and machine. People working with machines (computers) are not physically present, but are geographically dispersed without it being evident in communication with members of a group. Telepresence can only be achieved when the quality of communication is seamless, even if members are geographically separated from one another (Shin, 2002).

In summary, interactivity is determined by the interaction of individuals with technologies. Presence is an important aspect of interactivity as it will have a definite influence on learning in the class situation and the affectivity of learning in delivery of DE programmes. This interaction will determine in which phase of interactivity students are. Interactive technologies and their availability could influence the extent of a specific group of students' interactivity. Therefore, interactive technologies used at DE institutions should meet the needs of the students and the characteristics of the available infrastructure.

3.4.3   Rationale for interactivity

The rationale for this study is based on the life-cycle for implementing technologies for learning of Stoner (1996) whereby the learning environment is assessed and analysed so that the correct decisions are made about how and when new and improved technologies for learnings are integrated and implemented in the learning environment. In § 3.4.1 definitions for interactivity are explained. After studying the different definitions of interactivity, three aspects become evident. In the class situation there is a social aspect whereby individuals interact with one another; there is interaction between text and content supplied to the class, and finally there is interaction between the individual and various communication technologies used to understand and explain content given to the class.

Various definitions for interactivity are available (Domagk et al., 2010) due to the various learning environments technologies for learning are implemented in. Each of these learning environments has its own challenges. By identifying these challenges, the researcher will be able to develop an effective model for implementing technologies for learning at the UODL (Shahabadi & Uplane, 2015).

Townsend et al. (2007) state that accessibility and interactivity are the two aspects that will determine the success of DE programmes. Collaboration between all role players in DE will be strengthened through access and the use of technologies for learning that have interactive features. Interactive features could enable students to have better access to and interactivity with resources, teaching and learning as well as with role players involved in the delivery of DE programmes. Learning communities can be established, resulting in better collaboration between students (Beldarrain, 2006). This collaboration between student-lecturer and student-student can be real time collaboration or time-delayed collaboration (Beldarrain, 2006). Interactivity in teaching and learning has effected changes in the process of delivering DE programmes.

Interactivity in online courses is an important issue that should be studied, especially when lively and energetic discussions are taking place between students. Sharing of ideas and content, collaborative and participative group activities will then all play a role in the support and creation of a productive learning environment (Picciano, 2002). The connection between interactivity and learning is not clear yet, but the development of a student-centred course could contribute to the development of the student as well as the diversity of students enrolled for a programme (Roberts, 2002). Interaction as part of effective learning is thus not a given. Interaction can only be supportive of the learning environment if a student-centred approach is assumed in course development.

3.5   Technologies for learning

This section describes what technologies for learning are, the rationales for using them, and how technologies for learning have evolved during the delivery of DE programmes. The researcher takes into consideration the concept *emerging technologies* as it provides an understanding of how technologies can effectively be implemented and used in a teaching and learning environment. They are referred to as *emerging technologies* and have embedded characteristics such as openness, real-life connection and emphasis on cooperation. They also have the potential to fundamentally change or transform teaching and learning in education (Johnson, 2012). Veletsianos (2010) identifies five characteristics of emerging technologies and Gachago et al. (2013) a further two. The seven characteristics are:

1. **New technologies.** Technologies used in education may not be that new, as they could have been in use for a while at other educational settings. Students introduced to such technologies experience them as new, while others view technologies when they are first introduced.
2. **Hype-cycle**. Emerging technologies may exist in developing systems and may, at a later stage, enter the hype-cycle of the adoption of technologies.

3. **Early adopters.** Emerging technologies are not situated in the mainstream and early adopters will start using them until they reach their hype-cycle when many people use them.
4. **The "not yet."** This category of technology is not yet fully understood or investigated. Access to technologies for teaching and learning is mostly problematic as they lie outside the formal education sector.
5. **Unfulfilled.** Some emerging technologies are possibly troublesome or disruptive and their potential for use in education is generally unfulfilled.
6. **First adopters.** Only very specific individuals use emerging technologies—the first adopters and few others have access to these technologies.
7. **Personal learning opportunities.** Emerging technologies enable students and help them to shape their world; they assist students to become independent, autonomous and design their own learning opportunities.

3.5.1. Background

Due to the increase in numbers of non-traditional and mature students who enter DE, as well as the larger demand for the use of technologies for learning in the delivery of DE education programmes, the use of technology in delivering DE programmes has evolved during the last few years (Levine, 2001; Schenker, 2007). Timeline Beta (2011) provides the following timeframe regarding the development and implementation of technology in DE:

    1728:   First postal correspondence lessons in Boston (USA)
    1957:   The first educational programme on USA television (Sesame Street)
    1969-1970: Founding of the Internet and first tele-courses for DE students
    1971:   First learning webs
    1976:   The establishment of the first virtual college.

To a certain extent, the timeline for the development and implementation of technologies corresponds with the five generations (§3.2.4) of development of DE. The use of technologies in DE is dependent on the development of technologies over a period of time, as well as on an assessment of the geographical area of the students enrolled for DE programmes at DE institutions. Council on Higher Education (2014) states that DE institutions should evaluate and map the ICT infrastructure in the geographical areas where their students reside, and identify the opportunities and identify barriers that influence the use of technologies in that area, either negatively or positively. As technologies for learning evolved over time, institutions adapted content and resources. When the UODL was established in 2013, management considered it crucial to investigate and implement technologies for learning and other media to increase access to resources for students (Rabe & Sieberhagen, 2013). The use of technologies for learning in delivering DE programmes will remain a continuous process because they are constantly evolve. Stoner (1996) maintains that the continuous adaption of technologies and integration thereof corresponds with the life-cycle of integrating LT technologies in DE.

The use of interactive technologies is customised in order to adhere to the specialisations and needs of students and institutions (Dourish, 2003). Subsequently, the type of interactive technology used will be determined by the needs of the role players involved in the delivery of DE programmes. This will furthermore determine the phase of interactivity they are engaged in. In a global context, the needs of students from country to country, as well as different HEIs. Technologies for learning stimulate creativity in interaction with content and interaction amongst students (Wang, 2014). Available technology will determine the type of technologies for learning to be used and how access to resources could be made possible. Taylor (2001) states that for a number of years institutions on the forefront of delivering DE programmes have evaluated and investigated emerging technologies that could further enhance the delivery of DE programmes at their institutions. Progress and quality in the delivery of DE programmes for future purposes can thus only transpire when emerging technologies are used.

Interactivity in DE transpires among students, between students and learning material and between students and various interactive devices (§3.4.1) (Figure 3.1). Implementing interactive devices will enable role players to better understand and use the interactivity process to improve communication and teaching and learning in delivery of DE programmes. Advances in communication technologies have brought a new dimension to delivery of DE programmes and added advanced methods as options now available to students to interact with the different media (Chowdhury & Khatun, 2013). TEL should be further investigated in order to improve the quality of DE programmes (Chowdhury & Khatun, 2013). Technologies for learning can only be effective once the ICT infrastructure has been established at an institution.

3.5.1.2 Definition of technologies for learning

With the rapid development of computer technology over the last few years, multimedia technology and the internet have changed the philosophy of learning, especially in DE. These technologies enable close interaction between students and improve the standards of learning materials (Deb, 2012). Without the consideration of a connectivist pedagogy, no connection can be established between the content, students and digital artefacts (Figure 3.1), as distance learning technology plays an important role in determining the pedagogy. In connectivist models the technology determines the pedagogy (Anderson & Dron, 2012).

Technologies for learning can be defined as devices and resources developed not for the education sector, but which assist during changes of the learning landscape to enable students to access resources and teaching and learning (Johnson et al., 2015). Technology can be defined as communication mediation in a plethora of ways using various devices, techniques and methods of facilitation (Varadarajan et al., 2010). Del Campoa, Negrob, and Núñezc (2012) state that the DE

lecturer, over time, has moved from the chalkboard to the use of emerging communication technologies like IWBs and other devices.

3.5.2   Rationale for using technologies for learning

The more students are exposed to technologies for learning in DE programmes, the richer and more exciting the learning environment becomes (Fulford & Zhang, 1993; Scanlon & Issroff, 2005). It is therefore imperative that technologies for learning should play an important role in the strategic plans of institutions (Garrison & Kanuka, 2004). Collis and Wende (2002) state that institutions progress through three phases when the use of ICT is encouraged:

- Formation of an institution-wide infrastructure for technology
- Use of rich pedagogical infrastructures
- Identification of target groups in higher education where ICT can be strategically used.

With solid planning for the use of technologies for learning in DE, HEIs could shape their delivery of teaching and learning around technologies for learning best suited to their situation and their students' needs.

3.5.3   Use of technologies for learning

The use of technologies for learning through the internet enables DE students in diverse geographical areas to learn (Dede, 1996). After the correspondence phase, media such as radio and television assisted in the delivery of DE programmes, and in the phase or generation that we are now, where emerging interactive technologies are introduced. With the application of technologies for learning in classrooms, the philosophy of learning and distance learning has transformed. Interaction between student and teacher has improved, and also the quality of media used in the delivery of DE programmes when compared with the use of printed media (Deb, 2012). The introduction of technologies for learning and access to multimedia and web-based resources also has contributed towards the improvement of DE. Anderson and Dron (2012) postulate that the combination of technology and pedagogy contributes to the development of human creativity and responsiveness, which could lead to effective learning as well as the enjoyment of learning. Subsequently technology can be used to have a definite influence on the enjoyment and effectiveness of learning, and the creating of a positive learning environment. Council on Higher Education (2014) states that institutions implementing technologies for learning in delivery of DE programmes should first establish the ICT infrastructure available to the institution, who the targeted students are, and determine the opportunities and barriers for using these technologies.

To determine whether technologies for learning and ICTs are effective within a learning environment, certain factors should be taken in consideration. Scanlon and Issroff (2005) identify the following evaluation criteria that could assist institutions to determine if the technology used is effective:

- **Efficiency.** From the students' perspective, there should be effective communication between the student, the technologies for learning and the lecturer responsible for the programme (Figure 3.1). From lecturers' perspective, they will determine the students' potential to learn optimally through the available resources and time.
- **Cost.** The cost of developing software, printing, telephone use, data, etc. Another aspect is the cost for the student to attain access to resources using own devices and technologies.
- **Failure.** Different aspects such as technological failure, student failure, expectation failure and communication failure have an effect on the success of technologies for learning used in delivery of DE programmes. These failures include hardware, software and people components.
- **Interactivity.** Interactivity should afford each student the same opportunity to communicate with the lecturer, access to resources, and communication with fellow students. Immediate response is one key element that could determine the effectiveness of using technologies for learning in delivery of programmes.
- **Serendipity.** These criteria specifically view the control aspect of learning. Who has control of the teaching and learning? The students may access various other resources that differ from the resources the lecturer has in mind. The appropriateness of resources should then be evaluated.

Students enrolled for DE programmes at the UODL have been encouraged to bring their own devices (BYOD) since 2014 in order to access resources and recorded sessions. HEIs continually upgrade their IT infrastructures and policies to accommodate such students (Johnson et al., 2015). The UODL continuously improve their technologies to enable more access for all role players to resources and afford more students the opportunity to interact with teaching and learning.

3.6   Examples and case studies of interactivity across contexts

Various authors describe various modes of DE implementation developed during their quest to investigate interactivity and technologies for learning. These investigations relate to various case studies and research performed by respective authors. The researcher now provides a few examples of such case studies on interactivity to further clarify the concept.

Anderson (2003) identifies three modes of interaction, namely student-teacher interaction, student-student interaction and student-content interaction. Under traditional circumstances in classrooms, the interaction intensity between all three modes is low to medium. As soon as multimedia is introduced into the classroom, the levels of interactivity of student-content become high to very high. Student-student interactivity can reach high levels as soon as internet and web-chat options are available, encouraging students to interact with one another. It is evident from this study that the effective implementation of multimedia technologies attains high levels of interactivity between the teacher,

student and content. Should these technologies be scaled down, the levels of interactivity between all three entities will be lowered.

Tu and McIsaac (2002) focus on the extent of social presence and the relationship between social presence and interactivity in an online environment. Social presence is explained as the perception of a student's relationship with others in the learning environment (Zhan & Mei, 2013). Tu and McIsaac (2002) identify three dimensions of social presence, namely social context, online communication and interactivity. Social context is determined by the computer-mediated communication (CMC) of users with the CMC environment. This includes students' relationships with other students; students' attitudes towards technology; and their trust for others. It is clear that the students have to experience social presence in the learning environment to have a positive learning experience. Implementing various media features and improving response time by using various media increases interactivity.

Picciano (2002) qualitatively and quantitatively investigated students' perceptions and how much students learned in online environments. One aspect that became clear in his report was that there is a high correlation between social presence and interaction when students have a strong sense of social presence. Looking at students' perceptions of interactivity and learning, the study indicates that there is a strong positive relationship between students' perceptions of their interactions in the course and their perceptions of their quality and quantity of learning (Picciano, 2002). The researcher concludes that interaction between student-student and student-faculty is important in determining the success of online courses. Social presence and students' level of comfort with people in the learning environment have a positive influence on the quality and quantity they learned.

Northrup (2006) distinguishes between a number of interaction strategies, namely interaction with content, social interaction, collaboration and conversation, self-directed learning and support. Northrup's view of interactivity relates to the connection of students to other students by either synchronous or asynchronous means, sharing ideas in online courses. Interaction with content can be either student-centred or instructor-centred, where instructors frequently provide feedback. Student-centred relates to the instruction which enables analysis, synthesis or evaluation of certain course-related problems. Students should be given the option to view the content and resources available to them. Students find textual context boring. Social interaction is the experience students have with one another and with the instructor during teaching and learning. Courses with a strong cooperative or a two-way communication component should describe all requirements prior to the online facilitation. Students, through collaboration, should be motivated to actively take part in online programmes. Self-directed learning should encourage students to monitor and evaluate their own leaning during and after online sessions. An effective support system should be developed for every online programme in order to guarantee student retention and satisfaction.

Combrinck, Spamer, and Van Zyl (2015) investigated students perceptions of open distance programme delivery in interactive whiteboards at LSCs of UODL NWU. Moore's Transactional

Distance theory was used to determine the perceptions of students on the use of IWBs to determine what students' perceptions were of open distance learning programme delivery at the UODL NWU using the IWBs at LSCs (Moore, 1997). After analysing the collected data it was suggested that the current used of the IWB for open distance programme delivery at the UODL NWU contributes to the success of dialogue, structure and autonomy.

In summary, it is evident that the success of interaction between students, teacher-students and students-content largely depends on social presence, i.e. the students' relationship with other individuals in the environment, as well as their experiences and relationships with content to be mastered in learning environments. An attractive and stimulating learning environment will contribute to increased interactivity. The learning environment can be improved and frequency of interactivity heightened by integrating audio and video in the content. Beldarrain (2006) states that with the ever-evolvement of emerging technologies and tools available, DE will be pushed to create learning environments that will benefit students in the long run. Creating a suitable learning environment will strengthen students' learning experience (Beldarrain, 2006).

3.7   Chapter summary

DE has evolved over time through four generations, proceeding from paper-based correspondence to the integration of LTs over time (Taylor, 2001). Aspects such as interactivity, flexibility, accessibility and technology integration are all consequences of the development and of DE over time. All DE institutions proceeded through the four generations, from delivering through correspondence only to integration of technologies for learning and modern communication technologies.

Summarising this section, it can be deduced that various aspects such as accessibility to resources and teaching and learning, and flexibility to all role players, will provide the opportunity for students to access teaching and learning with more openness. Barriers to teaching and learning can be diminished when students have access to teaching and learning. Implementing new and emerging technologies for learning in delivering DE programmes could enhance accessibility and flexibility for students, as these provide students more options to access teaching and learning resources. Interactivity is the one aspect that could enhance all facets of delivery of DE programmes.

Interactivity has various definitions (Domagk et al., 2010). The three types of interactivity relate to student-student, instructor-student and student-content. Type of interactivity is determined by the situation it relates to. Interaction always exists between humans themselves, humans and content or between humans and technologies. Interaction can enhance delivery of DE programmes as it complements teaching and learning, affording students increased opportunities to better interact with and comprehend content. Interactivity in DE could assist with the removal of learning barriers like time and distance associated with DE. Interactivity and interactive technologies assist to provide increased

access to resources and teaching and learning. More and improved media which are better integrated in teaching and learning environments will improve interactivity. Interactivity should be encouraged in large groups before focusing on individual interactive sessions. When interactivity is encouraged in large groups, frequent interactivity is more evident than when only individuals are encouraged to interact in the learning environment.

Interactivity, accessibility and flexibility all contribute to DE becoming open and student-centred. ODL furthermore places the student in the centre of learning whereby the student can access teaching and learning at any time and from any location, thanks to emerging communication and technologies for learning available to them. Anywhere and anytime learning could become more effective and real when more interactive, and when LTs are used in the delivery of DE programmes. Students now have choices when and where they want to interact with the learning content.

With the initial implementation of DE at the NWU through correspondence over time, the institution has evolved through all four generations of development of DE. Emerging technologies have been implemented, enabling students and role players to interact and communicate effectively. Implementing emerging communication technologies at study centres of the UODL enables students to be involved in teaching and learning, irrespective of time and location. With the development of DE at the UODL new technologies have been, and still are investigated, and curricula are adapted in order to assist with integration of LT in delivery of teaching and learning. Stoner (1996) identifies various steps in the life cycle in implementation of LTs in an ODL environment. This life cycle is not a once-off, but it should continuously be used as guideline when using technologies for learning in delivery of DE programmes.

This literature review culminated into four aspects which were used during the qualitative phase of the study to compile an interview schedule for interviews with ODL participants (Addendum 2.1). These five aspects were (i) technology-enhanced learning for distance education; (ii) open distance learning for developing contexts; (iii) interactivity; and (iv) technologies for learning. These aspects are depicted in Figure 3.5.
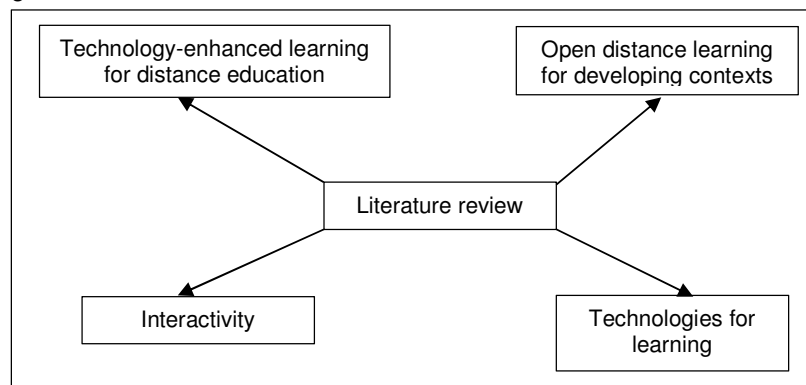
Figure 3.5: **Four aspects identified from the literature review for compiling an interview schedule**

Chapter Four

Expanding of the Literature Concepts through Qualitative Strategies

4.1   Introduction

The research question that drives this study is: *Which components would a model comprise; effectively integrating interactive learning technologies into distance education programmes at the UODL, improving the quality of teaching and learning?* (§1.2). Chapter Two provides detail of the qualitative and quantitative research methodology followed during this study and the reader is asked to refer back to this chapter for explanations of the various strategies. Chapter Three unpacks the concept of *interactivity* as it manifests in ODL, and in its chapter summary refers the reader to four aspects of importance to be taken forward to the qualitative aspects of the investigation (§ 3.7).

Figure 4.1 provides an outline for the qualitative analysis as described in Chapter Four.

4.2   Literature review

The literature review identified four aspects (§ 3.7) which relate to the essential aspects of interaction during effective ODL. They are:

- **Technology-enhanced learning for distance education:** The use of technologies for learning that provides the opportunities for interaction during the delivery of DE programmes.
- **Open distance learning for developing contexts:** ODL is a student-centred approach whereby various innovative technologies are used to improve the quality of teaching-and-learning relating to a specific context. In the case of the UODL, the context relates to students in urban, rural and deep rural areas where they experience constraints to access and to resources.
- **Interactivity:** The use of technologies for learning that enables two-way communication between students, peers and the institution regarding academic and administrative support.
- **Technologies for learning:** The use of emerging technologies for learning which assist in the delivery of DE programmes irrespective of the time and location of students.

These four constructs constitute the first steps of the qualitative analysis (§ 2.5). The researcher transformed these constructs into interview questions for the quantitative phase of the research. The next section provides information on how these four constructs were used during the qualitative phase of the study.
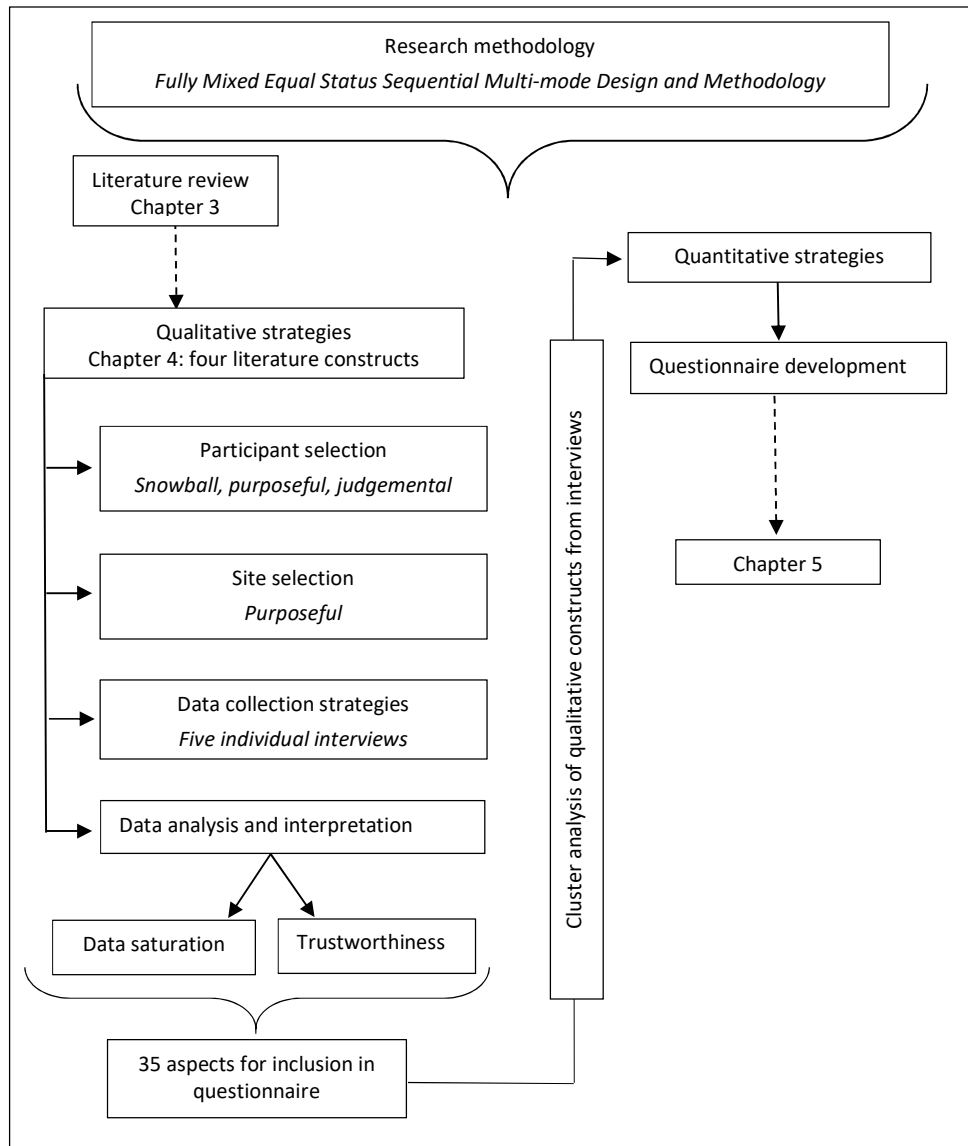
Figure 4.1   Focus on the qualitative aspects of this study

4.3   Qualitative strategies

In order to understand and contextualise these four aspects, identified from the literature review, the researcher conducted individual interviews with five ODL participants as the qualitative data collection strategy of this study (Figure 4.1). He used these four constructs (§ 4.2) to compile questions for the interviews. The interview schedule is available as Addendum 2.2.

4.3.1   Participant selection

The researcher selected five participants who adhered to the specific selection criteria (§2.8.2) for inclusion in the interviews. He became aware of a student at the Potchefstroom learner support centre who met all of the participant criteria (§ 2.8.2). After the interview, the participant informed the

researcher of a student at the Rustenburg learner support centre who also met the required criteria. This second participant directed the researcher to a colleague in the same class and the researcher approached her for an interview. This third participant referred the researcher to two more students who were closely involved with the delivery of ODL programmes and they were also included in the qualitative phase of this study. This was a typical unfolding of snowball participant selection (Cohen et al., 2011a; Merriam, 2009; Teddlie & Yu, 2007) where a participant would identify participants with similar, yet pertinently different characteristics. The researcher also followed a judgemental sampling strategy when he selected participants who adhered to the selection criteria for inclusion in the qualitative aspects of the research (§2.8.1) (Marshall, 1996), as well as convenient participant selection as the participants were selected in terms of easy access and their willingness to participate in the study (§ 2.8.2). Table 4.1 describes the demographic characteristics of the selected participants.

Table 4.1   Demographic characteristics of the qualitative participants

Participant	Characteristics
Participant 1 (6)[1]	He is involved all aspects regarding the delivery of interactive technologies as he is employed as an e-learning coordinator at the UODL. He is a qualified educator and has taught at various schools in SA and in England, using interactive whiteboards in his classes. The participant attended no scheduled contact sessions and relies on downloading resources and recorded sessions to assist him in teaching-and-learning. He used the Potchefstroom LSC.
Participant 2	She is a practising educator in Carletonville and regularly attends contact sessions at a learner support centre of her choice. She makes use of the internet to access resources and recorded sessions. She and other students in the same area have created a WhatsApp™ group to share important information regarding their studies with one another. She used the Rustenburg LSC.
Participant 3	He is a practising educator in the Klerksdorp area, regularly attends contact sessions and regards interactive whiteboards as a successful means of conveying teaching-and-learning over distance. He uses an interactive whiteboard in his class at the school he teaches. He is familiar with internet and interactive technologies used in teaching-and-learning. He regularly downloads resources and recorded sessions to assist him during his studies. He used the Potchefstroom LSC.
Participant 4	She is a qualified educator who teaches at a school in Ventersdorp and regularly attends sessions at a learner support centre of her choice. She prefers to attend live sessions that are facilitated on the interactive whiteboards at learner support centres. She used the Rustenburg LSC.
Participant 5	He is employed as an educator at a school in Potchefstroom. He regularly attends all the scheduled contact sessions at his centre and furthermore also downloads all resources and recorded sessions that are made available. He mentioned that downloading all these resources and attending scheduled contact sessions was beneficial for his studies. He used the Potchefstroom LSC.

4.3.2   Site selection

The researcher aimed to select students who regularly attended scheduled contact sessions at any of the 65 LSCs which the UODL of the NWU use for student support (§2.8.1). However, due to constraints of time and cost, the researcher made use of a purposeful sampling strategy to select the participants (Merriam, 2009). They were from the Rustenburg (two participants), Klerksdorp (one participant), and Potchefstroom (two participants) (Figure 4.2). Although the researcher offered to visit

---

[1] The researcher made an error importing Participant 1 into Atlas ti™. The interview of Participant 1 interview is reflected as P6: Participant 6 in the Atlas.ti™ hermeneutic unit (Addendum 2.5).

the participants at their respective learner support centres, all the interviews took place at the Potchefstroom learner support centre when the participants came to visit the centre for other purposes. Although the participants related to learner support centres in the North-West province, all learner support centres throughout South Africa have the same technologies, student support interventions, and opportunities for personalised teaching-and-learning (§ 1.1.3 and § 2.8.1).
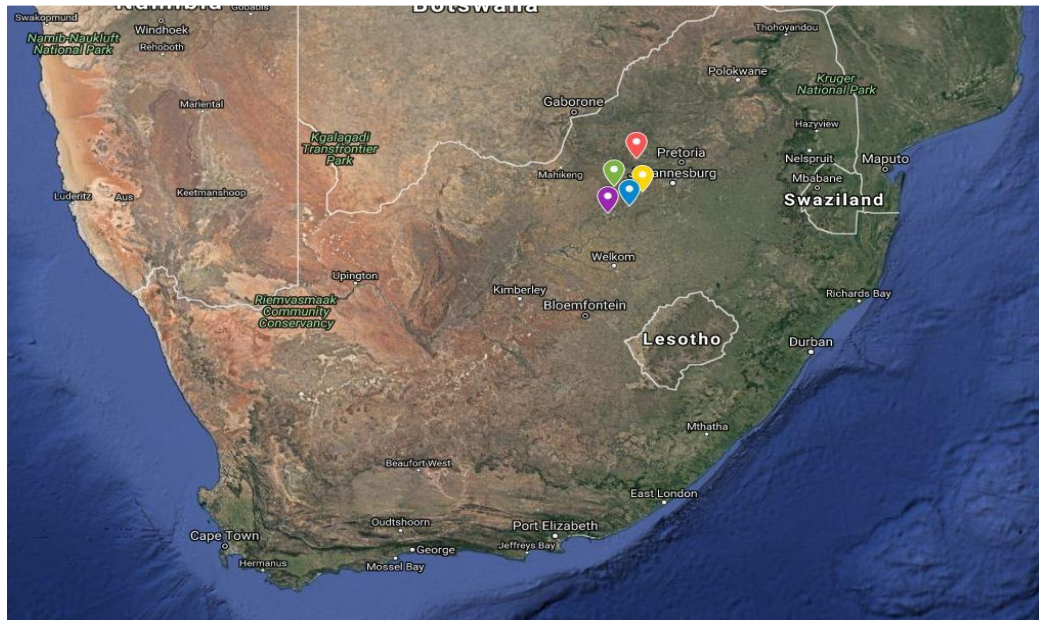
Figure 4.2   Location of the learner support centres the participants originated from

4.3.3   Data collection strategies

The researcher used a voice recorder (§2.8.3.4) to record the interviews of participants (Onwuegbuzie, Leech, & Collins, 2010) as they were comfortable with recording of the interviews and also gave their permission to do so. Although the researcher asked the same questions to all the participants (Addendum 2.2), the interview followed a semi-structured sequence as the participants responded in different ways to the questions. The interview came to a close when the participants had no more information to add to the questions the researcher posed.

The researcher transcribed the interviews verbatim from the voice recorder. To ensure that the transcriptions were correct, the participants received an electronic copy of the interview to verify the correctness of the transcribed interviews (§2.8.4.4). All the participants signed off the transcriptions, indicating that they believed they were a true reflection of the interview (Addendum 2.5).

4.3.4   Data analysis and interpretation

The researcher did not assign all the transcribed interviews (Addendum 2.7) to Atlas.ti™ as primary documents in the hermeneutic unit at the same time. After each interview he assigned an interview

document—a primary document—to Atlas.ti™ and analysed the document. Thereafter he viewed the codes which emerged and the quality of the interview, and adapted his questioning and the interview schedule to ensure that the interviews would provide optimal information (Creswell, 2013; Francis et al., 2010; Guest, Bunce, & Johnson, 2006; Saldana, 2009). He continued with this process until no more new codes emanated from the analysis of an interview in order to establish data saturation (§ 4.3.4.1).

The researcher linked codes to phrases or sentences which the participants uttered. The codes originated from a theory-driven approach of the literature review (Chapter Three) (DeCuir-Gunby et al., 2011). The researcher made use of the constant comparative method of coding where each code was compared to the text in the five primary documents (Boeije, 2002). To ensure valid and consistent coding, the researcher compiled a codebook (Table 4.2, §2.8.4.5) which lists the 35 codes and provides a literature explanation, as well as an example of each from the analysis (DeCuir-Gunby et al., 2011). The Afrikaans utterances were translated into English, and examples of utterances are available in Table 4.2. Addendum 4.1 presents the original text from the participants who responded in their home language, Afrikaans.

During assigning of the documents, the researcher made a technical mistake, and had to remove the first interview from the hermeneutic unit, and redo it. Interview 1 now shows as number six on the primary document list in Atlas ti™ (Addendum 2.7).

4.3.4.1 Data saturation

Due to the nature of qualitative sampling strategies, as well as of qualitative research, one cannot predict how many interviews should be included in an analysis (Francis et al., 2010) (§2.8.4). Data collection and analysis should continue up to the point where data saturation can be indicated. When the same thoughts, actions, response and perspectives are heard from participants, no additional participants are needed as data saturation has been achieved (Gray et al., 2011). In order to demonstrate data saturation, the researcher compiled Table 4.4 which references to the codes used during the analysis against the primary documents. Table 4.4 indicates five primary documents and 587 instances of coding. After the fourth interview no new codes were added, indicating the last interview added no information (Guest et al., 2006). The researcher concluded that for this analysis, the data seemed saturated—no more new codes emerged (Merriam & Tisdell, 2016). No need for further data collection was deemed necessary to confirm the 35 codes which emerged from this analysis.

Table 4.2   Codebook of the 35 codes relating to interactivity as they emerged from the qualitative analysis (DeCuir-Gunby et al., 2011)

Code	Explanation from literature	Example from the analysis
Academic progress	The speed or pace or progress of students is monitored to see if learning outcomes are/have been achieved (Domagk et al., 2010).	• Effective communication will improve students' results (P3:13-13). • No it will definitely have an influence. How will you determine if a student or learner have achieved their goals if no feedback is given or no assessment is done (P5:29-29).
Accessibility	Accessibility constitutes an integral part of DE as it assists students with the bridging of their intellectual, geographical and cultural gaps. Increased transparency is obtained in the delivery of DE programme delivery when increased accessibility is granted to students to use technologies for learning and to access resources (Simonson et al., 2011).	• Accessibility if I understand it correctly is if everybody has the same access or access to study material and access to study centers access to books, libraries those kind of things (P6:8-8).
Accessibility to resources	Increased flexibility facilitates increased access to learning resources which should be available at any time and place (Commonwealth of Learning, 2011; UNESCO, 2002).	• This aspect is to make sure everybody has the same opportunity and by that I mean equal opportunity to study and equal opportunity also mean for resources for everybody (P6:8-8).
Anytime	Due to students' diverse locations, asynchronous learning should be available to them for access to the learning content, teaching-and-learning tools, at any time and place (Haller, 2014).	• Anytime anywhere learning means that you can study obviously anytime and anywhere so for example if I have the relevant content available to me 12 o'clock at night so if I can listen to a recording I can do it at my time and when I have time to study (P6:6-6).
Anywhere	Digital environments afford students with various methods and techniques to access information from anywhere and at any time, enabling them to obtain information and interact with online resources (McNeil et al., 2000).	• Where students are not physically present in classes, but still has access to the lecturer or facilitator, whoever it may be (P5:20-20).
Availability	The use of technologies for mass communication and the availability of the internet afford students access to DE (Geray, 2007).	• I think personally one of the biggest improvements is to make it available to everybody but also to obviously the internet has a lot to do with this so if they don't have availability or internet access then you won't be able to take it to them (P6:17-17).
Barriers	Increased flexibility and interactivity can contribute to the lifting of barriers like time, distance and location. Increased flexibility of programme delivery processes facilitates improved access to learning resources available at any time and place (Commonwealth of Learning, 2011; UNESCO, 2002).	• So the person with the barrier has availability of technology I think can overcome the barrier quicker that the person without the any interactive technology (P6:23-23).
Challenges	The multi-modal model creates opportunities to challenge students and create new and more creative means of learning (Picciano, 2009).	• I anticipate that there will be problems with some people or some individuals with no access to the internet. Technology is limited in our country and that is a fact (P5:10-10).
Communication	Various technologies could empower role players to form a community of learning; enabling them to take a step closer to access resources and improve communication with the	• Results of students will be improved through effective communicationP3:13-13). • Students in the rural places can effectively be communicated in

	institution itself. Communication in DE becomes possible through printed media, electronic media and other electronic devices (Dohmen, 1967).	different ways (P6:10-10).
Communication devices	Mobile phones, interactive whiteboards and many other modern communication devices which enable direct dialogue (Lim et al., 2014).	• SMS and sending them links if it is a smart phone to link to the recordings; they can maybe listen to recordings of lecture on their cell phones (P6:10-10).
Distance education	The teaching-and-learning takes place across distance whereby an array of situation-specific media, correspondence techniques, programmes, support and management structures are utilised to establish and improve communication and feedback between the institution and students over a wide geographical area irrespective of time, space and location (Simonson et al., 2011).	• Distance education is a process where a student is not close to a university like on campus students that can attend courses and receive a qualification through the distance process. Distance education is when you receive books in the post maybe that you read through and you study and write an also write an exam at a centre that is closest to you. You also attend classes that is closest to you at a centre (P6:4-4).
Equal opportunity	The choice of learning technologies to deliver DE programmes adds more flexibility as students are given the opportunity to choose how and when they want to access their teaching-and-learning (Taylor, 2001).	• I think one of the, if it can be an aspect is to make sure everybody has the same opportunity and by that I mean equal opportunity to study and equal opportunity also mean for resources for everybody (P6:8-8).
Feedback and assessment	Students' feedback on documentation relates to dialoguing and interactivity (Domagk et al., 2010).	• There is a lot of interaction question and answers sessions and monkey puzzles questions and it depends on the lecturer how they ask the student to fill in a for instance, what do you call that, surveys (P6:17-17).
Flexibility	Flexibility in learning comprises three modes: (i) face-to-face tuition, (ii) DE, and (iii) the use of learning technologies Kember (2007).	• Any time, any place? I think you can improve yourself irrespective where you are (P4:7-7).
Frequency of sessions	Synchronous e-learning is the use of communication technologies which facilitate scheduled classes in real time whereby students can interact with lecturers at any time (Shahabadi & Uplane, 2015).	• Sessions are not scheduled for every Saturday (P3:10-10).
Geographical area	Geographical area is the physical environment or place a student lives in. DE is not limited to prescribed spaces, geographical areas or borders (Fägersten & Dalarna, 2013).	• Students in the rural places can effectively be communicated in different ways (P6:10-10). • Technologies can be used from any location if you have access to internet (P3:7-7).
Infrastructure	DE can be delivered at any place and at any time through the technological infrastructure and communication technologies to stimulate creativity in interaction with the content and interaction amongst students (Wang, 2014).	• We basically need an infrastructure that you can develop to accommodate everyone (P3:26-26).
Innovation	Advancing cultures of change and improvement whereby printed media is gradually transformed to digital media (Johnson et al., 2015).	• The internet made everything available and accessible to us (P5:26-26).
Interactivity	Interactivity relates to the interaction between humans which refers to interpersonal communication, be it face-to-face or via learning technologies (Quiring & Schweiger, 2008).	• The moment I attend a class/session students are interactive from other locations (P2:14-14). • Communication it is communication from both sides and all the parties involved, that is interactive (P6:13-13).

		• I understand interactivity that both parties say that the lecturer and the students are interactive with each other (P6:13-13).
Internet accessibility	The internet is used for the delivery of content as web pages for additional support to students who have access to the internet (Abid et al., 2013).	• The majority of people do not have access to the internet (P4:10-10).
Learner support centres	Learner support centres of the UODL are equipped with a resource centre, interactive whiteboards, facilitators to assist students, and technologies for students to access resources. Learner support centres are located all over SA. During 2004 the School for Continuing Teacher Education (SCTE) used television and satellite broadcasts to augment the delivery of teaching and learning through DE (Rabe & Sieberhagen, 2013).	• You also attend classes that is closest to you at a centre (P6:4-4).
Learning environment	Using an array of approaches in which students are challenged and experience teaching and learning in a comfortable way will create new and more creative means of learning (Picciano, 2009).	• It is very convenient because everyone can see the lesson, ask questions and give opinions while the lecturer are lecturing. Everyone knows what is going on (P4:26-26).
Learning technologies	Technologies for learning relate to the use of devices and resources not developed for the education sector, but which assist during changes of the learning landscape for students to access resources and teaching and learning through technologies for learning (Johnson et al., 2015).	• Interactive whiteboards (P3:32-32).
Motivation	The act whereby students initiate learning and learning activities maintaining an involvement in learning and furthermore have a commitment to the learning process will create motivation (Ames, 1990)	• Well I think obviously how many times or contact sessions or the contact that you have with the lecturer or how the content is available to you and is explained to you if you are only have self-study to do that might have an influence on you (P6:6-6).
ODL	ODL is a learner-centred approach whereby students at remote locations access their teaching-and-learning at any time (Kanuka & Conrad, 2003).	• You can use cell phones, SMSs and emails (P58:20-20). • Well I know that there are centres where I can view all sessions (P4:10-10).
Quality	Quality is evaluated in conditions of absolute limits that have to be surpassed to obtain a quality grade for example where the output has to meet a pre-set national standard (Harvey & Green, 1993).	• It is clear that through interactivity contact with students is established and quality is improved with more contact (P2:23-23).
Recorded sessions	Recorded sessions refer to the flexible learning model whereby interactive technologies are used in learning environments to record lectures in order for students to view them later (Heydenrych & Prinsloo, 2010).	• So if I can listen to a recording I can do it at my time and when I have time to study (P6:6-6).
Software	Software are divided into three groups namely operating systems that that controls the internal operations of the computer, application tools that support the development of applications and application solutions performing tasks needed by the end-user (Mowery, 1999).	• We sometimes have difficulty with software at our school. We use the Parrot programme. Sometimes the software fail on the computers. This happens with a lot of computers. Computers then have to be restarted and then they experience difficulties to reboot these computers (P3:23-23).
Structured	DE delivery via TEL encompasses synchronous and asynchronous learning. Structured and non-structured learning experiences are linked to synchronous and asynchronous	• Classes are more structured and the tempo of classes are faster (P3:29-29).

	learning (Manouselis et al., 2011).	
Study material	Material and content have to be re-designed and adapted to accommodate technologies for learning to meet the needs of students. This relates to the phase in Stoner's cyclical framework whereby technologies for learning are selected, learning material is integrated, and content is adapted and implemented (Stoner, 1996).	• Study material given to you or study content (P72:8-8). • Distance education is when you receive books in the post maybe that you read through and you study and write an also write an exam at a centre that is closest to you (P6 63:4-4).
Support	All students should be reached through teaching and learning during the delivery of DE. Knowledge should be available to all role players across spatial, time and cultural boundaries (Visser et al., 2012)	• You have support from your lecture through distance (P2:4-4).
Teaching-and-learning	The interaction between the lecturers, students and learning in order for students to achieve success (Prince & Felder, 2006).	• How the content is available to you and is explained to you (P6:6-6).
Technological ability and knowledge	Technological infrastructure suitable for a specific environment should be taken into consideration in order for all students to benefit from the implementation (Stoner, 1996).	• The knowledge and skills he must have (P2:11-11).
Technological possibilities	Technologies and developing a technological infrastructure that could enable students to access resources/content at any time from any place. The cost implications of such implementation should be investigated (Stoner, 1996).	• The internet made everything available to us (P5:26-26).
Two-way communication	Various types of media and technologies can be used in direct two-way communication between students and the lecturer	• There is a lot of interaction question and answers (P6:17-17).

4.3.4.2 Trustworthiness

Trustworthiness is the most important issue in terms of the quality of qualitative research. Trustworthiness comprises the aspects of credibility, dependability, transferability and conformability (§2.8.4.3) (Graneheim & Lundman, 2004; Rolfe, 2006). In qualitative research validity and reliability cannot be viewed separately and the correct terminology that embodies both is trustworthiness (§2.8.4.3). The issues of trustworthiness are summarized in Table 4.3.

Table 4.3   Trustworthiness of qualitative research

Trustworthiness	Procedures followed to ensure trustworthiness of qualitative research
Credibility	Internal validity confirms that the topic being studied is supported and sustained by the data collected, and also correlates with the data collected (Cohen et al., 2011a; Zachariadis et al., 2013). Credibility is obtained when the study measures that which it is supposed to study (Shenton, 2004). The researcher ensured that the data collected regarding interactivity, interactive technologies and DE relate to and support the topic of this study (§2.8.4.4)
Dependability	The process whereby transcripts of interviews were checked by the interviewees is known as member checking (Torrance, 2012). The researcher employed member checking of all interviews undertaken with participants (§2.8.4.4). To ensure trustworthiness, the researcher obtained written consent from all participants to take part in this research; and the researcher furthermore checked all data collected as well as transcribed interviews with participants for accuracy (§2.6 & §2.8.4.4). The researcher supplied these consent forms (Addendum 2.3) as evidence that full consent was provided by participants in all aspects of the qualitative phase of the study. The researcher ensured dependability by using member checking (§2.8.4.4), triangulation (§2.5.1), clarifying the researcher's position in this study (§2.8.4.2) and accommodating participants' circumstances.
Transferability	McMillan and Schumacher (2014) and Shenton (2004) state that, if the results obtained from all the data collected in the study are generalized and these results can be applied to individuals and/or organizations outside the location from which the research was done, then transferability was obtained. The researcher's objective for this study is to use the results from data collected regarding interactivity, LTs and effective teaching and learning to be employed to of DE programme delivery at other institutions (§2.13.3).
Confirmability	To ensure confirmability in qualitative research the researcher must confirm as far as possible that the findings are the result of the opinions of the participants and not the preferences and characteristics of the researcher (Shenton, 2004). I undertook interviews with students who were knowledgeable on technologies for learning and who had attended scheduled contact sessions at any of the learner support centres to understand their perceptions and lived experiences on technologies for learning (§2.8.2). Although I used a theory-driven approach (§2.8.4) to identify codes, the transcribed interviews were used to finalize the codes (constructs) that were used.

The researcher calculated Cohen's Kappa which is commonly used in research to determine the coefficient of agreement between evaluators of the coding of the interviews (Kimberlin & Winterstein, 2008). A peer evaluator knowledgeable with ODL and qualitative research independently coded a randomly selected interview. Together they calculated the Cohan's Kappa calculated for this study as 0.94. Landis and Koch (1977) and Pace et al. (2012) state that if the value calculated for Cohen's Kappa falls between 0.81-1.00 a complete agreement between evaluators exists.

Table 4.4 **List of codes and the number of times codes were used in the analysis**

Participant	Academic progress	accessibility	Access to resources	Any time	Anywhere	Availability	Barriers	Challenge	Communication	Communication devices	Distance Education	Equal opportunities	Feedback and assessment	Flexibility	Frequency of sessions	Geographical area	Infrastructure	Innovation	Interactivity	Internet access	Learner support centre	Learning environment	Learning technologies	Motivation	ODL	Quality	Recorded sessions	Software	Structured	Study material	Support	Teaching and learning	Technological ability and knowledge	Technological possibilities	Two-way communication	Total
P 2	0	6	3	1	4	2	1	4	10	5	1	1	3	2	2	7	0	3	6	1	2	3	4	0	1	1	2	0	1	5	6	3	5	0	3	**98**
P 3	2	6	3	2	2	4	3	5	7	6	1	0	5	2	1	6	4	6	1	9	5	5	9	0	3	0	0	1	1	4	6	10	1	4	1	**125**
P 4	1	9	3	1	4	3	2	2	6	2	1	1	2	2	1	2	1	5	3	2	1	4	2	3	5	0	1	1	0	0	6	3	0	1	3	**83**
P 5	3	10	5	2	4	2	8	8	4	4	2	2	3	2	1	4	1	7	7	5	0	1	0	1	5	0	0	2	0	0	3	5	2	4	6	**113**
P 6	2	14	9	3	7	6	7	0	6	11	2	6	6	5	2	9	1	2	9	5	3	3	6	3	4	1	2	1	0	3	8	14	0	4	4	**168**
	8	**45**	**23**	**9**	**21**	**17**	**21**	**19**	**33**	**28**	**7**	**10**	**19**	**13**	**7**	**28**	**7**	**23**	**26**	**22**	**11**	**16**	**21**	**7**	**18**	**2**	**5**	**5**	**2**	**12**	**29**	**35**	**8**	**13**	**17**	**587**

4.4   Quantitative strategies

After the qualitative strategies, the research forwarded the quantitized data as depicted in Table 4.4 to the NWU Statistical Services at the Potchefstroom campus of the NWU who performed a Ward's minimum variance method (Szekely & Rizzo, 2005) and 1-Pearson's *r* correlation to the data as indicated in Table 4.4 in order to cluster the data and find correlation between constructs (§2.9) (Szekely & Rizzo, 2005). The researcher used 1-Pearson's *r* to obtain a clearer indication of the meaning of the size of the correlations between the codes used in this study that are clustered together as these provided the researcher with the quantity of the variance that is shared between two variables (Cramer & Howitt, 2004).

The results of the cluster analysis are depicted as Figure 4.3. A Dendogram provides a graphical representation of results obtained through a cluster analysis where the using of lines indicates, through the various stages of the analysis, which variables or clusters are paired (Cramer & Howitt, 2004). The Dendogram (tree diagram) indicates four clusters according to which the quantitative questionnaire could be structured. The researcher labelled the four clusters according to the codes as concatenated to each cluster:

- **Infrastructure:** View of support structures for the delivery of ODL education programmes.
- **Learning environment:** Aspects which contribute to an effective teaching and learning environment for the delivery of ODL programmes.
- **Success in distance education:** Role of technologies for learning in ODL.
- **Technologies for Learning:** Technological aspects which play a role in the delivery of ODL programmes.
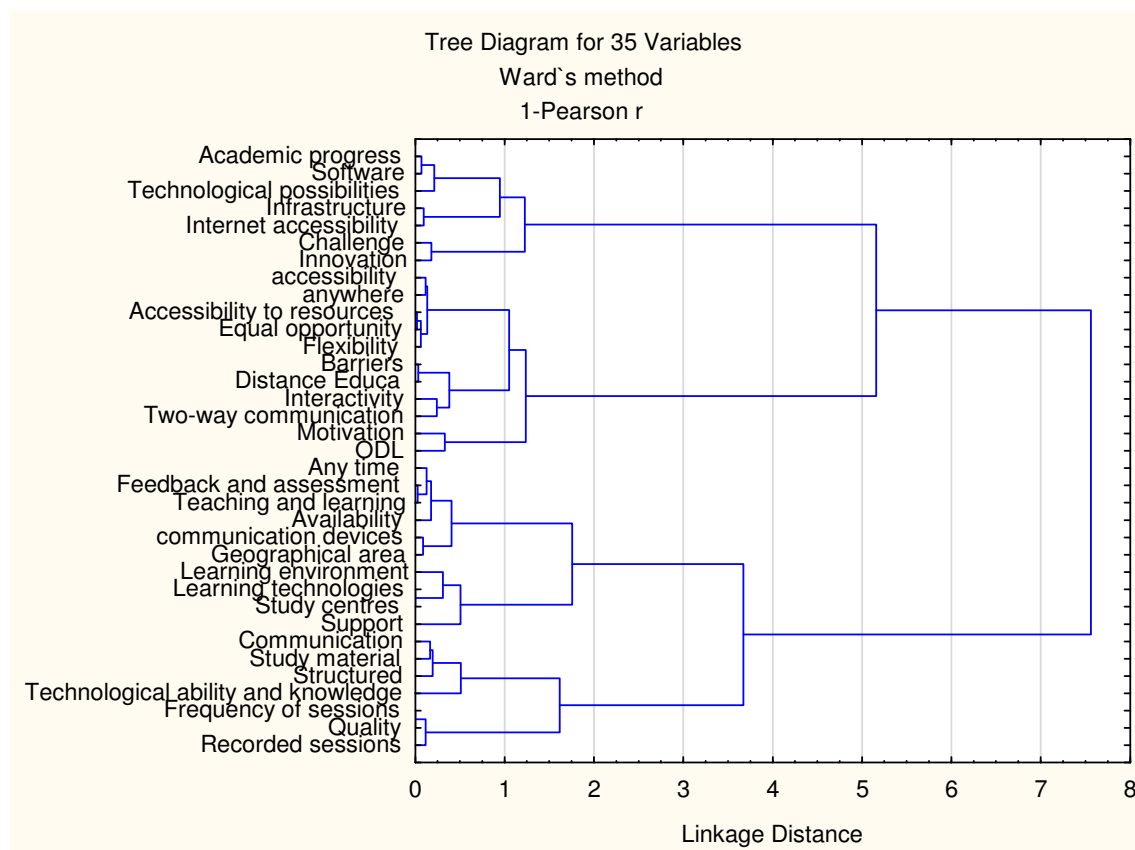
Figure 4.3 **Dendogram which indicates the clustering of quantitized qualitative data**

4.5 Development of the questionnaire

Cohen et al. (2011a) describe eight steps to follow when developing the questionnaire. The researcher followed these steps to develop the questionnaire:

Step 1: The researcher decides on the purpose of the questionnaire (Burke Johnson & Christensen, 2014). The purpose of the questionnaire was to elicit all respondents' perceptions on interactive distance education: interactivity, interactive technologies and the quality of teaching and learning during interactivity. The UODL identified the need to increase and refine technologies for learning in the delivery of DE programmes to improve accessibility, interactivity and support to all aspects of programme delivery and to accommodate all students during teaching-and-learning using these technologies. The researcher then compiled a research proposal and included aspects such as DE, interactivity, interactive technologies that would improve the quality of teaching-and-learning in DE programme delivery. The title for this study was *The use of interactive technology for effective teaching-and-learning in open distance learning*. This proposal was approved by the higher degrees committee of OPTENTIA and the researcher could continue with this study.

Step 2: Population and sample to be used (Burke Johnson & Christensen, 2014). The researcher selected registered distance education students of the NWU who attended contact sessions at any of

the LSCs to complete the questionnaire. Students registered for the BEd Honours, BEd Foundation phase, ACE and gr R Diploma were selected to complete the questionnaires. The researcher instructed the centre managers to only make these questionnaires available when the mentioned programmes were facilitated at the LSC. The researcher, with the assistance of the statistician, performed convenient sampling to determine the population and sample for the quantitative stage of this study, affording any student with the opportunity to complete the questionnaire. The timeframe for this study was from May to July 2016.

Step 3: Identifying the concepts to be studied (Burke Johnson & Christensen, 2014). The researcher conducted interviews with participants familiar with technologies used at LSCs of the UODL. The constant comparative method (CCM) of coding was performed, as the same questions were repeated during the interviews in the qualitative stage of this study to ensure that no new information surfaced. The researcher identified 35 codes (constructs) and a cluster analysis was performed. The researcher could collect valid constructs from the data that were collected (Kimberlin & Winterstein, 2008). The researcher could clearly determine what the respondents and participants understand as interactivity and the use of technologies for learning and interactivity to effectively deliver teaching and learning in DE. The hierarchical structure of Ward's minimum variance method and Pearson's *r* correlation was used to develop a Dendogram (Figure 2.3) where the different clusters (sections) were indicated. During the cluster analysis all the constructs were grouped into different clusters. The researcher formulated a question for each construct that was grouped in a cluster. The four clusters identified formed the different sections of the questionnaire. These were infrastructure, learning environment, success in distance education and technologies for learning.

Step 4: **The researcher used a four-point Likert scale for each question in the questionnaire**. The Likert scale afforded respondents the opportunity to state their agreement with each question in the questionnaire by selecting the option they agree with (De Vos et al., 2011; Fraenkel & Wallen, 2009; Maree, 2009). No misconception evident in the multiple choice questions contained in the questionnaire and the constructs at hand was measured (Maree, 2016). Identifying the correct construct is known as content validity.

Step 5: Formulating the question items. The researcher formulated a question for each of the constructs within the cluster (section). The researcher ensured that all constructs were covered in the questionnaire. The format of the questionnaire was:

- **Section A: Biographical information**
  This section aimed to collect biographical information; how students attended whiteboard sessions, and how they used their devices to access teaching-and-learning and resources which the UODL at the NWU makes available to registered students for their respective programmes.
- **Section B: Infrastructure**
  This section captured students' view of support structures for the delivery of ODL education programmes.
- **Section C: Learning environment**

This section captured the aspects which contribute towards an effective teaching and learning environment for the delivery of ODL programmes.

- **Section D: Success in Distance Education**
  This section captured the role of technologies for learning in ODL.

- **Section E: Technologies for Learning**
  This section captured the technological aspects which play an important role in the delivery of ODL programmes

Step 6: Ensuring that all issues were addressed. In some instances the researcher formulated more questions per construct to cover all aspects of that construct. Some questions thus had more than one sub-category, and 48 questions were included in the questionnaire.

Step 7: Pilot the questionnaire and refining aspects in the questionnaire. The researcher, before finalizing the questionnaire, presented the draft questionnaire to a pilot group to refine aspects included in the questionnaire. The management of UODL and staff from the Faculty of Education Sciences evaluated the questionnaire to determine the content and face validity of the questionnaire. This group involved with evaluating the questionnaire checked for the validity of the questionnaire. Face validity as well as content validity was applicable to this study as the researcher ensured that the measuring instrument used measured that which it was supposed to measure, and that all constructs that were set out to be measured were measured. Maree (2016) discusses the following types of validation to be considered when determining the validity of the questionnaire:

- **Face Value:** Does the instrument that is developed measure that which it is supposed to measure.

- **Content validity:** The measuring instrument must cover all the content that the identified constructs are set out to measure.

- **Construct validity:** How well are all aspects of constructs covered by questions in the questionnaire.

- **Criterion validity:** Criterion validity determines if a measuring instrument measures that which it is supposed to measure.

The instrument measures that which it is supposed to measure (Creswell, 2009; Maree, 2016). Jackson (2016) states that face validity is to determine if the test looks valid on its surface and furthermore if the test was valid to be used by the researcher in the study and the respondents who took the tests. The validity of the research instrument was determined, taking in consideration various aspects in this regard as they reflect in the literature (Chapter Three). The pilot group provided the researcher with a number of suggestions and recommendations regarding some aspects of the questionnaire after they had discussed it. The Executive Director of the UODL gave his opinion of and recommendations for the questionnaire, and the researcher was provided with suggestions and recommendations after the pilot group had completed the questionnaire. The researcher evaluated the input from the pilot group and the Executive Director, and all valid suggestions and recommendations were made on the questionnaire. The researcher submitted the final questionnaire to the NWU Statistical Services for validation and approval.

Step 8: The researcher made this questionnaire available as paper copies and as an electronic version which was to be completed on any communication device that could connect to the internet. The paper copies of the questionnaire were sent to LSCs where centre managers were requested to assist with the distribution of the questionnaire. Only the centre managers were allowed to handle this aspect of handing out and returning completed questionnaires to the UODL. Completed questionnaires were gathered by the centre managers and couriered back to the UODL. Students were not forced to complete the questionnaire and taking part was purely voluntarily. Students had to give written consent to complete the questionnaire. The electronic version of the questionnaire was sent with an SMS to the group of students identified to take part in the research. In the SMS the researcher requested that students only completed the questionnaire if they had not yet completed the hard copy questionnaire to ensure that one student does not complete both versions of the questionnaires. The researcher used Google Docs™ platform for the dissemination of the electronic questionnaire.

4.6 Chapter summary

Chapter Four describes the collection and analysis of the qualitative data from five the interviews. Through constant comparative analysis of the interviews the researcher identified 35 codes (constructs) (Table 4.4). Through a process of quantitizing of qualitative data, the constructs were grouped into four cluster groups Dendogram (Figure 4.3). The clusters were labelled as infrastructure, learning environment, success in distance education and technologies for learning (§4.4). These clusters became the sections in the quantitative questionnaire (Chapter Five). The researcher followed the eight steps prescribed by Cohen et al. (2011a) and allowed the questionnaire to be validated by the pilot group as well as the NWU Statistical Services to ensure that the questionnaire measures that which is was supposed to measure. The researcher ensured trustworthiness, and ethical guidelines were followed during the qualitative investigation.

Chapter Five

Analysis of the Quantitative Constructs

5.1   Introduction

Chapter Four uncovered four clusters as part of the qualitative analysis which formed the basis employed to develop a quantitative questionnaire (Addendum 2.5) to determine the components of interactivity during the use of learning technologies in ODL. This chapter presents the results from the quantitative data from the data collected by using the questionnaire. The NWU Department of Statistical Consultation Services (i) recommend which software was applicable to capture and process the data; and (ii) conducted the statistical analyses of the data collected from the questionnaire. The quantitative data were analysed with the SPSS™ (IBM, 2016) as descriptive and inferential statistical output. This chapter therefore includes the following analyses: (i) descriptive statistics; (ii) factor analysis; (iii) effect sizes; and (v) Spearman's rank-order correlations. Descriptive statistics described the general characteristics of the data (Cramer & Howitt, 2004).

Figure 5.1 provides the outline of this chapter describing the analysis of the quantitative constructs.

5.2   Descriptive statistics

Descriptive statistics aim to meaningfully organise and summarize numerical data using frequencies, percentages, distribution, mean, median, modus and deviancies (Burke Johnson & Christensen, 2014; Cohen et al., 2011b). The researcher presented the descriptive statistics as percentages of the biographical information (Section A, Table 5.1). The researcher also presented descriptive statistics about respondents' perceptions of infrastructure (Section B, Table 5.2), the learning environment (Section C) (Table 5.3), success in DE (Section D, Table 5.4) and technologies used for learning (Section E, Table 5.5) in delivering DE programmes.

Table 5.1 presents the descriptive statistics (§2.10) for the biographical information: (i) gender; (ii) age groups; (iii) qualification the student is registered for; (iv) area of residence; (v) mode of previous qualification; (vi) attendance of whiteboard sessions; (vii) access resources such as recorded sessions are downloaded; (viii) communication devices owned; (ix) platform on which administrative and academic support is preferred; (x) devices used to download resources/recorded sessions; and (xi) distance from learner support centre.
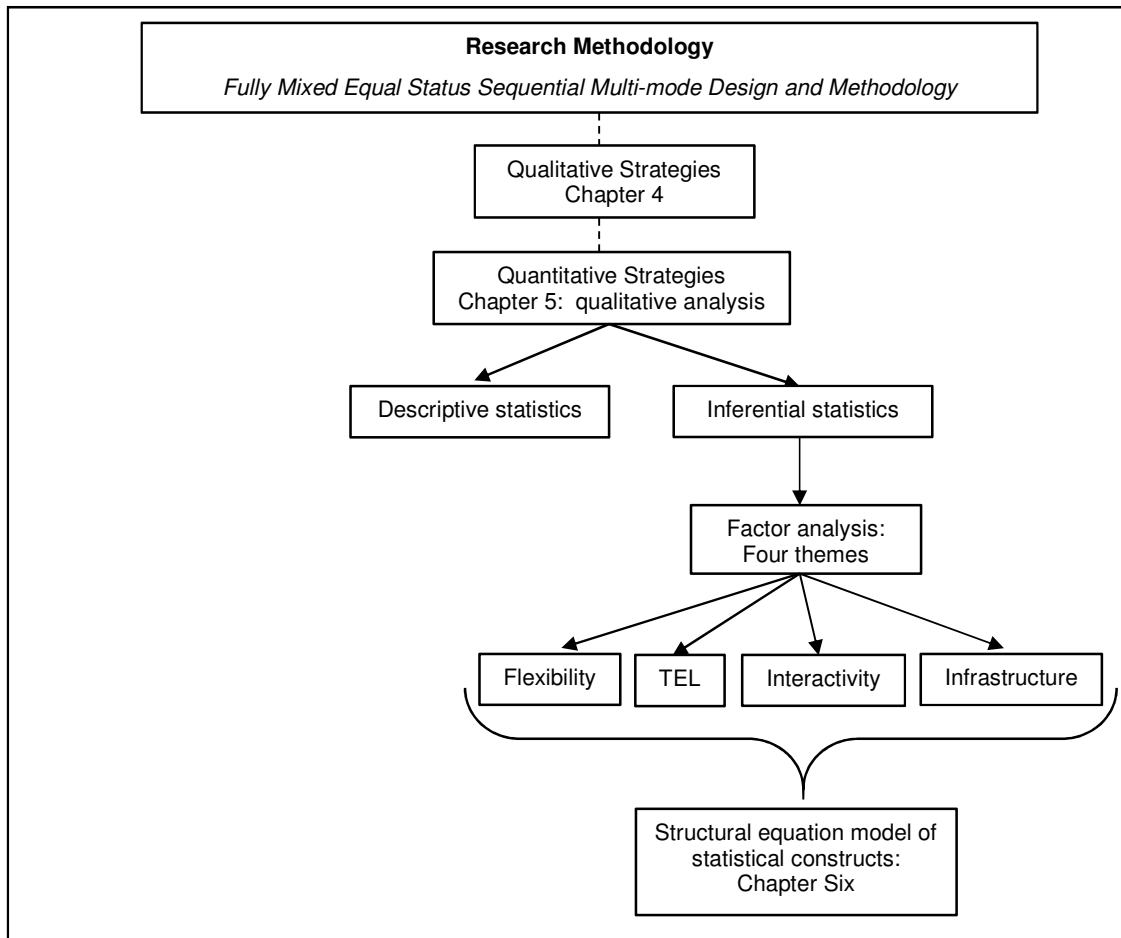
Figure 5.1   Outline of Chapter Five in terms of quantitative analyses

Table 5.1   Percentages of biographical information

Question	Sub-section	Distractors	Percentage
Q1	Gender	Male	16.88
		Female	83.08
Q2	Age group	20-29	16.37
		30-39	23.43
		40-49	44.46
		50-59	15.24
		60+	0.50
Q3	The programme/qualification I am registered for at the NWU	BEd Honours	33.12
		Gr R Diploma	36.52
		Advanced Certificate in Education (ACE)	24.94
		BEd Foundation phase	5.42
Q4	I live in a	Rural area	55.25
		Urban area	44.75
Q5	I have previously completed a qualification through distance education	Yes	46.31
		No	53.69
Q6.1-6.3	I attend whiteboard sessions	At a learner support centre close to me	73.30
		On my own device at a different location	16.62
		At a learner support centre and using my own device	9.82
Q7.1-7.4	I download resources like recorded sessions at	I do not download recordings	34.26
		a learner support centre	19.40
		my residence / house	29.35
		my workplace	18.89
Q8.1-8.5	I own the following information communication devices	Smartphone	65.37
		Tablet	28.72
		Laptop	41.06
		Personal computer	0.13
		Other	6.93
Q9.1-9.8	I like receiving administrative and logistical information via	SMS	87.15
		Post	0.13
		Call centre	3.15
		Downloads from the OLG website	18.01
		Downloads from the UODL website	4.41
		Facebook	4.79
		App (application on phone/tablet	6.93
		eFundi	3.65
Q10.1-10.5	I use the following device(s) to download resources / recorded sessions	I do not download resources	83.63
		Smartphone	44.96
		Tablet / laptop	36.52
		Computer / laptop support centre	22.29
		Other	4.79
		Please specify Other	
Q11.1-11.2	The learner support centre at which I attend my contact sessions is	Within 50km from where I stay	45.21
		Further than 50km from where I stay	53.65

5.2.1   Gender

The distribution of male and female respondents that completed the questionnaire differed. The female respondents (83.08%) were more than the male respondents (16.88%) that completed the questionnaire. In general more female educators are employed at schools than male educators.

5.2.2 Age group

The majority of the respondents (44.46%) were in the age group 40-49 years old. The second largest group of respondents were the age group 30-39 years old (23.43%). The smallest group were in the age group 50+ (15.74%). Many new teachers relate to the age group 20-29 years old (16.37%) which recently received their qualifications, not necessarily studying through DE. UODL anticipates that this number could possibly increase in future as new programmes for initial training were only introduced in 2015 and are planned for the future. The reason why the larger groups of respondents (67.89%) fall in the age group 30-49 years old is that prior to 2015 no initial training programme was offered to these educators to upgrade their qualifications.

5.2.3 Qualifications

The majority of respondents (36.52%) were registered for the Grade R Diploma. Foundation phase education was identified a priority, therefore many students received bursaries from Provincial Education Departments and UODL enrolled large groups for this programme during the 2015/2016 academic year. UODL introduced the Grade R Diploma students to technologies for learning when they were enrolled for this programme, therefore the larger response rate. The lower response rate for BEd Honours (33.12%) and ACE (24.94%) could be contributed to the fact that these two programmes were mostly paper based and respondents had limited access to electronic platforms (Moodle, UODL or OLG websites) whereas the Grade R Diploma and BEd Foundation phase students had a variety of electronic platforms to access resources. The requirements for grade R and BEd Foundation phase to enrol for these programmes include that they have to have access to internet and a device to access and download resources. The grade R and BEd Foundation phase students can also follow live sessions on the whiteboards from their own location and own device.

5.2.4 Area of residence

The majority of respondents (55.25%) resided in rural areas which makes DE a more feasible method to improve their qualification. Attending contact sessions, accessing resources, and using a variety of ICT resources and communication devices at any of the LSCs enable students to limit barriers of access, ultimately enabling them to learn at their own time and from any location (§3.2.3.2).

5.2.5 Qualifications completed through distance education

There was not a large difference in responses between respondents who had previously completed a qualification through DE and those respondents who had not completed a qualification through DE. The majority of students (53.69%) are new enrolments and have not as yet completed a qualification through DE. More than forty per cent (46.31%) of the students had previously completed a programme through DE as many educators furthered their qualification while already being employed

as educators at schools/institutions as part of their professional development, encouraged by the different Provincial Education Departments (North-West University, 2015).

5.2.6   Whiteboard sessions

The data indicated that 73.30% of respondents attended scheduled whiteboard sessions at the various LSCs. Previous research conducted with students enrolled with the UODL showed that the majority of students have positive learning experiences when attending whiteboard sessions at the LSCs (§3.2.4). Only 16.62% of respondents used a device to connect to the live whiteboard sessions. The low number of students attending sessions on their own devices from another location could be contributed to the lack of internet connectivity, cost of these devices or the students' limited knowledge to use these devices. These respondents attended at the location of their choice and not at any of the LSCs. The smallest group (9.82%) attended scheduled whiteboard sessions at the LSCs and used a device during the sessions.

5.2.7   Downloading of resources

Most of the respondents (67.64%) indicated that recorded whiteboard sessions were downloaded from LSCs, the workplace or elsewhere. The large number of students downloading recorded sessions could be an indication that students prefer to view the recordings for preparing for assignments and examinations (Zupancic & Horz, 2002). More than thirty per cent (34.26%) of students did not download recorded sessions. This can be attributed to no access to internet or that they considered the resources and material they had as sufficient to prepare for examinations. Being able to download recorded session and resources from the location of their choice adds flexibility and enables students to access learning from any place and any location, which is a characteristic of DE programme delivery (§3.2.3 & §3.2.3.1).

5.2.8   Information communication devices owned by students

Most of the respondents owned smartphones (65.37%) and laptops (41.06%). It is evident from this results that respondents preferred using ICT devices as these devices could be used at any time and from any location to access teaching and learning resources. Owning ICT devices enabled respondents to: (i) asynchronously interact and take part in learning, (ii) communicate with other students, and (iii) interact with content (§3.4.1). Key concepts in delivering DE programmes are accessibility and mobility, as these encourage active participation in teaching and learning from any location (Parsons & Ryu, 2006; Redelinghuys, 2012). While very few respondents owned a personal computer (0.13%), almost a third (28.72%) of respondents indicated that they owned a tablet.

5.2.9   Means of receiving administrative and logistical information

The least preferred means of receiving administrative and logistical information was through the mail (0.13%), call centres (3.15%) and eFundi (3.65%). The reason postal services were the lowest could be attributed to: (i) the unreliability of the postal services; (ii) time constraints, and (iii) alternative methods to access information. More than twenty per cent (22.42%) indicated they used the websites of OLG and UODL for administrative and logistical information. The means of receiving information with the highest rating was through SMS (87.15%). SMS provides academic and administrative support to students at HEIs and it improves communication between the student and the institution (Shenton, 2004). Respondents using eFundi (3.65%) are few, but this is due to the fact that the UODL has only recently started using this platform for delivering new programmes.

5.2.10   Devices used to download resources and recorded sessions

The majority of respondents used Smartphones (44.96%) and laptops or tablets (36.52%) to download resources needed for their studies. Respondents who indicated that the majority owned a device (§5.2.8), used these to access and download the resources. Some respondents (22.29%) made use of the computers and laptops at LSCs to download resources. By furnishing learner support centres with computers and laptops, the NWU enables the students who do not have internet access at their residence and workplace with the opportunity to access resources, sessions and recorded sessions at the LSC of their choice. The highest ranking response (83.63%) indicated that they do not download resources or recorded sessions.

5.2.11   Distance from nearest learner support centre

There is a balance between respondents (45.21%) residing within fifty kilometres and respondents (53.65%) residing more than fifty kilometres from a LSCs. These percentages correlate with §5.2.4, where the majority of respondents reside in rural areas (55.25%) and 44.8% reside in urban areas (44.8%). The 65 LSCs of the UODL are equipped with all technologies to assist students with academic and administrative support (§2.8.4.2). The learner support centres are present in all provinces of South Africa, affording everyone the opportunity to attend scheduled contact sessions (§2.8.4.2) (Redelinghuys, 2015). Affording students from rural and urban areas, equal opportunity to access a learner support centre for teaching and learning closes the geographical gap between rural and urban areas where students reside.

In the following section the researcher discusses the descriptive statistics of Parts B, C, D, and E of the questionnaire.

5.2.12 Respondents' responses regarding the infrastructure for delivery of distance education programmes

Table 5.2 presents the descriptive statistics (frequencies, percentages, means, and standard deviations) of respondents' perceptions (Questions 12 to 18 of the questionnaire, Addendum 2.5) on: (i) scheduled whiteboard contact sessions; (ii) means of access to study material; (iii) means of communication with NWU; (iv) communication from the university that could provide quality of service to the ODL student , (v) respondents' knowledge to use information and communication technologies for various support functions; and (vi) communication options for support for whiteboard sessions, contact sessions, SMS, etc. The highest means are highlighted in Table 5.2 and only those are reported (Addendum 5.1).

Table 5.2   Descriptive statistics of infrastructure for delivering distance education programmes

Scheduled whiteboard contact sessions	Never		Sometimes		Often		Always		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
I regard contact sessions as worthwhile for the programme I am registered for	46	5.99	183	23.83	118	15.36	421	54.82	3.19	0.99
I regularly attend contact sessions at a learner support centre	88	11.56	176	23.13	114	14.98	383	50.33	3.04	1.09
I do not regularly attend or connect to contact sessions	351	49.44	226	31.83	76	10.70	57	8.03	1.77	0.93
I connect to contact sessions from another location using my own device	410	56.79	164	22.71	53	7.34	95	13.16	1.77	1.06
I watch recorded sessions at a time convenient to me	241	33.15	210	28.89	100	13.76	176	24.21	2.29	1.16
Recorded whiteboard contact sessions	Never		Sometimes		Often		Always		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
I prefer live whiteboard sessions to recorded sessions	92	12.32	206	27.58	93	12.45	356	47.66	2.95	1.12
I regularly attend live whiteboard sessions	131	17.24	173	22.76	99	13.03	357	46.97	2.90	1.17
I regularly download and watch recorded whiteboard contact sessions	316	42.99	224	30.84	81	11.02	114	15.51	1.99	1.08
I do not have access to recorded whiteboard sessions	357	49.17	193	26.58	65	8.95	111	15.29	1.90	1.09
I prefer access to my study material (text books, study guides, manuals, readers)	Never		Sometimes		Often		Always		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
a combination of hard copies of study material and digital resources to complete distance education programmes at the UODL	25	3.27	124	16.21	118	15.42	498	65.10	3.42	0.88
only hard copies of study material to complete distance education programmes at the UODL	130	18.18	202	28.25	132	18.46	251	35.10	2.70	1.13
all study material in digital format to complete distance education programmes at the UODL	158	22.22	232	32.63	96	13.50	225	31.65	2.55	1.15
I prefer communication with the NWU	Never		Sometimes		Often		Always		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
telephone (landline)	215	31.85	194	28.74	68	10.07	198	29.33	2.37	1.21
Email	142	20.46	184	26.51	94	13.54	274	39.48	2.72	1.18
eFundi	453	69.91	96	14.81	39	6.02	60	9.26	1.55	0.96
cell phone	28	3.98	112	15.93	83	11.81	480	68.28	3.44	0.90
SMS	29	3.86	87	11.57	76	10.11	560	74.47	3.55	0.84
social media (e.g. Facebook, Twitter)	412	62.71	138	21.00	38	5.78	69	10.50	1.64	0.99

Communication from the university improves the quality of service to me as an ODL student	Never		Sometimes		Often		Always		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
	16	2.05	31	3.96	209	26.73	526	67.26	3.59	0.67
I have sufficient technological knowledge to use information and communication technology devices to	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
access resources for learning	32	4.16	66	8.64	362	47.07	309	40.18	3.23	0.78
communicate with the university on administrative issues	42	5.59	65	8.64	310	41.22	335	44.55	3.25	0.83
The NWU (UODL) has sufficient communication options (whiteboard sessions, and contact sessions, SMS, etc.) in place to support my	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
academic challenges	29	3.73	67	8.61	304	39.07	378	48.59	3.33	0.79
administrative challenges	51	6.85	83	11.16	342	45.97	268	36.02	3.11	0.86

More than half (54.82%) of participants regarded scheduled whiteboard sessions as worthwhile for the programme they were registered for, while 5.99% did not agree. Less than a third (28.82%) of respondents indicated that they sometimes (23.83%) or never (5.99%) regard scheduled whiteboard contact sessions as worthwhile for the programme they are registered for, while 11.56% do not do so on a regular basis. More than half (50.33%) regularly attended contact sessions at LSCs. Less than a third (24.21%) watched recorded sessions at a time convenient to them, and 33.15% never watched recorded sessions.

Less than half (47.66%) of participants preferred attending live whiteboard sessions to watching recorded sessions, while 27.58% of respondents preferred it sometimes. This closely corresponds with respondents who regularly attended live whiteboard sessions (46.97%). Less than a fifth indicated that they regularly downloaded and watched recorded whiteboard sessions (15.51%) and 15.29% indicated that they did not have access to recorded whiteboard sessions. Any UODL student can download and watch recorded whiteboard sessions, but 42.99% of participants indicated that they never downloaded and watched these sessions while 26.58% sometimes had access to recorded whiteboard sessions.

Respondents preferred to receive their study material in different formats; 65.10% preferred a combination of hard copies and digital resources to complete distance education programmes through UODL. More than a third of the respondents preferred hard copies only (35.10%), while 31.65% preferred only the digital format of their study material to complete distance education programmes at the UODL.

More than two-thirds preferred a cell phone (68.28%) and SMS (74.47%) to communicate with the NWU. Only 9.26% indicated that they preferred to use the eFundi learning management system to communicate with the NWU. More than sixty per cent (62.71%) never used social media for communication with the university, while 10.50% always used social media to communicate with the university. Other means of communication with the NWU preferred by respondents were telephone (29.33%) and email (39.48%). Frequent communication with the university improves the quality of service to each participant, as ODL student 67.26% agreed to this while only 2.05% of respondents did not agree.

Sufficient technological knowledge is needed to use information and communication technology devices, and 40.18% indicated they had sufficient knowledge to access resources for learning, while only 4.16% did not have the knowledge to use their devices to access resources. Almost fifty per cent (44.55%) agreed completely that sufficient knowledge of information and communication devices would assist in participants' communication with the university on administrative issues while 5.59% disagreed with this statement.

Almost fifty per cent of respondents (48.59%) completely agreed that the NWU (UODL) had sufficient communication to support participants with academic challenges and 36.02% of participants agreed that sufficient communication options for administrative support existed.

5.2.13   Respondents' responses regarding the learning environment for delivery of distance education programmes

Table 5.3 presents the descriptive statistics (frequencies, percentages, means, and standard deviations) on the perceptions of respondents regarding aspects of the learning environment (Questions 19 to 30 of the questionnaire): (i) technological support structure for students; (ii) student support at learner support centre, (iii) geographical residence of students; (iv) technologies used; (v) creation of student's learning environment, (vi) availability of support structures; (vii) how communication devices are used; (viii) availability; (xi) assessment; and (x) feedback and the convenience of scheduled contact sessions. The highest percentages and means are highlighted and reported (Addendum 5.1).

Table 5.3   Learning environment for delivery of distance education programmes

The NWU (UODL) has sufficient technological support structures that could assist me with	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
academic challenges	45	5.77	66	8.46	307	39.36	362	46.41	3.26	0.84
administrative challenges	33	5.90	92	12.33	326	43.70	284	38.07	3.14	0.85
technological challenges	50	6.64	95	12.62	330	43.82	278	36.92	3.11	0.85
LSCs	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
The learner support centre where I attend contact sessions is well equipped to support my learning needs	50	6.34	97	12.33	287	36.47	353	44.85	3.20	0.89
There are sufficient learner support centres in the geographical area where I live / work to attend contact sessions	198	25.38	149	19.10	225	28.85	208	26.67	2.57	1.14
I make use of the following learning technologies	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Interactive whiteboards at learner support centres	77	10.01	68	8.84	236	30.69	388	50.46	3.22	0.97
Text messages (SMS) from the UODL	27	3.59	32	4.25	221	29.35	473	62.82	3.51	0.74
Communication devices (tablets, smart phones) to access learning resources	40	5.37	47	6.31	273	36.64	385	51.68	3.35	0.82
Internet-based resources and tools	57	7.70	57	7.70	286	38.65	340	45.95	3.23	0.89
Computer-based learning	61	9.17	67	10.08	256	38.50	281	42.26	3.14	0.93
My *learning environment* is created by	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
study material dispatched to me in time	40	5.19	47	6.10	212	27.50	472	61.22	3.45	0.83
interaction taking place between me and the lecturer during whiteboard sessions	107	14.17	111	14.70	270	35.76	267	35.36	2.92	1.03
the learner support centre close to the place where I live	223	29.61	114	15.14	211	28.02	205	27.22	2.53	1.18
my interaction with other students while sharing academic experiences	81	10.74	76	10.08	291	38.59	306	40.58	3.09	0.96

The availability of the following adds value to my distance learning experience	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Resources for learning, available on any device	45	5.89	74	9.69	294	38.48	351	45.94	3.25	0.86
Easy access to administrative support	37	4.94	96	12.82	295	39.39	321	42.86	3.20	0.85
Easy access to academic support	32	4.25	90	11.95	302	40.11	329	43.69	3.23	0.82
Access to the learner support centre of my choice	59	7.77	85	11.20	268	35.31	347	45.72	3.19	0.92
I use my information and communication technology device(s) to	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
access social media *only* regarding my studies and not for other communication functions	146	19.62	125	16.80	263	35.35	210	28.23	3.72	1.08
download administrative information regarding my studies	42	5.65	71	9.56	298	40.11	332	44.68	3.24	0.84
communicate with lecturers regarding my studies	94	12.65	102	13.73	280	37.69	267	35.94	2.97	1.00
communicate with fellow students regarding my studies	74	9.92	68	9.12	249	33.38	355	47.59	3.19	0.96
download resources to assist me in my studies	27	3.59	43	5.72	247	32.85	435	57.85	3.45	0.76
search for additional resources from the internet	27	3.52	36	4.69	232	30.25	472	61.54	3.50	0.75
Information and communication technology devices assist me to	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
learn at my own convenience	22	2.90	27	3.56	227	29.95	482	63.59	3.54	0.70
learn at my own pace	12	1.59	29	3.85	216	28.69	496	65.87	3.59	0.65
access learning material from any location	42	5.64	66	8.86	247	33.15	390	52.35	3.32	0.86
access information pertaining to my studies	18	2.37	42	5.54	262	34.56	436	57.52	3.47	0.71
download recorded contact sessions	117	15.62	105	14.02	235	31.38	292	38.99	2.94	1.07
Use of various technologies	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
contribute to my learning	20	2.58	52	6.71	280	36.13	423	54.58	3.43	0.73
Effective teaching-and-learning in open distance learning (ODL) is when there is	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
only face-to-face teaching at learner support centres	192	25.57	162	21.57	218	29.03	178	23.70	2.56	1.82
only teaching through whiteboard sessions	156	20.58	158	20.84	226	29.82	218	28.76	2.67	1.10
a combination of whiteboard and face-to face teaching	108	14.50	79	10.60	235	31.54	323	43.36	3.04	1.06
interaction between the lecturer and students	67	9.03	67	9.03	266	35.85	342	46.09	3.19	0.94
frequent use of technologies for learning	32	4.34	69	9.35	294	39.84	342	46.34	3.28	0.82
I would like feedback on my progress from	Disagree		Disagree to some		Agree to some		Agree completely		Mean	Standard

lecturers	completely		extent		extent					deviation
	f	%	f	%	f	%	f	%		
during live whiteboard sessions	108	14.50	82	11.01	192	25.77	363	48.72	3.09	1.82
on assignments which I submitted to the UODL	10	1.29	28	3.61	135	17.40	603	77.71	3.72	0.60
via technologies for learning, e.g. tablets, smartphones	39	5.21	48	6.41	189	25.23	473	63.15	3.46	0.83
Assessment of my learning should take *only* place through	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
the assignments which I submit to the UODL	48	6.35	62	8.20	195	25.79	451	59.66	3.39	0.89
formal written examinations	54	7.21	56	7.48	206	27.50	433	57.81	3.36	0.90
portfolios as evidence of competence	58	7.80	45	6.05	238	31.99	403	54.17	3.33	0.90
combination of continuous learning and examinations	15	1.97	41	5.38	213	27.95	493	64.70	3.55	0.69
UODL	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
The UODL usually schedules contact sessions at times and dates convenient to me	57	7.33	101	12.98	264	33.93	356	45.76	3.18	0.92

Respondents (46.41%) agreed that they had sufficient support to address academic challenges; and 38.07% agreed completely that the support structure for administrative challenges was sufficient, and 90% disagreed. More than a third (36.92%) of respondents stated that enough was done by the NWU to overcome their technological challenges, and 6.64% disagreed completely. Of the respondents, 44.85% completely agreed that the leaner support centre where they attended the contact sessions was well equipped to support their learning needs, while 6.34% did not agree.

More than half of the respondents (50.46%) indicated that they made use of whiteboards at LSCs while 10.01% did not. More than two thirds (62.82%) found SMS messages useful while ten per cent disagreed. More than half (51.68%) used various communication devices to access learning resources while 5.40% did not use any communication devices for access to learning resources. Almost half of the respondents (45.95%) agreed completely that they made used of internet-based resources and tools while 7.70% did not. More than a third (42.26%) made used of computer-based learning while 9.17% did not.

The majority of respondents (61.22%) indicated that receiving their study material on time would assist in creating their own learning environment, while 5.19% of respondents did not view this as important to create a learning environment. Slightly more than a third (35.36%) of the respondents thought that interaction between the lecturer and the student during whiteboard sessions contributed to creating a positive learning environment, while 14.17% did not agree. About a quarter (27.22%) of respondents agreed that they had a LSC close to where they lived while 29.61% did not reside close to a learner support centre. Students interacted with fellow students while sharing academic experiences, and 40.58% responded that this helped to create a learning environment while 10.74% did not agree.

More than forty per cent (45.94%) indicated that resources for learning available on any device added value to their teaching-and-learning experience while 5.89% completely disagreed. Less than half (42.86%) of respondents responded that easy access to administrative support added value to the learning experience, while 4.94% did not agree. More than forty per cent of respondents indicated that 43.69% of them viewed easy access to academic support as adding value to the learning experience, while 4.25% did not agree. Many of the respondents (45.72%) indicated that access to LSCs of their choice added value to the learning experience while 7.77% did not agree.

Nearly thirty per cent (28.23%) responded that they used social media only for their studies and not for communication, while 19.62% did not only use social media for their studies, but also for other purposes. Less than half (44.68%) used devices to download administrative information, 35.94% used their devices to communicate with lecturers, 57.85% used their devices to download resources, and 61.5% used devices to search for additional resources. Many of the respondents (63.59%) indicated that the devices assisted them to learn at their own convenience (asynchronously) and at their own pace (65.87%). More than half (52.35%) used ICT to access learning material from any

location while 38.99% used ICT to download recorded sessions. More than fifty per cent of the respondents completely agreed (54.58%) that using technologies contributed to their learning while 2.58% did not agree.

The respondents had different opinions regarding the mode of DE delivery: (i) 23.70% said that contact sessions at LSCs should be face-to-face teaching, while 25.58% disagreed; (ii) 28.76% responded that success was achieved only through teaching via whiteboard sessions, while 20.58% disagreed: (iii) 43.36% regarded a combination between face-to-face and whiteboard sessions for ODL teaching-and-learning success 14.50% did not agree; (iv) 46.09% responded that to achieve success in ODL, there must be interaction between the lecturer and the student, while 9.03% did not agree; and (v) 46.34% of the respondents agreed that frequent use of technologies for learning contributed to the success of teaching and learning in ODL, while 4.34% disagreed.

Less than half (48.72%) preferred feedback by lecturers during whiteboard sessions while 14.5% did not. The majority of the respondents (77.71%) agreed that feedback provided to their assignments submitted was important while very few (1.29%) did not agree. More than sixty per cent (63.15%) of respondents did not mind receiving feedback of their progress via technologies for learning, using smartphones, tablets etc., while only 5.21% did not want to receive feedback in this way.

More than fifty per cent (59.66%) responded that assessment should only take place through the assignments that they submitted while 6.35% disagreed; 57.81% indicated that assessment should only take place during examination and 7.21% did not agree. More than half (54.17%) of the respondents agreed that only portfolios as evidence of competence should be taken in consideration for assessment, while 7.80% disagreed. Nearly seventy per cent (64.70%) agreed to a combination of assignments and examinations while 1.97% did not agree.

Regarding the convenience of scheduled contact sessions at the UODL, 45.76% of respondents viewed scheduled sessions as convenient while 7.33% did not regard the scheduled contact sessions as convenient.

5.2.14 Respondents' response regarding the success in distance education

Table 5.4 represents the descriptive statistics (frequencies, percentages, means, and standard deviations) of the respondents' response regarding aspects of success in distance education (Questions 32 to 40 of the questionnaire): (i) the approach to be followed, (ii) two-way communication via interactive whiteboards for success, (iii) internet access, (iv) motivation, (v) aspects of interactivity, (vi) aspects contributing to ODL success, (vii) barriers in distance education, (viii) equal opportunities in DE and (ix) and accessibility in ODL. The highest percentages are reported for respondents' response regarding the aspects of success in distance education.

Table 5.4   Success in distance education

The following aspects are important to my success in ODL	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
A lecturer-centred approach	50	6.60	104	13.72	243	32.06	361	47.63	3.20	0.91
A student-centred approach	26	3.50	65	8.75	302	40.65	350	47.11	3.31	0.78
Resources made available through innovative media	32	4.26	42	5.59	284	37.82	393	52.33	3.38	0.78
Content made available through technologies for learning	17	2.26	33	4.39	287	38.16	415	55.19	3.46	0.69
Two-way communication via interactive whiteboards contributes towards my success in ODL through communication	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
with my fellow students	27	3.58	73	9.67	270	35.76	384	50.86	3.37	1.07
with my lecturers	30	3.98	70	9.30	290	38.51	363	48.21	3.31	0.80
with the administration of the NWU UODL	37	4.97	81	10.89	297	39.92	329	44.22	3.23	0.83
within a classroom (face-to-face learning)	78	10.58	98	13.30	256	34.74	305	41.38	3.07	0.98
over distance using various technologies	21	2.82	64	8.58	296	39.68	365	48.93	3.35	0.75
I access the internet	Never		Once a week		Twice a week		More than 4 times a week		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
on a smartphone	58	7.63	44	5.79	163	21.45	495	65.13	3.44	0.91
at my place of work	182	25.10	96	13.24	172	23.72	275	37.93	2.75	1.21
from a Wi-Fi spot	266	36.74	86	11.88	162	22.38	210	29.01	2.44	1.25
at an internet café	239	32.92	92	12.67	188	25.90	207	28.51	2.50	1.22
on a computer at home	195	26.39	78	10.55	163	22.06	303	41.00	2.78	1.23
Motivation	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Having a strong reason to act or to accomplish Success) is important to achieve success in ODL	12	1.57	27	3.52	193	25.20	533	69.58	3.68	1.59
The aspects of *interactivity* are important to me in order to achieve success in ODL are	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Enabling more effective *learning*	9	1.20	34	4.53	245	32.62	463	61.65	3.55	0.64
Enabling more effective *teaching*	9	1.20	29	3.88	258	34.54	451	60.37	3.54	0.63
Communicating through various devices	13	1.74	35	4.70	264	35.44	433	58.12	3.50	0.67
Communicating face-to-face	60	8.09	90	12.13	279	37.60	312	42.05	3.13	0.93
Communicating over distance, using technologies for learning	12	1.60	48	6.41	259	34.58	430	57.41	3.48	0.69

The following aspects are important to my success in ODL	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Interacting with other students about the content	22	2.91	49	6.48	268	35.45	417	55.16	3.43	0.74
Learning on my own, using applicable technologies for learning	25	3.33	56	7.47	295	39.33	374	49.87	3.36	0.76
Acquiring skills for learning via technologies for learning	18	2.42	38	5.11	307	41.32	380	51.14	3.41	0.70
Applying much effort to use various technologies for learning	12	1.60	39	5.21	298	39.79	400	53.40	3.45	0.67
These aspects of ODL programme delivery contribute towards my success	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Considering the non-residential (off-campus) location of students	47	6.34	73	9.85	299	40.35	322	43.45	3.21	0.86
Supporting teaching-and-learning far away from residential campuses	32	4.28	79	10.58	275	36.81	361	48.33	3.29	0.82
Developing self-instructional programmes	17	2.28	45	6.05	313	42.07	369	49.60	3.39	0.70
Accommodating students separated in time or distance	33	4.46	73	9.86	284	38.38	350	47.30	3.29	0.82
Using an assortment of technologies for learning used in delivery of programmes	18	2.43	60	8.10	297	40.08	366	49.39	3.36	0.73
I experience the following as *barriers* to distance education	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Distances to travel to learner support centres	94	12.30	86	11.26	198	25.92	386	50.52	3.15	1.04
No access to resources	170	22.64	146	19.44	205	27.30	230	30.63	2.66	1.14
Inability to download resources	168	22.40	113	15.07	241	32.13	228	30.40	2.71	1.13
Restricted communication opportunities with lecturers	149	19.84	117	15.58	247	32.89	238	31.69	2.76	1.10
Unavailability of technologies for learning	166	22.31	132	17.74	239	32.12	207	27.82	2.66	1.11
Inability to interact with the technologies for learning	161	21.55	125	16.73	240	32.13	240	29.59	2.70	1.11
The aspects I consider *beneficial* regarding equal opportunities in the delivery of distance education programmes are	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
participating in teaching-and-learning irrespective of time or location	16	2.12	63	8.37	318	42.23	356	47.28	3.35	0.72
participating in teaching-and-learning only at specific times and specific locations	48	6.47	107	14.42	348	46.90	239	32.21	3.05	0.85
equal access to resources	16	2.14	52	6.95	296	39.57	384	51.34	3.40	0.71
I experience accessibility in ODL in	Disagree		Disagree to some		Agree to some		Agree completely		Mean	Standard

The following aspects are important to my success in ODL	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
receiving support at any learner support centre	54	7.17	92	12.22	284	37.72	323	42.90	3.16	0.90
receiving digital access to study material	49	6.60	87	11.73	294	39.62	312	42.05	3.17	0.88
receiving digital access to learning resources	41	5.51	85	11.42	289	38.84	329	44.22	3.22	0.85
attending contact sessions in my area	77	10.27	68	9.07	243	32.40	362	48.27	3.19	0.97
submitting assignments electronically	187	25.27	102	13.78	209	28.24	242	32.70	2.68	1.17
accessing academic and administrative support at NWU	37	4.99	64	8.64	266	35.90	374	50.47	3.32	0.83

To achieve success in ODL, 47.63% respondents preferred a lecture-centred approach and 6.60% did not, while 47.11% regarded a student-centred approach as important for success in ODL and 3.50% did not agree that a student-approach is important for their success in ODL. More than half 52.33% of the respondents believed that success in ODL is achieved through making resources available through innovative media while 4.26% did not agree. The majority (55.19%) preferred that content should be made available through technologies for learning, and only 2.26% did not prefer that mode of content distribution.

Slightly more than half of the respondents (50.86%) indicated that communication with peers contributed to their success, while 3.58% did not agree; 48.21% of the respondents indicated that communication between lecturers through the whiteboard contributed to their success while 3.98% did not agree; 44.22% regarded student success in ODL as being attained through communication between themselves and the administration department of the NWU UODL, and 4.97% did not agree; 41.38% indicated that face to face communication contributed to their success in ODL while 10.58% did not agree; and 48.93% indicated that using technologies would contribute to their success in ODL while 2.82% did not agree.

The majority (65.13%) indicated that they used a smartphone, while 7.63% do not use a smartphone for internet access; 37.93% accessed the internet from their place of work while 25.10% did not; 29.01% used a Wi-Fi spot to access the internet while 36.74% did not; 28.51% indicated that they accessed the internet from an internet café, and 32.92% possibly accessed it form other venues. Forty one per cent accessed the internet from a computer at home, while 26.39% did not access the internet from a computer at home.

Motivation is regarded as a strong contributor to achieve success in ODL as 69.58% of the respondents agreed while very few (1.57%) did not agree that motivation was a strong contributor to success in ODL as the respondent possibly was not aware of the potential ODL could offer them (Karoulis, 2011).

Various aspects of interactivity are important to achieve success in ODL and 61.65% responded that interactivity would enable more effective learning, while only 1.20% did not agree; 60.37% indicated that interactivity would enable more effective teaching while 1.20% disagreed: 58.12% responded that communicating interactively using various devices enabled students to achieve success in ODL while 1.74% did not agree; 42.05% indicated that face-to-face interaction would contribute to their success in ODL and 8.09% did not agree; 57.41% responded that interpersonal communication, whether asynchronous or synchronous, contributed to their being in ODL while 1.60% disagreed; 55.16% agreed that interacting with students on content helped them to be success in ODL while 2.91% disagreed; 49.87% responded that interactive learning would assist them to achieve success in ODL while 3.33% did not agree; 51.14% agreed that acquiring skills for learning via technologies for learning contributed to the success in ODL whereas only 2.42% of the respondents disagreed;

53.40% indicated that applying various technologies for learning would contribute to success in ODL while 1.60% disagreed.

Less than half (43.45%) thought that the consideration of non-residential location of students for success in ODL played a role while 6.34% did not agree; 48.33% responded that teaching-and-learning must be supported far away from residential campuses, and 4.28% did not agree; 49.60% regarded self-instructional programmes to contribute to the success in the delivery of ODL programmes whereas 2.28% did not agree; 47.30% indicated students resided in different areas and were not always able to attend live sessions while 4.46% did not agree; 49.39% wanted a variety of technologies to be used in the delivery of programmes for their success in ODL while 2.43% did not agree.

Various barriers to success in distance education are experienced. More than fifty per cent (50.52%) regarded the distance they had to travel to the learner support centre as a barrier while 12.30% did not perceive distances they had to travel as a barrier; 30.63% had no access to resources while 22.64% did have access; 30.40% could not download resources but 22.40% were able to; 31.69% regarded restrictions in communication opportunities as a barrier while 19.84% disagreed; 27.82% indicated the availability of technologies to be a barrier while 22.31% did not; 29.59% regarded the inability to interact with technologies for learning as a barrier in DE while 21.55% did not agree.

Less than half (47.28%) agreed that participating in teaching and learning, irrespective of time and location, was to be considered as an equal opportunity, while 2.12% did not agree; 32.21% agreed that participation in teaching and learning only at specific times and locations would afford equal opportunities while 6.47% did not agree; 51.34% regarded equal access to resources as equal opportunity while 2.14% did not see it as that.

Accessibility is an aspect of ODL that is experienced differently by students and less than half (42.90%) of respondents agreed that receiving support at learner support centres would improve accessibility, while 7.17% did not agree; 42.05% viewed access to digital study material as essential while 6.60% did not agree; 44.22% indicated that digital access to learning resources would improve accessibility while 5.51% did not agree; 48.27% viewed accessibility as being able to attend contact sessions in their area while 10.27% did not agree; 32.70% viewed accessibility as being able to submit assignments electronically while 25.27% did not agree; 50.47% agreed that access to administrative support would improve accessibility while 4.99% did not agree.

5.2.14 Respondents' responses regarding infrastructure for learning in delivery of distance education programmes

Table 5.5 represents respondents' responses regarding technologies for learning in DE programmes (Questions 41 to 48 of the questionnaire): (i) innovations assisting in students' studies, (ii) challenges

in ODL, (iii) internet accessibility for access to programme information, (iv) infrastucture for support of UODL (NWU) students, (v) availability of sufficient technology possibilities for learning, (vi) compatibility of software on students' devices for access to resources, (vii) confidence in using various features on the smartphone and (viii) academic progress. The highest percentages and frequencies can feature in any part of the scale as respondents could indicate more than one response in some of the questions.

Table 5.5   **Technologies for learning in delivering distance education programmes**

The innovations in ODL which assist my learning are	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
implementing of new technologies for learning in the delivery of ODL programmes	15	1.98	48	6.32	325	42.82	371	48.88	3.39	0.70
encouraging of interactivity	7	0.94	39	5.21	309	41.31	393	52.54	3.46	0.64
improving of access to resources	8	1.08	36	4.85	244	32.84	455	61.24	3.54	0.64
enhancing pedagogical methods for learning	13	1.76	45	6.10	287	38.89	393	53.25	3.44	0.69
Challenges in ODL are	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
not having access to internet	167	22.21	91	12.10	232	30.85	262	34.84	2.78	1.15
not owning a device to connect to internet	182	24.53	103	13.88	193	26.01	264	35.58	2.73	1.18
being a distance away from a learner support centre	99	13.13	83	11.01	237	31.43	335	44.43	3.07	1.04
experiencing difficulty to download resources from websites	132	17.67	79	10.58	238	31.86	298	39.89	2.94	1.10
not being knowledgeable in the use of technology	170	22.73	113	15.11	226	30.21	239	31.95	2.71	1.14
Accessibility	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Internet accessibility is important for my success in ODL as I use it to access programme information	24	3.15	39	5.12	193	25.36	505	66.36	3.55	0.74
The infrastructure that the NWU (UODL) has in place provides me with sufficient	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
administrative and logistical support	29	3.88	79	10.56	312	41.71	328	43.85	3.26	0.80
academic support	28	3.74	57	7.61	310	41.39	354	47.26	3.22	0.77
support at the learner support centres	34	4.55	71	9.49	291	38.90	352	47.06	3.29	0.82
communication with the NWU	36	4.82	58	7.76	265	35.48	388	51.94	3.35	0.82
opportunities for learning at learner support centres	48	6.43	67	8.98	281	37.67	350	46.92	3.25	0.87

Technological possibilities	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Sufficient technological possibilities are available to me for academic progress	53	6.85	96	12.40	317	40.96	308	39.79	3.14	0.88
Access	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
The software installed on my device is compatible to access resources	94	12.13	109	14.06	303	39.10	269	34.71	2.96	0.99
I am confident using the features on my Smartphone	To a small extent		To a moderate extent		To a large extent		To a very large extent		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
Internet	61	8.05	82	10.82	217	28.63	398	52.51	3.26	0.94
Apps downloader	100	13.55	101	13.69	217	29.40	320	43.36	3.03	1.06
Voice recorder	129	17.55	103	14.01	209	28.44	294	40.00	2.90	1.11
Document reader	82	11.13	78	10.58	225	30.53	352	47.76	3.15	1.00
Email	107	14.42	61	8.22	186	25.07	388	52.29	3.15	1.08
Camera	98	13.14	75	10.05	163	21.85	410	54.96	3.19	1.07
Video player	69	9.32	85	11.49	181	24.46	405	54.73	3.25	0.99
Social media applications (Facebook, WhatsApp, Twitter	122	16.53	74	10.03	202	27.37	340	46.07	3.03	1.11
SMS	10	1.32	21	2.78	121	16.03	603	79.87	3.74	0.57
My academic progress depends on	Disagree completely		Disagree to some extent		Agree to some extent		Agree completely		Mean	Standard deviation
	f	%	f	%	f	%	f	%		
my own effort	6	0.78	22	2.85	132	17.12	611	79.25	3.75	0.54
the learning technologies available to me	23	3.08	37	4.96	253	33.91	433	58.04	3.47	0.73
well-structured whiteboard sessions	29	3.88	84	11.23	249	33.29	386	51.60	3.33	0.82
sufficient timely feedback from the NWU	32	4.30	47	6.31	224	30.07	442	59.33	3.44	0.80
administrative support structures at the NWU	23	3.11	46	6.22	237	32.07	433	58.59	3.46	0.75
accessibility of digital resources	32	4.33	60	8.12	246	33.29	401	54.26	3.38	0.81

Less than 48.88% agreed that implementation of new technologies in delivering of ODL programmes would assist them to be successful while 1.98% did not agree; 52.54%responded that interactivity should be encouraged in ODL programmes while only 0.94% did not; 61.24% responded that innovations would improve access to resources while 1.08% did not agree; 53.25% responded that innovations would enhance pedagogical methods for learning while 1.76% did not agree.

Of the various challenges that exist in ODL programme delivery, 34.84% responded that not having access to the internet was a challenge while 22.21% did not agree; 35.58% responded that not owning a device to connect to the internet was a challenge while 24.53% did not agree; 44.43% regarded their distance from a LSC as a challenge while 13.13% did not; 39.89% experienced difficulties downloading resources from websites while 17.67% did not experience these difficulties; and 31.95% responded that not being knowledgeable in the use of technologies was a challenge in ODL while 22.73% disagreed. More than sixty per cent (66.36%) of the respondents indicated that it was very important to access programme information in ODL, and very few indicated otherwise (3.15% did not agree).

Respondents had different perceptions and views regarding the sufficiency of support infrastructure the UODL have in place, and 43.85% agreed that administrative and logistical support was important, while 3.88% did not agree; 47.26% responded that academic support was important while only 3.74% disagreed; 47.06% perceived support at LSCs as important while 4.55% responded that academic support at learner support centres was not important; 51.94% responded that communication with the NWU was important while 4.82% did not agree; and 46.92% indicated that opportunities for learning at learner support centres were important while 6.43% did not agree.

Some (39.79%) felt that the technological possibilities for academic progress at the LSCs were sufficient while 6.85% did not agree. Some of the respondents (34.71%) indicated that the software installed on their devices was compatible to access resources while 12.13% responded that the software on their devices was not compatible for access to resources.

A large group of respondents had smartphones (65.37%). Smartphones have various features that can be used by students, but they must be confident using the various features, and 52.51% indicated that they use the internet to a large extent on their smartphones while 8.05% used this feature to a limited extent; 43.36% were confident to use the application downloader on the smartphone while 13.55% did not feel confident to use this feature; 40.00% used the voice recorder while 17.55% used the voice recorder to some extent; 47.76% were confident to use the document reader while 11.13% were not; 52.29% were very confident to use the email feature while 14.42% used this feature to a small extent; 54.96% regularly used the camera on the smartphone while 13.14% used this feature to some extent; 54.73% were very confident to use the video camera on their smartphone while 9.32% used it to a small extent; 46.07% were very confident to use various social applications while 16.53%

did not; and 79.87% used the SMS feature on the smartphone and only 1.32% used SMS to some extent.

Academic progress relies on various aspects and respondents indicated that 79.25% of their academic progress would depend on their own effort; very few (0.78%) disagreed; 58.04% agreed that the learning technologies available to them contributed to their academic progress while 3.08% did not agree; 51.60% indicated that well-structured whiteboard sessions contributed towards their academic progress while 3.88% did not agree; 59.33% requested sufficient timely feedback from the NWU while 4.30% disagreed; 58.59%. were satisfied with the administrative support structures at the NWU, whereas 3.11% disagreed; 54.26% agreed that accessibility to digital resources contributed to academic progress. and only 4.33% did not agree.

5.3   Factor analysis

A factor analysis determined the correlation of items of in the questionnaire and to indicate underlying constructs (Addendum 5.2). The factor analysis also enabled the researcher to explore the data for patterns, verify and decrease the number of variables within the questionnaire (Cohen, Manion, & Morrison, 2011b, p. 402) where subsequent factors were, in turn, intended to account for the maximum amount of the remaining common variance until, hopefully, no significant common variance remained (Suhr, 2006). The factor analysis clustered the data into homogeneous groups, created new factors, and the researcher gained insight into the constructs underlying the data (Garrett-Mayer, 2006). A principle axis factor analysis with Oblimin rotation was conducted on Parts B, C, D and E of the questionnaire (Addendum 5.2). The factor analysis validated the correlation coefficient between the factors. The shaded areas in the tables indicate the group items loading of each factor. All variables that had more than one factor loading were grouped in the table according to the best interpretability. Factor loadings of ≤0.30 were extracted from the factor analysis and not included in the tables.

Barlett's test of sphericity tested whether the correlation matrix was an identity matrix, which would indicate that the variables were unrelated and unsuitable for structure detention. Significance values ≤0.05 indicated that the factor analysis could be useful. The Barlett's test of sphericity (Cohen et al., 2011b) determined if the covariance matrix was an identity matrix which would indicate that the variables were unrelated and unsuited for structure detention. The Kaiser-Meyer-Olkim (KMO) tested whether the observed data and their correlations were large enough to form a concise factor structure (Cohen et al., 2011b, p. 641). In coherence the factor analyses the Cronbach's coefficient alpha (α) tested the reliability of the extracted factors—an alpha (α) that was reliable (α≥0.70) and highly reliable (α≥0.80)**.** Adequacy was determined using KMO (Cohen et al., 2011b) and indicated the measure of sample adequacy that ranged between 0 and 1 with a value of 0.50 as a suggested minimum. A measure of ≥0.90 indicated a good fit.

The researcher furthermore employed effect sizes to determine the practical significance of data collected. Practical significance is determined using the standardised difference in the means of two populations and effect sizes not only make the difference independent of units and sample size but also associate them with the spread of the data (Ellis & Steyn, 2003; Steyn, 2000). Effect sizes lie between 0 and 1 and measure the practical significance (Cohen et al., 2011a). Cohen (1988) provides the following guidelines regarding the effect sizes to determine practical significance:

- $d \leq 0.2$ relates to a small effect
- $d \leq 0.5$ relates to a medium effect
- $d \leq 0.8$ relates to a large effect.

The researcher considered data with $d \geq 0.8$ as practically significant. Medium and large effects were used in this interpretation. The researcher shaded medium and large effects in the tables. Data with $d \geq 0.8$ would be practically significant as they would be the result of a difference having a large effect (Cohen, 1988). A Spearman rank-order correlation (Addendum 5.3) determined the relationship between the extracted factors in the four themes (flexibility, TEL, interactivity and infrastructure in delivering DE programmes). Correlation is significant at $p \leq 0.05$ level (2-tailed). Only strong relationships ($r \geq 0.50$) were reported.

5.3.1 Reliability of extracted factors

The researcher had to determine the reliability of the questionnaire in order to establish if the questionnaire was reliable to collect data. Cronbach's coefficient alphas (α) were calculated to determine the internal consistency of items (factors) within the four themes: (i) Flexibility; (ii) TEL, (iii) Interactivity; and (iv) Infrastructure. The reliability coefficient ranges between 0 and 1. A value closer to one indicates a higher consistency while a value closer to zero indicates lower internal consistency. The alpha coefficient applied to this factor analysis: >0.90 very highly reliable, 0.80-0.90 highly reliable, 0.70-0.79 reliable, 0.60-0.69 marginally reliable and ≤0.60 low reliable (Cohen et al., 2011a). The researcher considered a Cronbach alpha (α) of ≥0.70 as a reliable and acceptable value (Cohen et al., 2011a).

The following sections discuss the factor analysis on Parts B, C, D, and E of the questionnaire.

5.3.2 Results of factor analysis for flexibility in distance education programme delivery

The items in Part B of the questionnaire focused on *Flexibility in DE programme delivery.* The factor analysis grouped the constructs as seven homogeneous groups according to Kaiser's criteria that all factors with eigenvalues larger than one are extracted (Field, 2009). Table 5.6 illustrates the pattern matrix of the seven extracted factors for Flexibility in DE programmes.

Table 5.6 **Pattern matrix for factor analysis for flexibility in distance education programme delivery**

| Question number | Question | Pattern matrix for factor analysis | | | | | | | Communalities Extracted values |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
		Flexible support	Flexible contact	Flexible content	Flexible access	Vehicles for flexibility	Flexible technology use	Barriers to flexibility	
18.1	Academic challenges	0.77							0.60
18.2	Administrative challenges	0.77							0.56
17.2	Communicate with the university on administrative issues	0.52							0.55
16	Frequent communication from the university improves the quality of service to me as an ODL student	0.48							0.36
17.1	Access resources for learning	0.40							0.51
13.2	I regularly attend *live* whiteboard sessions		-0.88						0.75
12.2	I regularly attend contact sessions at a learner support centre		-0.86						0.74
13.1	I prefer live whiteboard sessions to recorded sessions		-0.63						0.49
12.1	I regard contact sessions as worthwhile for the programme I am registered for		-0.62						0.50
14.2	Only hard copies of study material to complete DE programmes at the UODL			0.85					0.70
14.3	All study material in digitally format to complete DE programmes at the UODL			0.61					0.50
14.1	A combination of hard copies of study material and digital resources to complete DE programmes at the UODL			0.49					0.38
12.5	I watch recorded sessions at a time convenient to me				-0.82				0.68
13.3	I regularly download and watch recorded whiteboard contact sessions				-0.74				0.66
12.4	I connect to contact sessions from another location using my own device				-0.69				0.54
15.3	eFundi					-0.79			0.62
15.6	Social media (e.g. Facebook, Twitter)					-0.72			0.55
15.2	eMail					-0.67			0.51
15.1	Telephone (landline)								0.27
15.5	SMS						-0.86		0.73
15.4	Cell phone						-0.84		0.75
13.4	I do not have access to recorded whiteboard sessions							0.73	0.54
12.3	I do not regularly attend or connect to contact sessions							0.56	0.45
	Cronbach's Alpha	0.66	0.78	0.48	0.63	0.53	0.66	0.26	
	Mean	3.31	3.05	3.42	1.98	2.17	3.52	1.90	
	Standard deviation	0.52	0.85	0.88	0.77	0.82	0.75	1.09	
	p-value	0.06	0.00	0.06	0.60	0.16	0.00	0.21	
	Effect size	0.16	0.37	0.29	0.05	0.12	0.33	0.11	

Table 5.6 comprises seven factors and relates to the flexibility of delivering of DE programmes. Five variables grouped as factor 1; four as factor 2; three as factor 3, three as factor 4, three as factor 5, two as factor 6 and two factors as factor 7. The majority of the factors show a factor loading of ≥0.6: flexible support (0.66); flexible contact (0.78); flexible content (0.48); flexible access (0.63); vehicles for flexibility (0.53); flexible use of technology (0.66); and barriers to flexibility (0.26). The KMO measured 0.72, indicating that there had been adequate data for this factor analysis. The Barlett's test of sphericity showed a significance of p<0.00 for this factor analysis.

A thorough scrutiny revealed that factor 1 represented *flexible support* to students where all means of support were included: academic, administrative, communication and quality of service. The focus is on the flexibility of the support to improve the quality of the service students experience during the delivery of DE programmes. Improving methods of communication, particularly online, will enable students to access such support at any time and from any location. A mean of 3.31 (Table 5.6) indicates that respondents viewed communication as fundamental for success in DE programme delivery. Improving communication and interaction between role players in DE is fundamental for DE success (§3.2.3.1) (Areti & Bousiou-Makridou, 2006).

Factor 2 represented *flexible contact* for students enrolled in the DE programmes. Activities at the LSCs relate to live whiteboard sessions with the accredited facilitators. Such sessions enable students to choose their means of support. Students at a LSC can interact via the whiteboard with the facilitator on programme or module aspects which they require help on (Table 5.6) during the sessions as well as after sessions. A mean of 3.05 (Table 5.6) indicates that respondents regarded live sessions as important for flexible contact. There is a statistical significance (p=0.00) for respondents attending whiteboard sessions and contact sessions, indicating that having the option to attend these sessions adds flexibility in the delivery of DE programmes.

Factor 3 represented *flexible content* of study material available to students in digital and hard copy format. Students enrolled at the NWU UODL receive hard copies of their study material and have the option to access material on electronic platforms (eFundi and Moodle). Limiting students in their choice of study material format results in partial flexibility. Technologies introduced in programme delivery to students enable them to search, navigate and manipulate various web pages, presentations and study material (Domagk et al., 2010). A combination of the two options (digital and hard copies) would enable students more flexibility to access content; 65.1% (Table 5.2) of respondents indicated that they preferred a combination of formats of study material. A mean of 3.42 (Table 5.6) indicates that respondents considered the format of study material to be important, although the Cronbach Alpha (0.48) (Table 5.6) indicates an unacceptably low reliability between items regarding the flexibility of content.

Access to resources such as recorded sessions and connecting to whiteboard sessions using their own devices enables DE students to access resources and interact with online resources anywhere

and anytime (McNeil et al., 2000). Factor 4 represented *flexible access* for DE students to retrieve and download the recorded whiteboard sessions as well as resources, using their own devices. The UODL is obliged to provide adequate platforms for flexible access, to provide students with maximum opportunities to achieve academic success. A mean of 1.98 indicates that not many of the respondents had access to sufficient technologies to connect to sessions at a time convenient to them, therefore they were not able to download recorded sessions. This limited flexibility and access to resources. Improving technological infrastructure at LSCs and employing more platforms will improve assess and flexibility.

Providing DE students with multiple channels of communication and platforms for interacting with content would provide them with more control over their learning (Visser et al., 2012). Factor 5 comprised *vehicles for flexibility* and platforms used as vehicles for either communication or content sharing. Communication platforms comprise email, social media and LMS contributing to flexibility in DE programme delivery. Students are provided with various options to communicate, access and share information or content with lecturers and fellow students.

These vehicles furthermore refer to the availability of communication technologies and devices that would improve communication with the institution involved with DE programme delivery (Flemming & Hiple, 2004). Factor 6 comprised *flexible technology*—communication via SMS messages to inform students of: scheduled contact sessions, submission of assignments, registration procedures, and participation marks. Mobile communication affords the majority of students with the opportunity to communicate with their institution. The mean of 3.52 (Table 5.6) indicates the high preference for using cell phones and SMS to communicate with the university. There is a statistical significance (p=0.00) between SMS and cell phones used in the delivery of DE programmes. Creating flexibility and interactivity would remove barriers of time and location affording more students the opportunity to access resources for learning(Commonwealth of Learning, 2011).

Factor 7 comprised *barriers to flexibility*—no access to recorded whiteboard sessions, irregular attendance of contact sessions, and interferences to connect to whiteboard sessions. Limited access to resources influences academic progress negatively (Kanwar & Mishra, 2016). A DE institution must anticipate these barriers providing students with alternative options to access resources and support (Kanwar & Mishra, 2016). A mean of 1.90 (Table 5.6) indicates a low response rate regarding access to recorded sessions and attendance of contact sessions. Many of the respondents reside in deep rural areas too far from the LSCs or they as yet do not have sufficient access to technologies, both barriers to access (§3.2.4, §3.3.1 & §3.4.1).

5.3.3 Results of factor analysis for technology enhanced learning in distance education programme delivery

The items in Part C of the questionnaire focused on *TEL in distance programme delivering*. The factor analysis grouped the constructs as ten homogeneous groups according to Kaiser's criteria that all factors with eigenvalues larger than one should be extracted (Field, 2009). Table 5.7 illustrates the pattern matrix of the ten extracted factors for TEL in DE programme delivery.

Table 5.7   **Pattern matrix for factor analysis of Technology Enhanced Learning (TEL) in distance programme delivery**

| Question number | Question | Pattern matrix for factor analysis | | | | | | | | | | Communalities Extracted values |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
		TEL support	TEL devices	Assessment with TEL	Feedback with TEL	Interaction with TEL	Possibilities of TEL	TEL content	Advantages of TEL	Flexibility with TEL	TEL options	
24.2	Easy access to administrative support	0.74										0.73
24.3	Easy access to academic support	0.74										0.71
24.1	Resources for learning, available on any device	0.65										0.58
24.4	Access to the learner support centre of my choice	0.60										0.61
23.1	Study material dispatched to me in time	0.48										0.33
23.3	The learner support centre close to the place where I live	0.41										0.42
22.1	Interactive whiteboards at learner support centres		0.63									0.64
28.2	Only teaching through whiteboard sessions		0.60									0.58
20	The learner support centre where I attend contact sessions is well equipped to support my learning needs		0.58									0.59
23.2	Interaction taking place between me and the lecturer during whiteboard sessions		0.41									0.52
21	There are sufficient learner support centres in the geographical area where I live / work to attend contact sessions		0.39									0.46
22.2	Text messages (SMS) from the UODL		0.39									0.41
30.2	Formal written examinations			0.88								0.76
30.1	The assignments which I submit to the UODL			0.81								0.68
30.3	Portfolios as evidence of competence			0.80								0.67
19.2	Administrative challenges				-0.93							0.79
19.3	Technological challenges				-0.88							0.73
19.1	Academic challenges				-0.87							0.72
28.4	Interaction between the lecturer and students					0.77						0.68
28.3	A combination of whiteboard and face-to face teaching					0.75						0.65
28.1	Only face-to-face teaching at learner support centres					0.48						0.48
29.1	During live whiteboard sessions						0.62					0.47
29.2	On assignments which I submitted to the UODL						0.54					0.58
26.5	Download resources to assist me in my studies						-0.40					0.54
31	The UODL usually schedules contact sessions at times and dates						0.31					0.33

124

Question number	Question	Pattern matrix for factor analysis										Communalities Extracted values
		1	2	3	4	5	6	7	8	9	10	
		TEL support	TEL devices	Assessment with TEL	Feedback with TEL	Interaction with TEL	Possibilities of TEL	TEL content	Advantages of TEL	Flexibility with TEL	TEL options	
	convenient to me											
29.3	Via technologies for learning, e.g. tablets, smartphones							0.69				0.58
22.4	Internet-based resources and tools							0.68				0.64
22.3	Communication devices (tablets, smart phones) to access learning resources							0.65				0.52
28.5	Frequent use of technologies for learning							0.50				0.57
22.5	Computer-based learning							0.46				0.58
25.2	Download administrative information regarding my studies							0.38				0.54
25.4	Communicate with fellow students regarding my studies								0.76			0.63
23.4	My interaction with other students while sharing academic experiences								0.67			0.62
25.3	Communicate with lecturers regarding my studies								0.45			0.52
25.5	Download resources to assist me in my studies								0.43			0.64
26.2	Learn at my own pace									0.82		0.69
26.1	Learn at my own convenience									0.80		0.70
26.4	Access information pertaining to my studies									0.60		0.70
26.3	Access learning material from any location									0.59		0.68
25.6	Download recorded contact sessions									0.38		0.55
27	The use of various technologies for learning contribute to my learning									0.29		0.56
25.1	Access social media *only* regarding my studies and not for other communication functions										0.56	0.50
30.4	Combination of continuous learning and examinations			0.418							-0.43	0.51
	Cronbach's Alpha	0.78	0.64	0.77	0.83	0.52	0.37	0.75	0.71	0.83	0.12	
	Mean	3.16	2.98	3.42	3.19	2.94	3.72	3.28	3.18	3.47	2.72	
	Standard deviation	0.64	0.64	0.65	0.75	0.96	0.92	0.59	0.68	0.54	1.08	
	p-value	0.07	0.00	0.05	0.14	0.97	0.24	0.78	0.02	0.30	0.10	
	Effect sizes	0.17	0.33	0.19	0.11	0.00	0.12	0.03	0.21	0.10	0.16	

Variables from Part C of the questionnaire (Table 5.7) comprised ten factors and related to TEL in DE programme delivery. Six variables grouped as factor 1; six as factor 2; three as factor 3, three as factor 4, three as factor 5, four as factor 6 and six as factor 7, four as factor 8, six as factor 9 and two as factor 10. The majority of the extracted factors showed a high reliability with a Cronbach Alpha ≥0.70: TEL support (0.78); TEL devices (0.64); assessment with TEL (0.77); feedback with TEL (0.83); interaction with TEL (0.52); possibilities of TEL (0.37); TEL content (0.75); advantages of TEL (0.71); flexibility with TEL (0.83) and TEL options (0.12). The KMO measured 0.89 indicating that there had been adequate data for this factor analysis. The Barlett's test of sphericity showed a significance of p<0.00.

Visser et al. (2012) state that accessibility, availability and convenience are the main characteristics of DE and DE programme delivery. Factor 1 represented *TEL support:* creating a learning environment, utilising resources, accessing administrative and academic support, and attending sessions at LSCs. Digital resources should be used with ease and contribute towards an effective learning environment (Green et al., 2006). A mean of 3.16 (Table 5.7) indicates that respondents viewed access of support structures and creating a learning environment as important.

Manouselis et al. (2011) state that TEL covers all technologies that could support any form of teaching and learning activity. Factor 2 represented *TEL devices* used in delivery of DE programmes. Access to whiteboard sessions and LSCs enable students to use devices at these centres and technological devices to access teaching and learning. All UODL LSCs are equipped with the technology to afford students effective teaching and learning with technology. Students use their devices and devices at LSCs to download resources and connect to sessions. A mean of 2.98 (Table 5.7) indicates that respondents viewed TEL devices as important in delivering DE programmes (p=0.00).

Factor 3 represented *assessment for TEL* and comprised respondents' views on technology based assessment: assignments, examinations and portfolios of evidence. Submission of assignments and sections of examination are done electronically for selected programmes. Feedback on assignments and portfolios are important and the majority of respondents (77.71%) (Table 5.3) indicated that feedback by lecturers on assignments assist students to monitor their progress. Further development of TEL would enable more students to use electronic platforms to submit assignments, portfolios and online assessment. Electronic feedback from lecturers on students' assignments and portfolios would encourage TEL usage. A mean of 3.42 (Table 5.7) indicates that respondents felt strongly about using TEL for assessment and its significance in DE (p=0.049).

A technological framework can only be validated once the technological framework has been implemented and evaluated in the particular geographical area where students reside (Council on Higher Education, 2014). From the students' perspective, there should be effective communication among the student, the technologies for learning, and the lecturer responsible for the programme

(Scanlon & Issroff, 2005). Factor 4 represented *feedback for TEL* and comprised academic, administrative and technological challenges using technologies to support students in these challenges. A sufficient technological framework enables effective communication and support to students. Roleplayers in DE programme delivery will be more informed of students' challenges if the technological support structure is expanded. A mean of 3.19 (Table 5.7) indicates that sufficient technological support is required to assist them in these challenges. A Cronbach Alpha (0.83) (Table 5.7) shows a high reliability.

Towobola and Raimi (2011) and Dzakiria and Christopher (2010) state that the success of ODL is determined by the various types of technologies used to enable interaction and communication, either through real time (synchronous) or in delayed time (asynchronous). Factor 5 represented *interaction with TEL* in a blended environment: interaction between teacher and student, interaction between the student and the technology; interaction between the teacher, student, technology and the content. Various options for teaching-and-learning exist for students at the UODL. DE students at the UODL have the option to access teaching-and-learning through either face-to-face, online or a combination of face-to-face and online. DE institutions have to ensure that various options exist for students to take part in teaching-and-learning. Enabling students to choose their means of participating in the teaching-and-learning experience (face to face, online or blended) creates flexibility in delivering programmes. A mean of 2.94 (Table 5.7) indicates that students preferred interaction between student and lecturer, irrespective of the format.

Factor 6 represented *possibilities of TEL* and comprised the various teaching and learning opportunities for students to access resources, interact with facilitator, and plan their time. These were students' use of ICT communication devices to schedule times and dates for contact sessions, and academic feedback and support provided to students via SMS, Moodle, eFundi and through the various websites available. The current system provides basic services—access to resources and interactive whiteboard sessions, and feedback of assignments. However, in DE other forms of communication are imperative to ensure the success of DE (Chowdhury & Khatun, 2013; Dzakiria & Christopher, 2010). A mean of 3.72 (Table 5.7) indicates that more possibilities of TEL should be investigated to accommodate all aspects of DE programme delivery.

Picciano (2009) states that content can be delivered through direct instruction or through online strategies. Factor 7 represented *TEL content* and comprised the different ways of accessing content: internet based: via technologies and/or via online communication methods. The availability of TEL in delivering DE programmes enables students to access resources and use various devices for support, communication and feedback. A mean of 3.28 (Table 5.7) indicates that respondents would use TEL to access resources (Table 5.7).

Manouselis et al. (2011) state that technology-enhanced learning (TEL) covers all technologies that could support any form of teaching-and-learning activity. Factor 8 represented *advantages of TEL*

and comprised the use students' use of ICT communication devices to communicate with fellow students, to create a learning environment by sharing academic experiences through interaction, and communication with lecturers and peers. TEL provides support in many formats to students, irrespective of their location. Interaction with lecturers and fellow students through TEL is an advantage as content and resources can be accessed at any time from any location using various devices. TEL offers various options and platforms for communication and sharing of ideas for these students. Introducing various platforms will contribute towards further improving TEL. A mean of 3.18 (Table 5.7) indicates that more advantages exist for TEL than disadvantages, as sharing of ideas, content and access to support are important for success in DE (p=0.02).

Delivering DE programmes to students in diverse geographical areas, adhering to the concepts any time and any place, adds flexibility to the delivery of programmes (Visser et al., 2012). Factor 9 represented *flexibility with TEL* and comprised how ICT communication devices and technologies for learning assist students with learning. Affording students with the opportunity to access learning from any location and time convenient to them creates flexibility in learning. A mean of 3.47 (Table 5.7) indicates that respondents agreed that TEL adds to flexibility in delivering DE programmes.

The use of social media and other online experiences or a combination of online and social media assists students to develop a personal learning environment (PLE) (Dabbagh & Kitsantas, 2011). Factor 10 represented *TEL options* and comprised access information, reminders regarding academic and administrative support and access links to resources, via social media. A mean of 2.72 indicates that respondents agreed to a certain extent that social media were only used for purposes of their studies.

5.3.4   Results of factor analysis for interactivity in distance education programme delivery

The items in Part E of the questionnaire focused on *interactivity in distance programme delivering*. The factor analysis grouped the constructs as ten homogeneous groups according to Kaiser's criteria that all factors with eigenvalues larger than one is extracted (Field, 2009). Table 5.8 illustrates the pattern matrix of the six extracted factors for TEL in DE programme delivery.

Table 5.8   **Pattern matrix of factor analysis of interactivity in distance education programme delivery**

| Question number | Questions | Pattern matrix for factor analysis | | | | | | Communalities Extracted Factors |
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
		Characteristics of interactivity	Barriers to interactivity	Support for interactivity	Ubiquitous interactivity	F2f Interactivity	Flexibility of interactivity	
36.5	Communicating over distance, using technologies for learning	0.69						0.53
36.1	Enabling more effective *learning*	0.68						0.60
36.3	Communicating through various devices	0.67						0.55
36.8	Acquiring skills for learning via technologies for learning	0.64						0.56
36.2	Enabling more effective *teaching*	0.64						0.55
36.9	Applying much effort to use various technologies for learning	0.61						0.48
32.4	Content made available through technologies for learning	0.53						0.49
39.1	Participating in teaching-and-learning irrespective of time or location	0.48						0.40
36.7	Learning on my own, using applicable technologies for learning	0.47						0.44
36.6	Interacting with other students about the content	0.44						0.44
33.5	Over distance using various technologies	0.40						0.39
35	Motivation (having a strong reason to act or to accomplish success) is important to achieve success in ODL							0.08
38.5	Unavailability of technologies for learning		0.86					0.74
38.6	Inability to interact with the technologies for learning		0.85					0.74
38.2	No access to resources		0.81					0.65
38.3	Inability to download resources		0.80					0.65
38.4	Restricted communication opportunities with lecturers		0.76					0.60
38.1	Distances to travel to learner support centres		0.61					0.43
40.3	Receiving digital access to learning resources			-0.79				0.68
40.2	Receiving digital access to study material			-0.76				0.60
40.1	Receiving support at any learner support centre			-0.67				0.54
40.6	Accessing academic and administrative support at NWU			-0.66				0.51
40.4	Attending contact sessions in my area			-0.60				0.40
40.5	Submitting assignments electronically			-0.50				0.32
39.3	Equal access to resources			-0.34				0.32
39.2	Participating in teaching-and-learning only at specific times and specific locations							0.18
34.3	From a Wi-Fi spot				0.71			0.53
34.2	At my place of work				0.67			0.46
34.5	On a computer at home				0.60			0.40

Question number	Questions	Pattern matrix for factor analysis						Communalities Extracted Factors
		1	2	3	4	5	6	
		Characteristics of interactivity	Barriers to interactivity	Support for interactivity	Ubiquitous interactivity	F2f Interactivity	Flexibility of interactivity	
34.4	At an internet café				0.47			0.31
34.1	On a smartphone				0.42			0.31
33.2	With my lecturers					-0.72		0.61
33.4	Within a classroom (face-to-face learning)					-0.72		0.54
36.4	Communicating face-to-face					-0.59		0.40
32.1	A lecturer-centred approach					-0.56		0.34
33.3	With the administration of the NWU UODL					-0.54		0.46
33.1	With my fellow students					-0.52		0.29
32.3	Resources made available through innovative media					-0.40		0.42
32.2	A student-centred approach					-0.30		0.23
37.2	Supporting teaching-and-learning far away from residential campuses						0.77	0.64
37.4	Accommodating students separated in time or distance						0.74	0.60
37.3	Developing self-instructional programmes						0.72	0.59
37.1	Considering the non-residential (off-campus) location of students						0.71	0.51
37.5	Using an assortment of technologies for learning used in delivery of programmes						0.59	0.58
	Cronbach's Alpha	0.86	0.88	0.76	0.64	0.75	0.82	
	Mean	3.44	2.81	3.16	2.83	3.27	3.31	
	Standard deviation	0.48	0.88	0.57	0.78	0.55	0.61	
	p-value	0.28	0.17	0.04	0.77	0.01	0.88	
	Effect sizes	0.09	0.12	0.18	0.02	0.23	0.01	

Variables from Part D (Table 5.8) of the questionnaire comprised six factors and related to *interactivity* in DE programme delivery. Eleven variables grouped as factor 1; six as factor 2; seven as factor 3, five as factor 4, eight as factor 5 and five as factor 6. The majority of the extracted factors showed a high reliability with a Cronbach Alpha ≥0.70: characteristics of interactivity (0.86); barriers to interactivity (0.88); support for interactivity (0.76); ubiquitous interactivity (0.64); face to face (f2f) interactivity (0.75); flexibility of interactivity (0.82). The KMO measured 0.88 indicating that there had been adequate data for this factor analysis. The Barlett's test of sphericity showed a significance of p<0.00.

Interactivity is acknowledged as an imperative feature of internet- and web-based learning systems. When teaching and learning take place in a more online environment, the DE providers should address the six dimensions of interactivity: (i) determination to utilise information; (ii) amount and variety of user choices; (iii) expertise to monitor information across the entire population; (iv) ease of adding information; (v) interpersonal communication and facilitation (synchronous and asynchronous); and (vi) responsiveness of resources to the user (Chou, 2003).

Factor 1 presented *characteristics of interactivity* in DE programmes, particularly the dimension of interpersonal communication and facilitation: responsiveness of resources to user, and amount and variety of choices. The interactivity in DE programmes enables interpersonal communication (with peers facilitators, and DE providers) via technological devices; allows for teaching and learning using devices; and supports access to content. A mean of 3.44 (Table 5.8) indicates that interactivity is important to DE students as it will contribute to their success.

Addressing the six dimensions of interactivity is vital when DE providers create programmes and the support systems to deliver successful programmes. However, there are dimensional barriers which hinder interactivity: unavailability of technologies for learning; inability to interact with the technologies; incompetence to download resources; restricted interpersonal communication; and distance which students have to travel to utilise information. Barriers will negatively influence success in DE and academic progress. Students therefore should have access to technologies, receive training to interact with these technologies, and develop their interpersonal skills, to eradicate these barriers to DE programme delivery. In ODL the learner is separated from the lecturer and the challenge is to create a larger dimension of openness, accessibility and flexibility (Ghosh et al., 2012). A mean of 2.81 (Table 5.8) indicates that these barriers do exist and that respondents have experienced these barriers.

Factor 3 represented *support for interactivity* and comprised accessibility in ODL and equal access to resources. In order to have successful DE programmes, UODL must address these academic and administrative barriers. Support includes affordances of equal access to resources irrespective of location. A mean of 3.16 (Table 5.8) indicates accessibility to support and equal opportunities will

play a role in the success of ODL, and has a statistical significance (p=0.04) indicating that support for interactivity is detrimental for the success of DE programmes.

Factor 4 represented *ubiquitous interactivity* and comprised the dimension of amount and variety of user choices— the amount (number) of places and variety of choices students have to access academic resources and support. Respondents accessed internet from Wi-Fi hotspots, their workplace, an internet café, smartphone or from the computer at home. If internet is used for delivering DE programmes, there must be ubiquitous interactivity. The UODL creates ubiquitous interactivity with free internet and Wi-Fi at all LSCs to accommodate all students, irrespective of location, to access resources which they can benefit from in their studies. A mean of 2.83 (Table 5.8) indicates that the majority of respondents access internet in different ways and possibly use a wide variety of devices. Interpersonal communication (synchronous and asynchronous) is a vital dimension of interactivity to best meet students' instructional needs (Ellis & Mathis, 1985; Hackman & Walker, 1990). Factor 5 represented *face-to-face interactivity,* using the whiteboard and innovative media to create a student centred approach. A student centred approach is preferred in DE as their circumstances and environments must be assessed in order to successfully design a teaching-and learning environment that will benefit all students. Interaction using technologies for learning is as direct as face-to-face communication, with the advantage that more information and content can be shared using technologies for learning. A mean of 3.27 (Table 5.8) indicates that face-to-face interactivity is a significant (p=0.01) contributor to the success of ODL.

Factor 6 represents *flexibility of interactivity* relates to various of the dimensions of interactivity— support to non-residential location of students (interpersonal communication and facilitation by means of synchronous and asynchronous options), teaching and learning support far from residential campuses (interpersonal communication and facilitation by means of synchronous and asynchronous options), development of self-instructional programmes (variety of user options), accommodating students separated in time and distance and the assortment of technologies used in delivery of ODL programmes (interpersonal communication and facilitation by means of synchronous and asynchronous options). These aspects promote flexibility in ODL because of the diversity: the geographical location of students in ODL is different from one another, as are their teaching- and-learning needs. A mean of 3.31 (Table 5.8) indicates that flexibility in the various dimensions of interactivity is crucial for ODL.

5.3.5   Results of factor analysis for infrastructure distance education programme delivery

The items in Part E of the questionnaire focused on infrastructure in distance programme delivery. The factor analysis grouped the factors as ten homogeneous groups according to Kaiser's criteria that all factors with eigenvalues larger than one be extracted (Field, 2009). Table 5.7 illustrates the pattern matrix of the seven extracted factors for infrastructure in DE programme delivery.

Table 5.9　　Pattern matrix of factor analysis of infrastructure in distance education programme delivery

Question number	Questions	Pattern matrix for factor analysis							Communalities Extracted Factors
		1	2	3	4	5	6	7	
		Infrastructure for student support	Infrastructure & technology	Barriers to infrastructure	Innovation for infrastructure	Infrastructure for programme delivery	Infrastructure options	Infrastructure for motivation	
44.3	Support at the learner support centres	0.86							0.74
44.2	Academic support	0.84							0.75
44.5	Opportunities for learning at learner support centres	0.83							0.72
44.4	Communication with the NWU	0.80							0.70
44.1	Administrative and logistical support	0.77							0.68
45	Sufficient technological possibilities are available to me for academic progress	0.45							0.54
47.2	Apps downloader		-0.81						0.72
47.1	Internet		-0.77						0.70
47.4	Document reader		-0.68						0.57
47.3	Voice recorder		-0.55						0.66
46	The software installed on my device is compatible to access resources		-0.55						0.49
47.5	Email		-0.50						0.52
42.2	Not owning a device to connect to internet			0.83					0.70
42.4	Experiencing difficulty to download resources from websites			0.8					0.70
42.1	Not having access to internet			0.80					0.68
42.5	Not being knowledgeable in the use of technology			0.80					0.66
42.3	Being a distance away from a learner support centre			0.71					0.55
41.3	Improving of access to resources				0.85				0.71
41.2	Encouraging of interactivity				0.83				0.70
41.4	Enhancing pedagogical methods for learning				0.82				0.68
41.1	Implementing of new technologies for learning in the delivery of ODL programmes				0.76				0.68
48.5	Administrative support structures at the NWU					-0.85			0.75
48.4	Sufficient timely feedback from the NWU					-0.84			0.68
48.6	Accessibility of digital resources					-0.79			0.72
48.3	Well-structured whiteboard sessions					-0.65			0.55
48.2	The learning technologies available to me					-0.60			0.51
47.6	Camera						0.83		0.74
47.7	Video player						0.74		0.72
47.8	Social media applications (Facebook, WhatsApp, Twitter)						0.64		0.53

Question number	Questions	Pattern matrix for factor analysis							Communalities Extracted Factors
		1	2	3	4	5	6	7	
		Infrastructure for student support	Infrastructure & technology	Barriers to infrastructure	Innovation for infrastructure	Infrastructure for programme delivery	Infrastructure options	Infrastructure for motivation	
48.1	My own effort							0.75	0.64
47.9	SMS							0.61	0.56
43	Internet accessibility is important for my success in ODL as I use it to access programme information							0.26	0.26
	Cronbach's Alpha	0.89	0.84	0.86	0.84	0.85	0.78	0.43	
	Mean	3.27	3.05	2.87	3.46	3.41	3.16	3.68	
	Standard deviation	0.66	0.79	0.90	0.55	0.62	0.88	0.62	
	p-value	0.76	0.07	0.38	0.65	0.09	0.17	0.42	
	effect sizes	0.03	0.16	0.08	0.04	0.16	0.13	0.08	

Variables from factor E (Table 5.9) comprised seven factors and related to DE infrastructure. Six variables grouped as factor 1; six as factor 2; five as factor 3, four as factor 4, five as factor 5, three as factor 6, and three as factor 7. The majority of the extracted factors had a factor loading of ≤0.70: infrastructure for student support (0.89); infrastructure and technology (0.84); barriers to infrastructure (0.86); innovation for infrastructure (0.84); infrastructure for programme delivery (0.85); infrastructure options (0.78); and infrastructure for motivation (0.43). The KMO measured 0.89 indicating that there had beenadequate data for this factor analysis. The Barlett's test of sphericity showed a significance of p<0.00.

Garrison and Kanuka (2004) state that effective teaching and learning is obtained when institutions invest in a reliable, stable and accessible infrastructure. Factor 1 represents *infrastructure for student support* and comprised administrative support, logistical support, academic support, LSCs support, communication with NWU, opportunities for learning at LSCs and the technologies available to students for academic progress. The infrastructure at the UODL enables support for students in all aspects of their studies. ODL requires all technological possibilities to be used to support students. A mean of 3.27 indicates that the infrastructure at the UODL provides sufficient support to students.

It should be determined whether the proposed technologies for learning are suited to the teaching-and-learning environment where they will be implemented (Stoner, 1996). Factor 2 represented infrastructure and technology and related to the confidence of respondents to use features on their smartphone and if the software on their devices was suitable to access resources. Using features on their smartphones enables students to access resources and communicate with the university using various options for communication. A mean of 3.05 indicates that respondents are confident to use various features on their smartphones.

Success in DE can only be achieved when sufficient support is provided to students once situational and institutional barriers have been removed (Potter, 2013) In ODL the learner is separated from the lecturer and the challenge is to create a larger dimension of openness, accessibility and flexibility (Ghosh et al., 2012). Factor 3 represents *barriers to infrastructure* and comprised challenges of ODL such as: insufficient access to internet, not having a device to connect to the internet, the distance away from LSCs, and the struggle to download resources and use technologies. With these challenges the institution delivering these programmes must anticipate how these challenges will be addressed. Dzakiria and Christopher (2010) state that the success of ODL is determined by the various types of technologies used to enable interaction and communication, either through real time (synchronous) or in delayed time (asynchronous). ODL combines DE and OL (Kanwar & Mishra, 2016) to make learning affordable for students and provide access to students in HEIs (Garrett, 2016). A mean of 2.87 indicates that the challenges mentioned must constantly receive attention in order to remove all barriers that could influence success for students in ODL.

Factor 4 represented *innovation for infrastructure* and comprised pedagogical methods, improving access to resources, encouraging interactivity, implementing new technologies for learning, and assisting students with learning. DE institutions must establish a technological infrastructure to improve overall service delivery and support in ODL. Interaction between role players will increase if more students are encouraged to use new technologies for learning (Wei et al., 2015). A mean of 3.46 indicates that more innovative technologies must be identified for ODL to assist students in their learning.

Factor 5 presented *infrastructure for programme delivery* and comprised learning technologies available, well-structured whiteboard sessions, sufficient timely feedback from the NWU and administrative support structures at the NWU that determined academic progress of students. The structure and format of teaching-and-learning, be it face to face or interactive whiteboard sessions, must accommodate all DE students. Communication in any format will contribute to students' academic progress. The communication infrastructure forms the basis of all support to DE students. Once the technologies have been identified for delivery of programmes at a DE institution, an infrastructure for academic and administrative support must be established. Communication and support to students must be available on various platforms identified, and all students must have access to these platforms. A mean of 3.41 indicates that a definite infrastructure must be in place for DE students to achieve academic progress.

Beldarrain (2006) states that with the ever-evolvement of emerging technologies and tools available, DE will be pushed to create learning environments that will benefit students in the long run. To improve the learning environment and heighten interactivity, audio and video can be integrated in the content. Factor 6 represented *infrastructure options* and features such as the camera, video player and social media applications on their smartphones which respondents were comfortable using. A mean of 3.161 indicates that respondents were confident to use application (apps) on their smartphones.

Factor 7 represented *infrastructure for motivation* and comprised students' academic progress through their own effort, confidence in using SMS, and the importance of internet accessibility for success in ODL. ODL students will experience success when they have confidence in using technological features that assist them in their learning (Glover et al., 2005). Using SMS confidently and being able to access the internet will motivate students and create a personal learning environment enabling students to learn on their own. A mean of 3.68 indicates that an infrastructure for support will motivate learning.

5.3.6   Synopsis of four themes derived from the principal component axis factor analysis: Flexibility, technology enhanced learning, interactivity, and infrastructure

Figure 5.2 illustrates a synopsis of the four themes (essential aspects) and factors allocated to each theme of the principal axis factor analysis conducted on Parts B, C, D, and E of the questionnaire.
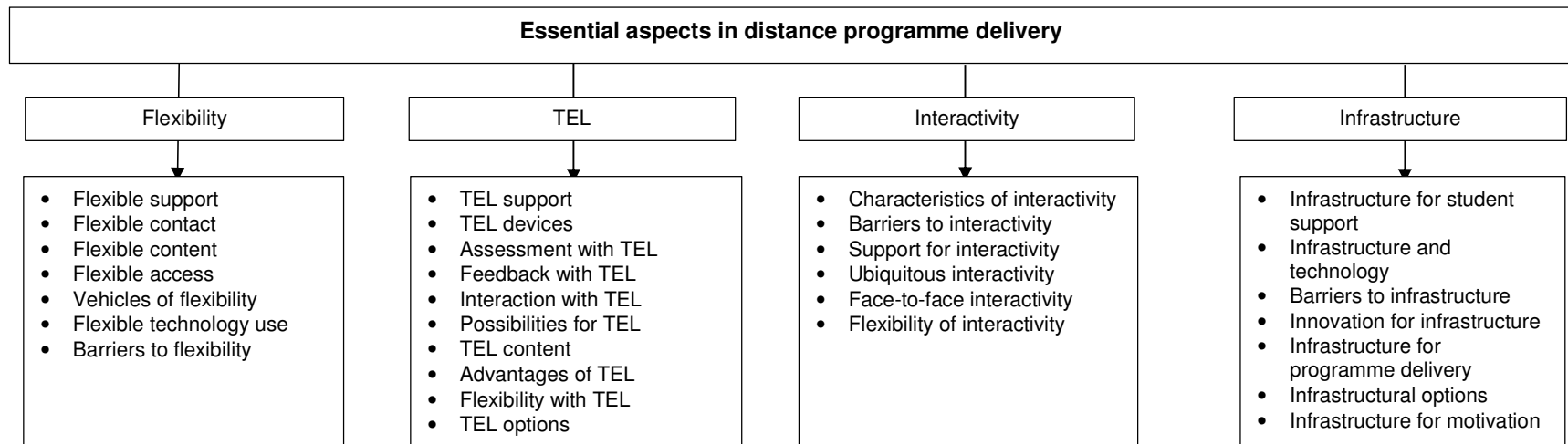
Figure 5.2   Synopsis of four themes derived from the principal component axis factor analysis
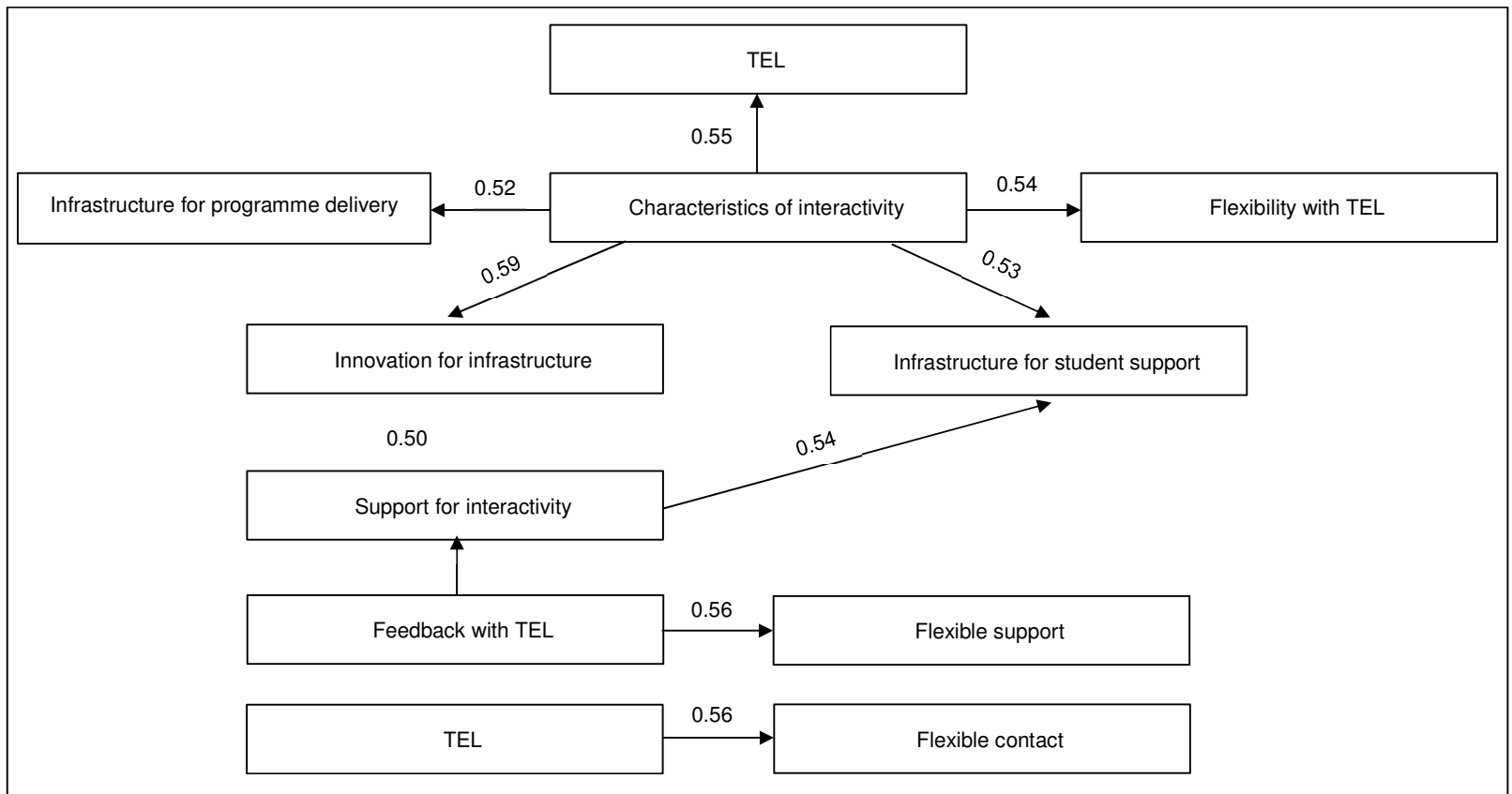
Figure 5.3   Linear relationship between flexibility, TEL, interactivity and infrastructure

5.4   Results of Spearman rank order correlations

Figure 5.3 presented a diagram indicating the linear relationships between Flexibility (Table 5.6), TEL (Table 5.7), interactivity (Table 5.8) and infrastructure (Table 5.9) (following pages).

The following sections discuss the Spearman rank order correlation r_s of the extracted factors, and the four themes, i.e. flexibility (Addendum 5.4). Values of $r_s \geq 0.50$ are large effects which are indicative of practical significant correlations and are described. Only these values are reported in the following sections.

5.4.1   Correlation between the characteristics of interactivity and infrastructure for student support

Correlation relationships between the factors relating to the characteristics of interactivity and infrastructure for student support (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s=0.53; p=00). Communication and interactivity are two aspects that are pivotal for success in DE (Areti & Bousiou-Makridou, 2006; Isman et al., 2003). Stoner (1996) states in his life cycle model of technologies for learning integration (Figure 3.4) that during the initiation phase of this cycle, technologies and a technological infrastructure must be developed, affording students access to all resources; furthermore improving communication between role players in DE programme delivery. Establishing a communication infrastructure whereby students can interact with the institution, resources and role players will improve academic and administrative support in DE programme delivery.

5.4.2   Correlation between the characteristics of interactivity and innovation for infrastructure

Correlation relationships between the factors relating to interactivity and innovation for infrastructure (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s=0.59; p=00). Interactivity was explained in §4.2. New innovations will enable students to explore more learning spaces and assist them to develop new learning spaces (Johnson et al., 2015). The variety of ICTs available within a DE structure encourages interactivity and enables students to access resources and learn in numerous ways, in turn enhancing the total learning process (Ghosh & Das, 2014). Innovation and technologies transform programmes into a learner centred approach (Kuboni et al., 2014). DE institutions must continue to implement more ICT technologies, enabling improved communication and programme delivery to students and enhancing the learning process as students will have access to more resources, transform learning to a learner centred approach, and improve communication channels and interaction institutions.

5.4.3 Correlation between the characteristics for interactivity and infrastructure for programme delivery

Correlation relationships between the factors relating to the support for interactivity and infrastructure for programme delivery (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s=0.52; p=00). Collis and Wende (2002) state that the ICTs and use of rich pedagogical practices will encourage students to use of ICT in DE. Enabling more interactivity and implementing a variety of technologies in delivery of DE programmes will improve programme delivery and interactivity. DE institutions must ensure that a sound technological infrastructure is in place, affording more students to interact with the institution and access resources more frequently.

5.4.4 Correlation between the support for interactivity and infrastructure for student support

Correlation relationships between the factors relating to the support for interactivity and infrastructure for student support (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s=0.54; p=00). New ICTs provide additional possibilities for learner support and interactivity removing barriers of time and location (Kuboni et al., 2014). DE institutions must not only implement new technologies to deliver programmes in various locations, but also all technologies implemented must be able to support students in all aspects of their studies, improving interactivity and communication. DE students must be able to access support from any place and at any time. Reiter et al. (2013) states that asynchronous learning's aim is to support any learning style and affording students with various options to access resources and support.

5.4.5 Correlation between the support for interactivity and innovation for infrastructure

Correlation relationships between the factors relating to the support for interactivity and innovation for infrastructure (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s=0.50; p=00). A learning culture could be created amongst learners with improved usage of technologies, whereby the level of interactivity will be increased (Andersson & Hatakka, 2010). DE institutions must enable more students to interactively take part in all sessions, discussions and feedback through new technologies. It is important that the technologies used within a learning environment suit that environment's teaching and learning (Stoner, 1996). Choosing suitable technologies for a specific environment will bring more innovation into the support infrastructure of the institution and will enable more interactivity. Increased interactivity includes interactivity between the learners and facilitators and interactivity between the learner and the device (Hoffman & Nova, 1996).

5.4.6 Correlation between the characteristics of interactivity and technology enhanced learning

Correlation relationships between the factors relating to the characteristics of interactivity and TEL content (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s=0.55; p=00). TEL is not only concerned about content, but includes learning paths for learners to navigate to resources and engage in collaborative peer learning activities (Manouselis et al., 2011). Institutions delivering DE programmes must provide sufficient guidance and information to learners to enable them to access content as well as support structures and resources.

5.4.7 Correlation between the characteristics of interactivity and flexibility with technology enhanced learning

Correlation relationships between the factors relating to the characteristics of interactivity and flexibility with TEL (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s =0.54; p=00). TEL must widen access to learning for DE students, improve quality of teaching and learning and promote participation and inclusiveness (Jenkins et al., 2011). DE students, irrespective of location and timeframe must be able to access resources and support structures. Institutions offer a variety of platforms that students could access, but students do not always have the technology for access. DE institutions must evaluate which technologies are available to students and then develop programmes that suit these technologies. If suitable technologies are used in DE programme delivery, flexibility will be evident when accommodating asynchronous learning.

5.4.8 Correlation between the infrastructure for student support and technology enhanced learning support

Correlation relationships between the factors relating to the infrastructure for student support and TEL support (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s=0.50; p=00). Support to DE students include academic and administrative support on any platform the institution makes available to students. These support structures must accommodate technological support as well as support to students having no access to technologies. Before institutions embark on delivery of DE programmes, a sufficient support infrastructure must be developed to support students using devices or students not having access to technologies.

5.4.9 Correlations between feedback with technology enhanced learning and flexible support

Correlation relationships between the factors relating to feedback with TEL and flexible support (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s=0.56; p=00). Feedback was explained in Table 4.2 and §3.2.3. NWU UODL students indicated (Table 5.1) that 65.37% had smartphones and 87.15% of the respondents indicated that they preferred receiving

information via SMS. Institutions must keep in mind that all students do not have access to technologies and that they rely on other means, basic communication such as SMS, as a support structure for their studies. Regular feedback on all platforms used by the institution will encourage active participation. Students do not want to feel lost in the system and must constantly be informed on all aspects of the programme they are enrolled for.

5.4.10   Correlation between technology-enhanced learning devices and flexible contact

Correlation relationships between the factors relating to TEL devices and flexible contact (Figure 5.3) indicate that there is a strong significant relationship between these two factors (r_s=0.56; p=00). Anywhere and anytime learning was explained in §3.4.1 & 3.3.1. Flexible contact enables DE students to use any device to access resources, academic and administrative support at a time, location and via a device of their choice. Access to resources and support must be developed to accommodate students involved with synchronous and asynchronous learning. DE programmes synchronously and asynchronously must offer the same access and support.

5.5   Chapter summary

Chapter Five presented the results of the survey which were distributed electronically and in hard copy to students enrolled for DE programmes through the NWU UODL. Of the respondents that completed the questionnaire, 522 submitted electronically, using various devices, and 273 hard copies of the questionnaires sent to LSCs were returned. Three types of analysis were executed and were described in this chapter: descriptive statistics were performed and presented for Section A, B, C, D and E of the questionnaire. Inferential statistics (principal axis factor analysis) and Spearman correlation coefficient were performed of Sections B, C, D and E.

An overview of the research is presented in Chapter Six, which provides a synopsis (Figure 5.2) of four themes derived from the principal component axis factor analysis performed using SEM. Chapter Six also maps the guidelines for use of technologies for learning in DE programme delivery, gives recommendations for future research and reflects on the research journey through the ODL landscape.

Chapter Six

Identifying Components for a Model for Effectively Integrating Interactive Technologies into Distance Education Programmes

6.1   Introduction

Chapter Six finally addresses the research question: *Which components would a model comprise, effectively integrating learning technologies into distance education programmes at the UODL, improving the quality of teaching and learning?* This chapter also addresses the additional research questions as listed in Chapter One. Figure 6.1 outlines the overview of this chapter.
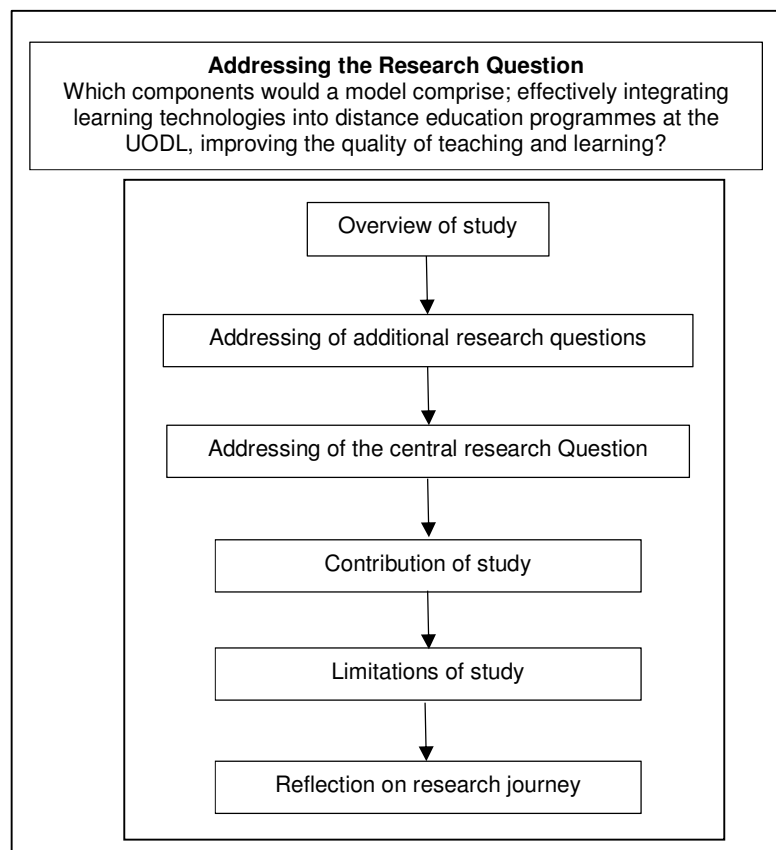
Figure 6.1   Schematic view of this study

6.2   Overview of study

In order to address the research questions, the research first provides a brief overview of the study.

6.2.1   Chapter One: **Overview of the research journey followed for this multi-modal approach regarding technologies for learning in DE**

Chapter One provides the framework for the study which includes the context of this research. It lists the central and additional research questions, outlines the main thoughts of the literature review, argues the ethical considerations for this study, and presents the envisaged contribution of this study. The study elucidates the value of interactive technologies used by the UODL for its delivery of distance education programmes. The chapter describes the research methodology as a fully mixed equal status sequential multi-mode design and methodology. Chapter One clarifies the terminology essential for the use and integration of interactive technologies in DE.

6.2.2   Chapter Two: Mapping the research design and methodology

This chapter explains the choices the researcher made on the design and methodology used during this study. The research commences with an explanation of the world view for this study which was rooted in the functionalist paradigm (Burrel & Morgan, 1979). The research design which suited the study best was a multi-mode bounded case study following a methodology of fully mixed equal status sequential multi-modal design methodology. From the literature review five aspects (§3.7) culminated which were deemed essential for interaction during effective ODL programme delivery. Examples and case studies of interactivity across contexts were provided as reference and guidelines for interactivity in ODL context. Figure 6.2 presents the map of the research design as followed during the study. The literature review (Chapter Three) identified four constructs which were transformed into questions used during qualitative interviews with participants. The analysis of these Interviews resulted in 35 codes which were consequently quantitized in order to ascertain four new constructs which formed the foundation of a quantitative questionnaire. Biographical information questions were added to the questionnaire. Data from 699 respondents were analysed with a battery of statistical tests.
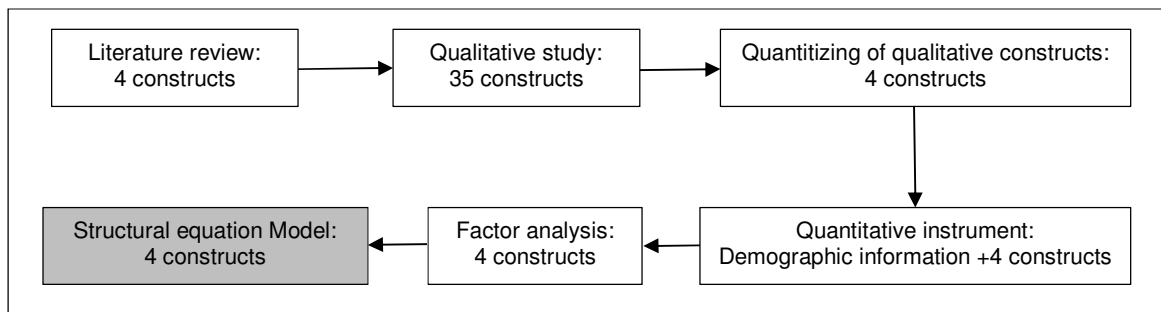
Figure 6.2:   Research design map followed during the study

6.2.3   Chapter Three: Examining the literature on interactivity

Chapter Three presents the literature review and includes the concepts TEL for DE, ODL for developing context, interactivity, learning technologies and examples and case studies of interactivity

across contexts (Figure 3.2). The researcher investigated how these concepts contribute to the efficacy of distance education programme delivery and improve the quality of teaching and learning in DE. The researcher discussed the five generations technological innovations which evolved in distance education (Taylor, 2001) and compared these generations with the progress of technology integration at the UODL. In ODL, students are geographically separated from the institution, and the challenge for ODL is to create more openness and flexibility in teaching and learning. The needs of students regarding accessibility and flexibility should be assessed before any interventions regarding interactive technologies are embarked on and more accessibility is created. Many definitions are available for interactivity because of the many authors' views on interactivity. The devices used by an institution determine the context in which interactivity takes place (Domagk et al., 2010). Interaction and interactivity can only be supportive of the learning environment if a student-centred approach is assumed in course development. With the implementation of LTs in teaching and learning, the philosophy of learning in distance education has transformed and interactivity between the student and the institution has improved. Social presence is an important aspect for interactivity and has three dimensions, namely social context, online communication and interactivity (Tu & McIsaac, 2002). It is evident that the success of interaction amongst students, between lecturers and students, and students and content largely depends on social presence, i.e. the students' relationship with other individuals in the environment they find themselves in, as well as their experiences and relationships with content to be mastered in learning environments. Dialogue, structure and student autonomy are further aspects that improve interaction between role players in delivery of distance education programmes (Moore, 1997). The five aspects identified through the literature review were used to develop the interview schedule used in the qualitative research.

6.2.4   Chapter Four: Expanding of the literature concepts through qualitative strategies

Chapter Four presents the strategies followed during the qualitative research in this study. Four aspects (constructs) were identified from the literature (Chapter Three) to develop the qualitative questionnaire. The constructs were technology-enhanced learning for distance education, open distance learning for developing contexts, interactivity, and technologies for learning. In developing the questions for the qualitative questionnaire, the researcher ensured that the identified questions included these aspects. The researcher developed a custom-made interview schedule for the individual interviews. The qualitative strategy comprised participant selection, site selection, data collection strategies, data analysis and interpretation, and the constructs to be used in developing the quantitative questionnaire. Participants taking part in this research adhered to the criteria for inclusion in the study. Participants were knowledgeable about technologies used by the UODL at LSCs and other possible participants were identified by fellow students. Five participants were interviewed and the researcher ensured that data saturation was achieved. These interviews were recorded and transcribed upon which each interview document, a primary document, was assigned to Atlas.ti™ for analyses. The researcher, after analysing the interviews and working through the literature (theory-driven approach), identified 35 codes that were included in the codebook. Three constructs were

clustered through quantitizing, using Ward's minimum variance method and Pearson's *r* correlation (§2.9). A dendogram (Figure 4.3) was created where all constructs were paired, providing a graphical indication of the correlation that exists between the constructs. The objective of Ward's minimum variance method of clustering is to classify the observations into two or more separate, complete clusters conforming to the diverse populations sampled, producing a hierarchical structure that provides some understanding into a possible nested structure in the data (Szekely & Rizzo, 2005). Through clustering the various constructs, nested groups were formed.

The four themes identified during the cluster analysis were presented as the different sections in the quantitative questionnaire. The four clusters identified comprised: (i) infrastructure (Section A); (ii) learning environment (Section B); (iii) success in distance education (Section C) and (iv) technologies for learning (Section D). Biographical information (Section A) requested information regarding age, gender, devices owned, place of residence, etc. The researcher used the 35 codes (constructs) to formulate the questions included in the questionnaire. A question for each of the 35 codes (constructs) was formulated to be included. In some instances more than one question was formulated for a construct for better explanation, and the questionnaire comprised a total of 48 questions. A Likert scale was used in each of the questions in the questionnaire to afford respondents the opportunity to state their agreement regarding the questions they had to answer. The questionnaire was distributed in hard copy to LSCs and an electronic version was available for respondents to complete on the device of their choice.

6.2.5   Chapter Five: results from the quantitative data relating to the components of interactive learning technologies

Chapter Five presents the quantitative research results of the study. The progression from identifying the concepts in the literature, coding, clustering of constructs and the identification of the statistical constructs that would form part of the model for integration of interactive technologies in distance education is presented in Table 6.1. The researcher used descriptive analysis (§2.13.1) to present percentages of Section A (biographical information) and the percentages, frequencies, percentages, mean and standard deviation of section B (Table 5.2), C (Table 5.3), D (Table 5.4) and E (Table 5.5) of the quantitative questionnaire in order to meaningfully summarize and organize the numerical data (Burke Johnson & Christensen, 2014; Joubert et al., 2016).

A factor analysis clustered the variables and the researcher also determined the reliability amongst the grouped variables. These statistical constructs and the variables grouped together with each statistical construct are presented as Table 6.1.

Table 6.1   Development of research constructs across the study

Literature concepts	Qualitative constructs	Dendogram		Statistical constructs
• TEL for DE • ODL • Interactivity • Learning technologies	• Academic progress • Accessibility • Accessibility to resources • Any time • Anywhere • Availability • Barriers • Challenge • Communication • communication devices • Distance education • Equal opportunity • Feedback and assessment • Flexibility • Frequency of sessions • Geographical area • Infrastructure • Innovation • Interactivity • Internet accessibility • Learning environment • Learning technologies • Motivation • ODL • Quality • Recorded sessions • Software • Structured • Learner support centres • Study material • Support • Teaching-and-learning • Technological ability and knowledge • Technological possibilities • Two-way communication	**Infrastructure** • Recorded sessions • Frequency of sessions • Technological ability and knowledge • Structured • Study material • Communication **Learning environment** • Support • Learner support centres • Learning technologies • Learning environment • Geographical area • Communication devices • Availability • Teaching-and-learning • Feedback and assessment • Any time **Success in Distance education** • ODL • Motivation • Two-way communication • Interactivity • Distance education • Barriers • Flexibility • Equal opportunity • Accessibility to resources • Anywhere • Accessibility **Technologies for learning** • Innovation • Challenge • Internet accessibility • Infrastructure • Technological possibilities • Software • Academic progress		**Flexibility** • Flexible support • Flexible contact • Flexible content • Flexible access • Vehicles of flexibility • Flexible technology use • Barriers to flexibility **TEL** • TEL support • TEL devices • Assessment with TEL • Feedback with TEL • Interaction with TEL • Possibilities for TEL • TEL content • Advantages of TEL • Flexibility with TEL • TEL options **Interactivity** • Characteristics of interactivity • Barriers to interactivity • Support for interactivity • Ubiquitous interactivity • Face-to-face interactivity • Flexibility of interactivity **Infrastructure** • Infrastructure for student support • Infrastructure and technology • Barriers to infrastructure • Innovation for infrastructure • Infrastructure for programme delivery • Infrastructural options • Infrastructure for motivation

The researcher determined the reliability between the clustered variables using Cronbach's coefficient alpha (α) (§5.3.1). The mean and standard deviation to all clustered groups were presented. After completion of the factor analysis the researcher employed inferential analysis (§2.13.2) with the

statistical constructs identified through the factor analysis presented in Table 5.6 as (flexibility), Table 5.7 (TEL), Table 5.8 (interactivity) and Table 5.9 (infrastructure). The inferential analysis used during this phase of the research included effect sizes (p) and a Spearman's rank-order correlation (r_s)

The next section addresses the five additional, as well as the central, research questions.

6.3   Addressing the additional research questions

Table 6.2 lists the research questions of this study, together with where the evidence for the addressing of these questions as listed in the questionnaire (Addendum2.7).

Table 6.2   Validation of central research questions and additional research questions

Research Question	Evidence
Additional research question 1: What are the characteristics of learning technologies in delivering distance education programmes?	Descriptive statistics (Questions 25.1-25.6; 32.3-32.4; 41.2-41.4; 45)
Additional research question 2: What are the requirements and aspects an infrastructure at the UODL must adhere to for success in distance education programme delivery?	Factor analysis and Cronbach's Alpha correlation coefficient (Questions 18.1-18.2; 20; 21; 24.1-24.4; 37.1-37.5; 44.1-44.5)
Additional research question 3: How can interactive technologies contribute towards the delivery of distance education programmes at the UODL?	Factor analysis, Cronbach's Alpha correlation coefficient and effect sizes (Questions 33.1-33.5; 36.1-36.9)
Additional research question 4: What are the aspects of effective use of interactive technologies in delivering of distance education programmes at the UODL?	Factor analysis, Cronbach's Alpha and effect sizes (Questions 17.1-17.2; 22.1-22.5; 25.1-25.6; 26.1-26.5; 27)
Central **research question:** Which components would a model comprise; effectively integrating interactive-learning technologies into distance education programmes at the UODL, improving the quality of teaching and learning?	Structural Equation Modeling
Additional research question 5: What will the influence be of the management tasks in utilizing learning technologies at the UODL?	Components identified during factor analysis and SEM to be included in management of interactive technologies at the UODL

6.3.1   What are the characteristics of learning technologies in delivering distance education programmes?

Regarding the characteristics of LTs in delivering distance education programmes, communication with peer students, lecturers and using these technologies to download resources are reliable (α=0.71) with the advantages of TEL but the effect size (d=0.21) showed a small effect. Downloading

administrative information regarding their studies is reliable (α=0.71) with TEL content. Searching for additional resources from the internet is highly reliable (α=0.71) with flexibility with TEL. Implementation of new technologies for learning, encouraging interactivity, improving access to resources and enhancing pedagogical methods for learning are highly reliable (α=0.84) with innovations for infrastructure. Making content available through technologies for learning (α=0.86) is highly reliable with characteristics of interactivity while LTs used to make resources available through innovative media were reliable (α=0.75) with face-to-face interactivity and had a small effect (*d*=0.23). Sufficient technological possibilities available for academic progress is highly reliable (α=0.89) with an infrastructure for student support. LTs provide opportunities for students for interaction with the institution through two-way communication or using various devices face-to-face.

6.3.2   What are the requirements and aspects an infrastructure at the UODL must adhere to for success in distance education programme delivery?

Infrastructure at the UODL, providing administrative and logistical support, academic support, support at LSCs, support for communication with the NWU and providing opportunities for learning at LSCs are highly reliable (α=0.89) with infrastructure for student support. Regarding sufficient technological support structures at the UODL, academic, administrative and technological challenges are highly reliable (α=0.83) with feedback with TEL. Success of ODL programme delivery considering the non-residential (off-campus) location of students, supporting teaching-and-learning far away from residential campuses, developing self-instructional programmes, accommodating students separated in time or distance and using an assortment of technologies for learning used in delivery of programmes are highly reliable (α=0.82) with flexibility of interactivity. With the various communication options available within the infrastructure for support at the UODL, academic challenges and administrative challenges are marginally reliable (α=0.66) with flexible support. Responses regarding sufficient LSCs in the geographical area where students live and work to attend whiteboard contact sessions are marginally reliable (α=0.64) with TEL devices, while how well LSCs are equipped to support their learning needs is marginally reliable (α=0.64) with TEL devices. Resources for learning available on various devices and easy accessibility to administrative and academic support as well as LSCs the student chose are reliable (α=0.78) with TEL support.

6.3.3   How can interactive technologies contribute towards interactivity in the delivery of distance education programmes at the UODL?

Regarding aspects of interactivity enabling effective teaching, learning and communication through face-to-face, between fellow students, over distance using various devices and acquiring skills for learning using technologies for learning affording students to learn on their own without much effort are highly reliable (α=0.86) with characteristics of interactivity. Two-way communication between students, lecturers, administration staff of the UODL and in a face-to-face classroom situation using the interactive whiteboards at LSCs is reliable (α=0.75), with face–to-face interactivity and an effect

size (d=0.23) indicating a small effect. Two-way communication over a distance using various technologies is highly reliable (α=0.86) with characteristics of interactivity.

6.3.4   What are the aspects of effective use of interactive technologies in delivering of distance education programmes at the UODL?

Respondents having sufficient technological knowledge to use ICT devices to access resources for learning and communicating with the university on administration issues is marginally reliable (α=0.66) with flexible support. Using interactive whiteboards at LSCs and text messages (SMS) communicating with the UODL is marginally reliable (α=0.64) with TEL devices and an effect size of (d=0.33), which is an indication of a small effect. The use of communication devices to access learning resources, internet based resources and tools and making use of computer-based learning are reliable (α=0.75) with TEL content. Information and communication technology devices assisting students to learn at their own convenience, pace, accessing learning material from any location as well as information pertaining to their studies are highly reliable (α=0.83) with flexibility with TEL. A vast amount of technological possibilities are available to students for academic progress. Are sufficient technologies available to students for academic progress is highly reliable (α=0.89) with infrastructure for student support.

6.4   Addressing the central research question

The central research question which underpinned this study was: *Which components would a model comprise, effectively integrating interactive learning technologies into distance education programmes at the UODL, improving the quality of teaching and learning?* During the factor analysis the internal consistency of items (factors) within the four themes presented good measurement. The factor analysis performed indicated that 60.00% of factors within these themes had a Cronbach's Alpha of α≥0.70, which indicates reliability, while ten factors had a high reliability (α=0.80-0.90). The researcher decided that because so many factors were reliable with the themes, a Structural equation modelling (SEM) should be applied because the theory was well reflected in the data. Hooper, Coughlan, and Mullen (2008) state that a model is developed with the data that best reflect the underlying theory, and this is known as model fit.

Researchers apply SEM to test, adapt and approve the models they construct, determining causal relationships between variables and furthermore enabling researchers to construct models the data can be tested against (Cohen et al., 2011a). The fundamental relationships between the components in the questionnaire were performed using SEM. The goodness-of-fit (CFI) statistics provide various measures to evaluate model fit. Liang, Huang, and Tsai (2012) state that the Chi-square is performed for independence in examining the association among factors. The smaller the Chi-square, the better the fit, and should the value be zero, it is indicative of a perfect fit; the more categories there are, the

bigger the Chi-square will be (Cramer & Howitt, 2004). The size of this value's interpretation depends to a large extent on the viewpoint of the researcher, but in practice some interpreted ratios of 3, 4 or even 5 are regarded as representing a good model fit (Mueller, 1996). The Chi-square test statistic is divided by its degrees of freedom (CMIN/DF) value of 6.168, which should be <5 to indicate a good fit (Mueller, 1996). In spite thereof that the Chi-square is shared by degree of freedom (DF), the Chi-square is influenced by the size of the sample, and since the sample was 795, it can be expected that the CMIN/DF would be >5. The Comparative Fit Index (CFI) had a value of 0.71. A CFI value larger than 0.90 is indicative of a good fit (Franke, 1996). Root Mean Square Error of Approximation (RMSEA) value of 0.08 with a 90% confidence interval of 0.078-0.084, should be smaller than 0.1 for acceptable fit (Blunch, 2012).

SEM with AMOS (Amos Development Company, 2011) tested the relationship between interactivity, infrastructure, TEL and flexibility as hypothesised in Figure 6.3.

Table 6.3   Standardised Regression Weights and Correlations between flexibility, TEL, interactivity and infrastructure in Open Distance Learning

| Activity System	Standardised Regression Weights	P values
Flexibility←Interactivity	-0.07	0.60
Flexibility←Infrastructure	0.08	0.61
Flexibility←TEL	0.88	****

p<0.05

Although none of these relationships were statistically significant (p<0.05), with flexibility the standardised regression weights for interactivity were -0.07, for infrastructure 0.08 and for TEL 0.88. Values for Standard Regression Weights are standardised so that their values vary between -1.00 and 1.00, and the higher the value is, irrespective of the sign, means that the predictor has a stronger association with the criterion (Cramer & Howitt, 2004). TEL had a very strong association with flexibility (0.88) while infrastructure's correlation with flexibility was 0.07. Interactivity had a negative association with flexibility (-0.07).

Table 6.4   Correlation between infrastructure, TEL and interactivity

Activity System	Spearman correlation
Interactivity ↔ Infrastructure	0.88
Interactivity ↔ TEL	0.82
Infrastructure ↔ TEL	0.84

The correlation between infrastructure, interactivity and TEL was statistically significant and high—it varied between 0.82 and 0.88 (Table 6.4). The correlation size can vary between -1.00 and 1.00, and the bigger the size of the correlation, the stronger the linear relationships are between the variables (Cramer & Howitt, 2004). Interactivity, infrastructure and TEL indicate that there is a very strong relationship between these variables. Figure 6.3 illustrates the SEM relating to flexibility, TEL, interactivity and infrastructure in the delivery of distance education programmes.
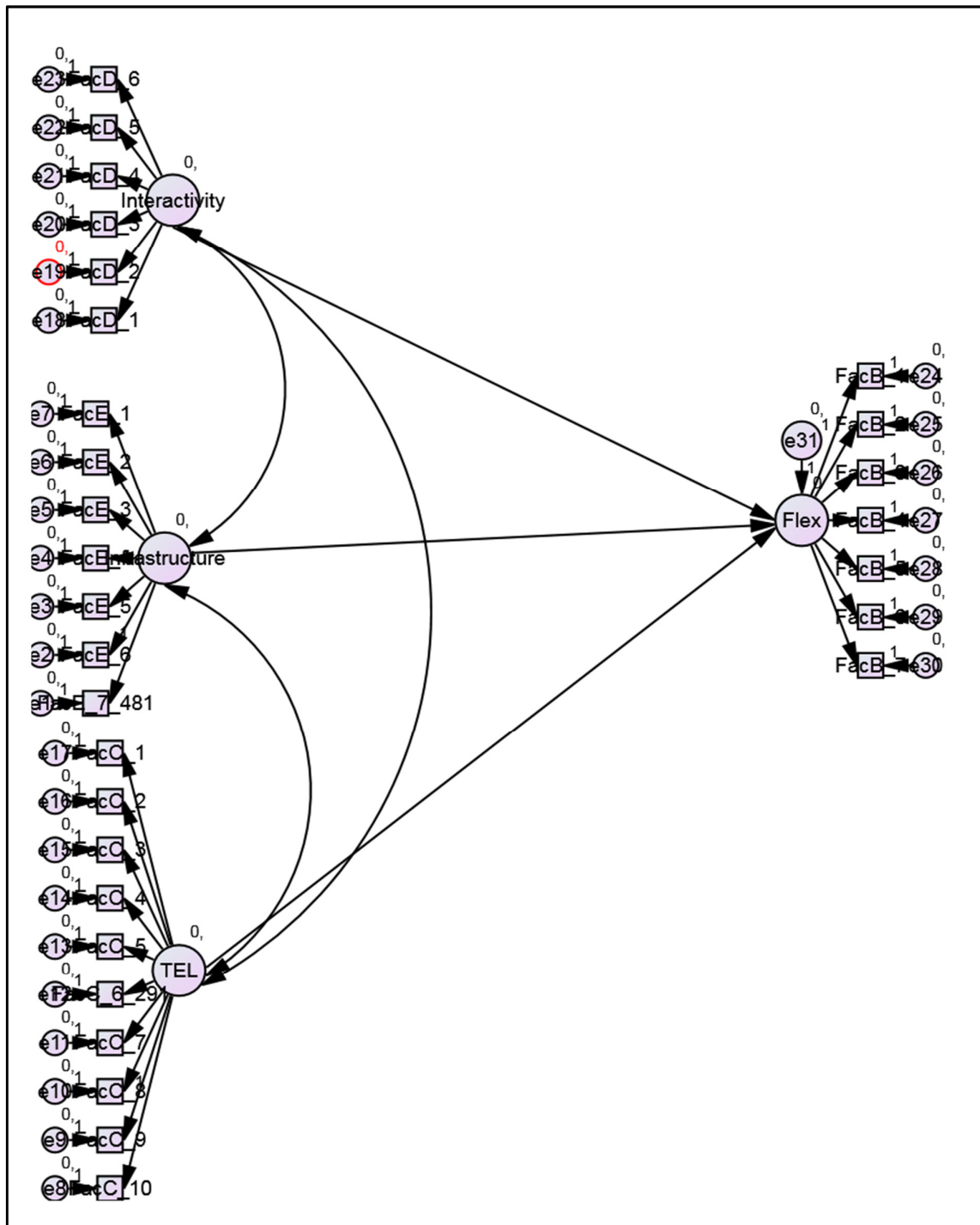
Figure 6.3   **Structural equation model for interactivity, infrastructure, TEL and flexibility**

The application of the model, as well as the responsibilities of the UODL and the NWU regarding the model, is discussed in § 6.5 in terms of the addressing of management tasks.

6.5   How should management tasks be applied at the UODL for utilizing learning technologies?

Before embarking on how the management tasks should be applied to the UODL, the management tasks and responsibilities of the NWU for utilizing learning technologies should be clarified. In the following sections the researcher addresses the management tasks of the NWU and the management tasks of the UODL to effectively integrate interactive technologies in delivery of distance education programmes to improve the quality of teaching and learning. The researcher will commence with the vision and mission statements of the NWU and UODL after which the management tasks according to the components identified in the SEM will be discussed and recommendations made. The recommendations of the management tasks of the NWU and UODL for the four components identified will be discussed in the sections that follow. The identified components are interactivity, infrastructure, TEL and flexibility. By executing the SEM these components were identified as vehicles to integrate interactive technologies in DE to improve the quality of teaching-and-learning. The management tasks of the UODL are dependent on the policies and frameworks of the NWU, consequently it is foreseeable that only when the relevant management tasks of the NWU are developed and/or adapted, will flexibility in programme delivery be effective and can overcoming barriers to access , anytime and anywhere learning be possible in ODL.

6.5.1   Vision and mission of North-West University

On an institutional level, the responsibility for utilizing technologies in enhancing teaching and learning in DE is determined by the NWU's vision and mission statements. The Vision statement of the NWU states that the university aims "To be a pre-eminent University in Africa, driven by the pursuit of knowledge and Innovation" (North-West University, 2006). The mission statement of the NWU is "To become a balanced teaching-learning and research university and to implement its expertise in an innovative way" (North-West University, 2006).

In the Annual Performance Plan and Strategic Plan North-West University 2016 (North-West University, 2016), it is stated that:
• Distance learning must be repositioned and ODL programmes be integrated into all faculties.
• Mixed face-to-face and technology must be promoted in the classroom for distance learning and lecturing staff.
• A valid methodology must be developed to determine the success rate of ODL students.
• An increased demand exists for distance, technology enabled tuition and for a flexible tuition model of programme delivery.
• NWU wants to accelerate the rapid re-positioning of distance learning to reflect Decision 2 above with full undergraduate qualifications, as well as to reflect Decision 1 above: Integrate ODL programmes into faculties.

It is clear from the NWU's vision and mission statements that expertise in teaching-and-learning must be driven and implemented in an innovative way in the formal teaching-and-learning environment and in ODL. The statements in themselves place a responsibility on the NWU to invest, develop, implement and maintain innovation which will enhance teaching and learning. Innovation in DE programme delivery includes not only new approaches in teaching-and-learning but also technologies for learning that must be introduced and implemented effectively to improve access, interactivity, infrastructure and support. Support includes administrative and academic support structures, furthermore expanding on technologies made available to students in remote areas. In order for the NWU to ensure that this responsibility manifests in the teaching and learning domain, specific management tasks need to be implemented.

6.5.2   Vision and aims of the Unit for Open Distance Learning

The vision for the UODL is "to provide, through ODL, access to increasing numbers of students, to quality education programmes, by means of on-going effective support and appropriate technology" (Unit for Open Distance Learning, 2015). The aims developed by the UODL to accomplish its mission are (Unit for Open Distance Learning, 2015):

- To provide broader access to higher education addressing the education needs of the country through ODL.
- To progressively ensure good communication and maintain these communications with faculties.
- To support and expand on learning technologies.
- To develop and improve all infrastructures for support at the UODL to adhere to and match international standards.
- To continually train staff enabling them to do use the technologies for TEL optimally.

The vision and aims of the UODL are reflected in the components identified through the SEM that was executed. The management tasks of the NWU and the UODL will enable these components to form core features in the delivery of ODL at the NWU, ensuring more flexibility by removing barriers of access to anywhere and anytime learning.

6.5.3   Infrastructure

Implementation of a suitable technological, academic and administrative support infrastructure will provide DE students with the opportunity to access teaching-and-learning at a time and place convenient to them, adding flexibility in all aspects of programme delivery.

6.5.3.1 Management tasks of the NWU regarding information and communication infrastructure for ODL

The responsibility for the NWU in using technologies to enhance teaching and learning in DE is foremost determined by national policies. The Policy for the Provision of Distance Education in South African Universities in the Context of an Integrated Post-school System as set out in the Schedule as policy in terms of section 3 of the Higher Education Act, 101 of 1997, provides for provisioning and expansion of quality distance education at higher education institutions. In schedule 2.2 of this act, it is pointed out that universities must utilize technology to improve the quality of distance education provision. The NWU is in the process to accelerate the re-positioning of distance education in some undergraduate programmes and integrate ODL into all faculties (North-West University, 2016). The following recommendations are suggested regarding the management tasks of the NWU on infrastructure for ODL:

- The Policy on the responsible use of Information and Communication Technology, Networks and Information Resources at the North-West University (2012) states that information resource infrastructure must be accessible to students and staff within the NWU and beyond the campus (North-West University, 2012). This policy does not accommodate ODL specifically, and the researcher recommends that this policy be amended to include the establishment, management and support of a technological infrastructure for ODL, focusing on access to teaching and learning from remote sites of the NWU. Before institutions embark on implementing technologies for learning for delivering DE programmes, the ICT infrastructure must be established, keeping in mind the students who are targeted, and furthermore the barriers as well as opportunities for use of these technologies must be determined (Council on Higher Education, 2014).

- To improve the quality of DE provision, a workable and supportive technological infrastructure is needed. Stoner (1996) states that a suitable technological infrastructure for a specific environment must be considered in order for students to benefit from the implementation of various technologies for learning. This will require the development and adaptation of the financial policy and budget of the NWU, and also an expansion of human capital to ensure that the technology can be acquired, implemented and maintained.

- To adapt academic and administrative support structures and put these in place to specifically accommodate ODL and not only the on-campus environment.

- To develop and implement a student-centred approach in teaching-and-learning for all modes of delivery at the NWU that benefits both on-campus and off-campus students. A student-centred approach is a key aspect of ODL as resources are made available through innovative media to all role players, removing barriers obstructing teaching and learning (Msweli, 2012; Towobola & Raimi, 2011)

- To develop a technological infrastructure establishing student learning communication, as ODL students are separated in time and space from the institution. This infrastructure will adhere to the needs of the students to communicate with one another, and share information and content within an asynchronous environment such as ODL (Brown, 2001).

6.5.3.2 Management tasks of the UODL regarding infrastructure for ODL.

The UODL is dependent on policy and strategies of the NWU to implement a technological, academic and administrative infrastructure to deliver DE programmes matching international standards. Currently the UODL has established an infrastructure for programme delivery at LSCs using IWBs and affording students access to resources and recordings, using Panopto™ and SMART Bridgit™, not supported by NWU. The academic and administrative support infrastructure is provided to students using the helpdesk, SMS, social media, eFundi and Moodle™. The UODL is continuously doing research on new innovations and technologies for infrastructure that could remove barriers and improve flexibility in programme delivery.

The researcher recommends that the following aspects must be implemented to further improve the infrastructure for support in ODL:

- Invest in more advanced innovative technologies, devices and software to be implemented at LSCs, keeping up to date with global tendencies and contributing to expanding technological infrastructure at LSCs. Mbwesa (2011) states that in order to understand the essence of ODL, the implementation of new and innovative pedagogical techniques providing enhanced opportunities for learning is essential.
- Academic managers in collaboration with ADS must develop an online platform for students enrolled for distance education programmes. This platform will be dependent on the technological infrastructure developed and put in place by the NWU. Providing the UODL with an infrastructure to develop online learning, both interactivity and collaborative learning will become more accessible from any location and ideas are shared and analysed much more easily (Picciano, 2009).

6.5.4   Interactivity

This component includes interactivity between students and learning, students and students, students and content and students and technologies.

6.5.4.1 Management tasks of the NWU regarding interactivity

The researcher proposes the following recommendations regarding the management tasks of the NWU regarding interactivity in ODL:

- The researcher recommends that the NWU, within the teaching and learning policy as well as the ICT and network policy, accommodates and addresses barriers of interactivity, ubiquitous interactivity, support for interactivity and flexible interactivity in ODL, specifically to provide the UODL with fewer barriers in effectively delivering DE programmes using various technologies for learning. Improving and addressing these aspects of interactivity will improve communication

between all role players. Technologies used in DE programme delivery aim to create two-way communication and high levels of interactivity which will best meet students' instructional needs (Ellis & Mathis, 1985; Hackman & Walker, 1990). Interactivity is rated by lecturers and administrators as a decisive attribute for present-day DE programme delivery (Wagner, 1994).

- The NWU must develop greater understanding for students learning through use of learning analytics enabled by a single or integrated LMS. This will enable the NWU to understand all students in their specific contexts and to optimize learning, irrespective of the environment and technologies used. This will benefit distance as well as contact students. At this stage much more focus is on contact students and their context.

6.5.4.2 Management tasks of the UODL regarding interactivity

The UODL currently affords students with IWBs, laptops and various other communication devices to interact with the UODL for academic and administrative support. The UODL has established technological support structures (ADSL and Wi-Fi) at LSCs to enable students that normally do not have access to the opportunity to interact during live teaching-and-learning sessions using the device of their choice. The UODL currently uses Moodle™ and eFundi as LMS to support students, but not all programmes have access to eFundi, and Moodle™ is used as a repository site only. The UODL has succeeded in supporting students on both these platforms in all aspects of their studies, although it would be beneficial to have only one LMS that has interactive capabilities to be used by all students at the UODL.

The researcher recommends that the following be implemented at the UODL to expand interactivity:

- Academic managers should liaise with faculty to not only convert current programmes suitable for ODL, but also be involved in academic support and interaction with ODL students at LSCs. This support from academic managers must be during live sessions and via social media.
- Academic managers must ensure that aspects for interactivity and content sharing are conveyed to students during teaching-and-learning irrespective of the type of technology being used for delivering programmes. Sharing of ideas and content, collaborative and participative group activities will then all play a role in the support and creation of a productive learning environment (Picciano, 2002).
- Social media platforms must be adapted to not only serve as administrative and logistical support. More focus must be placed on academic support to enable students to share information and content, such as creating a social media platform for different faculties for academics to interact with students on the learning experience and sharing resources and content more actively. Academic managers from faculty must manage each of these platforms.
- Invest in the implementation of an instant messaging service whereby students can in real time interact over an IP network with one another and share content. This can be during live sessions at LSCs. WhatsApp, WeChat and Snapchat are examples of instant messaging. Implementing

instant messaging needs lecturers to be more active in all aspects of learning, interacting with students more often and during live sessions.

- Develop one LMS accommodating all programmes delivered by the UODL.
- Academic managers and faculty must develop blogs to boost the learning experience; some blogs are student-controlled while others are instructor-managed. Developing blogs will improve interactivity and assist DE students to create their own learning environment. Abid et al. (2013) recommend and describe the development of LMSs where students and lecturers connect and interact inter alia through social media, blogs, interactive whiteboards etc.

6.5.5 Technology-enhanced learning

Various technologies can be used to enhance teaching and learning in the delivery of DE programmes. Any form of teaching-and-learning activity is supported and covered by TEL (Manouselis et al., 2011).

6.5.5.1 Management tasks of the NWU regarding TEL

To enable effective use of technologies for ODL the NWU must focus on providing more innovative technologies and platforms that will assist the UODL to fully implement TEL. The researcher recommends the following:

- A TEL implementation plan and policy for ODL assisting with effectively implementing technologies and their adaption for DE programme delivery enabling access to teaching-and-learning irrespective of time and location.
- TEL policy must include access to teaching-and-learning using various technologies and devices with support structures. Synchronous and asynchronous learning can be achieved in DE using TEL (Manouselis et al., 2011).
- Financial planning and budgeting should provide for the appointment of staff are needed for TEL infrastructure support in ODL.
- Plan, document and control the best in class, evolution of the IT systems and infrastructure.
- Provide innovative Teaching and Learning Technology solutions and service.
- Embark on focusing to become a multimodal institution at the forefront of ODL delivery in South Africa and Africa. TEL is associated with multi-modal learning as a mode for delivering DE programmes whereby online programmes and activities are combined with classroom or traditional activities Picciano (2009). Bonk and Graham (2006) and Klímová (2008) describe multi-modal learning as the concept that could improve pedagogy while it provides access and flexibility to students and cost-effectiveness to the institution.

6.5.5.2 Management tasks of the UODL regarding TEL

The UODL currently uses various technologies in the delivery of DE programmes at LSCs. The UODL provides various options for access and support at LSCs affording students with many possibilities to access resources and teaching and learning. The problem, however, is that NWU do not support all technologies used at LSCs (IWBs) for teaching-and-learning, and that more innovative technologies are proposed by the UODL than by NWU, although the NWU clearly states in its ICT policy that it supports access on campus and beyond campus using various technologies. The UODL is constantly reviewing and investigating the advantages for using TEL as well as possibilities TEL can offer UODL in programme delivery. The connectivity at LSCs enable facilitators to assist students with various devices to access resources and teaching and learning adding flexibility in delivering of DE programmes. The UODL is dependent on the NWU to fully support and provide all technological infrastructure of the UODL at all LSCs, and currently there is only partial support by the NWU to this infrastructure at LSCs. The following aspects regarding TEL should be implemented at the UODL to expose DE students to technologies and the effective use of these technologies in ODL:

- Academic managers together with faculty must ensure that content developed to be used for programme delivery is suitable for TEL. Not only the frequency of communication is important, but also the dialogue between the DE students to be able to better engage with this content.

- Immediate assessment using Google forms and Survey Monkey. This is immediate assessment, and the understanding of concepts during live sessions could be assessed. Interactivity between lecturers and students will be promoted.

- Students must be afforded the opportunity to access online evaluation and feedback, using various devices that will expand TEL in DE programme delivery. TEL interventions counteract the barriers of time and location that influence teaching and learning within DE programmes. In a TEL environment, connectivity among students themselves, between students and lecturers and between students and resources, is evident and viewed as a process of intervening in teaching and learning (Zitter et al., 2012).

- Continuous online assessment to improve the quality of teaching-and-learning, as students can provide immediate feedback from his/her learning experience. Improving technological infrastructure at the UODL and at LSCs will afford students more and better access.

6.5.6 Flexibility

The SEM indicated that infrastructure, interactivity and TEL are the components that should to be addressed to improve flexibility in delivery of DE programmes at the UODL. The UODL however is dependent on the NWU to establish an infrastructure specifically for ODL regarding innovative technologies, support and access from any place and at a time convenient to students for flexibility to be possible. Creating flexibility and interactivity in DE will make it easier for students to access learning resources, and diminish barriers like time, distance and location (Commonwealth of Learning, 2011; UNESCO, 2002).

6.5.6.1 Management tasks of NWU regarding flexibility

Flexibility in ODL is dependent on the infrastructure set out and developed by the NWU within its management structure and policy. The researcher makes the following recommendations regarding flexibility in ODL:

- The teaching-and-learning policy of the NWU (2011) requires compulsory attendance, which is not possible in ODL as stated in the policy. Policy should be adapted as ODL affords students the opportunity to access teaching-and-learning from any location and at any time. This will provide more flexibility in all aspects of DE programme delivery.
- The NWU must put infrastructure in place specifically for ODL, to enable flexible support, flexible contact and flexible access using various technologies and devices at LSCs.

6.5.6.2 Management tasks of UODL regarding flexibility

The UODL currently provides students with the opportunity to interact with lecturers during live sessions at any of the 65 LSCs. Students may visit LSCs not only to attend scheduled IWB session but to access and download resources using the Wi-Fi installed at all LSCs. Several students connect to live IWB sessions using their own devices at a location convenient to them. Providing students with access from any location and opportunity to interact adds flexibility to ODL.

The researcher recommends the following aspects regarding flexibility to the UODL:

- Provide more administrative and support structures at LSCs using various technologies. DHET (2012) emphasises the importance of support in distance HEIs and supports a network of well-designed and maintained learning centres for DE students to be priority. Furthermore, improved access to as well as the use of appropriate technologies is of strategic importance in delivering DE programmes at HEIs (DHET, 2012).
- Equip LSCs with more innovative technologies and devices enabling students with more opportunities to interact on various platforms with lecturers and support staff regarding academic and administrative matters. "*Increasing ubiquity and flexibility of ICTs has opened up new opportunities for quality expansion of teaching and learning*" (DHET, 2012).
- Accept electronic submission of assignments by all students enrolled for DE programmes.
- Provide intensive training to centre staff regarding all aspects of technologies and platforms available to students which could improve interactivity and the use of technologies.

In conclusion, the researcher recommends that NWU management's limited knowledge of ODL must be addressed and ODL be incorporated in the teaching-and-learning strategy document. ODL specifically does not reflect in the teaching-and-learning strategy policy document of the NWU (North-West University, 2011). The exclusion of ODL in the teaching-and-learning strategy document of the NWU results in lack of understanding of ODL programme delivery. Better understanding of ODL will enable management to better comprehend the importance of infrastructure for support, TEL,

interactivity and flexibility in delivering distance education programmes. Understanding the infrastructure needed for ODL programme delivery will enable the UODL to remove barriers hampering flexibility in ODL.

6.6   Contribution of this study

In addition to the research conducted to develop a model for effectively integrating interactive technologies in delivering distance education programmes, subsequently improving the quality of teaching and learning, the research contributes to various levels of improving DE programme delivery:

- Through the SEM that was performed after completion of the quantitative phase of this study, four components were identified that would assist the UODL with integrating interactive technologies in DE programme delivery improving the quality of teaching-and-learning. The four components identified were TEL, interactivity, infrastructure and flexibility. The data analysis indicated that flexibility in ODL is dependent on the development of infrastructure, interactivity and TEL.

- Definite guidelines, strategies and policy changes were suggested to the NWU to address the four identified components through the SEM.

- Considering only the quantitative analysis (though the questions focused on technology), the researcher suspects that an underlying desire of many students has to do with being shown how to u:se TEL. Their agreement with needs for interaction, communication, formative assessment, access to resources as well as the availability of appropriate technology may be expressing a yearning for hands-on training in utilising various means to increase understanding: To be shown how-to.

- Strategies and changes to ICT and network policy of NWU should be identified to effectively use interactive technologies in programme delivery.

- Interactivity was indicated as a definite aspect to improve success of teaching and learning in ODL. It was also reported that interactivity in its various forms contributes to flexibility in DE programme delivery as it affords students access from any location and at any time.

- Improving technological infrastructure at LSCs will enable the establishment of one LMS for access to all students regarding communication, resources and learning.

- Academic managers must be more closely involved in all aspects of programme delivery. This specifically includes managing more platforms where students can obtain academic support and feedback regarding all aspects of teaching-and-learning on a more direct and immediate manner.

- Additional platforms are needed for feedback regarding academic and administrative support. Students prefer feedback from lecturers via technologies for learning. Platforms such as eFundi are unknown to them and must be investigated to include all ODL students.

6.7   Limitations of this study

Limitations exist in any research and in all studies, irrespective of how careful the planning and execution of the research may have been. Any research or study inherently has limitations which could relate to choices of theoretical limitations, the methodological approach selected and aspects or circumstances that could have a negative influence on the data collection and data analysis. More respondents (522) completed the electronic version of the questionnaire on their own devices, but a smaller number of respondents (273) completed the hard copy questionnaire. The reason a lower number of respondents completed the hard copy of the questionnaire could be because the sessions taking place in the timeframe the researcher allocated for the quantitative research stage was during the examination information sessions (June and July), and a smaller number of students attended these sessions, as the examination information was also made available on the NWU and OLG website, and students could have downloaded it before the sessions were facilitated.

6.7.1   Theoretical limitations

Both qualitative and quantitative research methods are important in any study that is undertaken. Viewing this research from a functionalist perspective, its approach is essentially rational explanations of social affairs, highly pragmatic in orientation and often problem orientated in approach, offering practical solutions to practical problems (Burrel & Morgan, 1979). Only a small number of participants were interviewed, representing various programmes delivered by the UODL (in total 795 respondents completed the online and hard copy version of the quantitative questionnaire.) The majority of these groups attended whiteboard sessions at LSCs, indicating that whiteboard sessions add value to facilitation. One major limitation is that a very small number of students download resources or recorded sessions although they have smart devices (the majority), laptops and tablets. Accessibility to resources and downloading of recorded sessions are important aspects to add flexibility to delivery of distance education programmes.

6.7.2   Methodological limitations of this study

The quantitative questionnaire was lengthy due to the large number of constructs that were identified and had to be included in this questionnaire. The ideal would have been to construct a quantitative questionnaire for each of the four aspects identified in the literature in order to thoroughly investigate each of these aspects. More hard copy responses would have been received if the questionnaire had been shorter.

6.8   Future questions for research

The researcher through this study identified the following possible aspects for research regarding the use of interactive technologies in DE:

- How to develop a model to assist ODL students with limited access to technologies to learn to create learning environments beneficial for their own learning.
- How students with limited capacity for technologies could maximize their access and flexibility to teaching and learning at any time, taking geographical diversity and DE infrastructure in consideration.
- How to develop a management model to measure academic progress of ODL students with their participation in teaching and learning through technologies for learning.

6.9   Reflection on the researcher's journey

About four years ago, the UODL began to install interactive whiteboards at learning support centres. This would improve the quality of teaching-and-learning as the lecturer and students could now speak to each other. These lectures eventually could be downloaded by students. This afforded more flexibility, and stimulated the researcher's interest in enhancing quality teaching-and-learning in open distance learning by implementing learning technologies. This would also assist in removing barriers hampering access to teaching and learning. The UODL is well structured for ODL with the resources available to them to effectively deliver DE programmes at LSCs. A technological infrastructure was established at each of these centres to accommodate all DE students. Further investment regarding the infrastructure from the NWU will strengthen programme delivery and add more flexibility in programme delivery.

The researcher was not knowledgeable in using a multi-mode of research as he only had experience with quantitative research. Being exposed to a much higher level of research, using qualitative and quantitative research, was to the advantage of the researcher, as aspects regarding DE programme delivery were investigated thoroughly, and analysing the data during both stages of the research provided the researcher with answers to the research question formulated. Using this methodology and design provided the researcher with the opportunity to verify and interpret results more clearly. The researcher was introduced to Endnote™ when this study commenced, and found it to be a very structured and organized way to develop and compile the bibliography for this research, ensuring that correct references were used throughout each chapter of this study.

Compiling the questionnaire, the researcher used a four-point Likert scale, tested the questionnaire on colleagues and found their feedback extremely valuable. Most of their recommendations and suggestions were accepted, and the researcher adapted the questionnaire before making it available electronically and distributing it at LSCs.

Conducting interviews was a new experience to the researcher, and extremely interesting and informative. Transcribing and interpreting these, the researcher had to use Atlas ti™, after attending various workshops presented by an expert who guided the researcher in the use and implementation of Atlas ti™. Atlas ti™ was a valuable tool in analysing each interview conducted as it provided the researcher with sufficient guidelines to identify the codes and to construct the code book.

The instruments developed by the research during both stages were unique, as all aspects used in the qualitative stage and codes identified were used in the development of the quantitative questionnaire, providing the researcher with real issues that needed to be investigated throughout his study. Researchers apply SEM to test, adapt and approve the models they construct, determining causal relationships between variables and furthermore enabling researchers to construct models the data can be tested against. The SEM was applied to establish the relationship among the four themes, and it became clear that there is indeed a relationship between TEL, interactivity, technology and infrastructure. This process of research enabled the researcher, by analysing results from both stages of the research and finally performing Sequential Equation Modelling (SEM), to develop a model for implementation at the UODL. This model was applicable and unique as it had never previously been used at the UODL to determine components that would assist in integrating interactive technologies effectively to improve the quality of teaching and learning.

The research process not only addressed the research questions and provided the UODL with valuable information and instruments, but also enabled the researcher to grow as an academic as well as a person. The research experience has been unforgettable, and the skills and knowledge obtained will remain part of the researcher's remarkably enriched life.

List of References

Abid, A., Jabbar, A., Saeed, S., Akhtar, N., & Iqbal, J. (2013). A Descriptive Study: Integration of Technology Bring Flexibility to Distance Education in Pakistan. *Journal of Education and Practice, 4*(13), 111-118.

Abowitz, D., & Toole, T. (2010). Mixed Method Research: Fundamental Issues of Design, Validity, and Reliability in Construction Research. *Journal of construction engineering and management, January*(2010), 108-116. doi: 10.1061/ASCECO.1943-7862.0000026

Abrioux, A. (2008). Structural Framework for Higher Education Open And Distance Learning In Papa New Guineau (pp. 50). Canada: Athabasca University.

Abrioux, D. (2006). Strategic Issues in Single- and Dual-mode Distance Education: The Organizational Blending of Two Canadian Distance Universities. Retrieved 14 Februarie, 2016, from https://www.col.org/

Adcock, R. (2001). *Measurement validity: A shared standard for qualitative and quantitative research.* Paper presented at the American Political Science Association.

Aguti, J., Au, W., & Brown, C. (2009). University education for national development. In S. Marshall & W. Kinuthia (Eds.), *Bridging the knowledge divide. Education technology for development* (pp. 436). Charlotte, NC: Information Age Publishing, INC.

Ames, C. (1990). Motivation: What teachers need to know. *Teachers college record, 91*(3), 409-421.

Amos Development Company. (2011). Amos 20.0.0 (Build 817) Retrieved 26 April, 2013, from http://amosdevelopment.com

Anderson, B., & Simpson, M. (2012). History and heritage in distance education. *Journal of Open, Flexiblie and Distance learning, 16*(2), 1-10.

Anderson, T. (2003). Getting the mix right again: An updated and theoretical rationale for interaction. *The International Review of Research in Open and Distributed Learning, 4*(2).

Anderson, T., & Dron, J. (2012). Learning technologies through three generations of technology enhanced distance education pedagogy. Retrieved 18 March, 2015, from http://www.eurodl.org/index.php?p=current&sp=full&article=523

Anderson, T. D., & Garrison, D. R. (1998). Learning in a networked world: New roles and responsibilities (pp. 97-112).

Andersson, A., & Hatakka, M. (2010). Increasing Interactivity in Distance Educations: Case Studies Bangladesh and Sri Lanka. *Information Technology for Development, 16*(1), 16-33.

Areti, V., & Bousiou-Makridou, D. (2006). Satisfying distance education students of the Helenic Open University. *e-mentor, 2*(14), 12.

Arinto, P. B. (2016). Issues and Challenges in Open and Distance e-Learning: Perspectives from the Philippines. *The International Review of Research in Open and Distributed Learning, 17*(2).

Ascough, R. (2002). Designing for online distance education: Putting pedagogy before technology. *Teaching Theology and Religion, 5*(1), 17-29.

Banados, E. (2006). A Blended-learning Pedagogical Model for Teaching and Learning EFL Successfully Through an Online Interactive Multimedia Environment. *CALICO Journal, 23*(3), 533-550.

Bashir, M., Afzal, M., & Azeem, M. (2008). Reliability and Validity of Qualitative and Operational Research Paradigm. *Pakistan Journal of Statistical an Operational Research, IV*(1), 35-45.

Bazeley, P. (2006). The contribution of computer software to integrating qualitative and quantitative data and analyses. *Research in the Schools, 13*(1), 64-74.

Beauchamp, G., & Kennewell, S. (2010). Interactivity in the classroom and its impact on learning. *Elsevier, 54*(3), 759-766. doi: 10.1016/j.compedu.2009.09.033

Beebe, M. A. (2004). *Impact of ICT revolution on the African academic landscape.* Paper presented at the CODESRIA Conference on Electronic Publishing and Dissemination, Dakar, Senegal.

Belawati, T., & Baggaley, J. (2010). Distance education in Asia: The PANdora guidebook T. Belawati & J. Baggaley (Eds.), (pp. 147). Retrieved from https://scholar.google.co.za/scholar?q=Distance+education+in+Asia%3A+The+PANdora+guidebook&btnG=&hl=en&as_sdt=0%2C5

Beldarrain, Y. (2006). Distance Education Trends: Integrating new technologies to foster student interaction and collaboration. *Distance Education, 27*(2), 139-153.

Bezjian-Avery, A., Calder, B., & Iacobucci, D. (1998). New Media interactive advertising vs traditional advertising. *Journal of Advertising Research, 38*(4), 23-32.

Blunch, N. (2012). *Introduction to structural equation modeling using IBM SPSS statistics and AMOS*. London: SAGE.

Bodgan, R., & Taylor, S. (1975). *Introduction to qualitative research methods*. New York.

Boeije, H. (2002). A purposeful approach to the constant comparative method in the analysis of qualitative interviews. *Quality and quantity, 36*(4), 391-409.

Bolboaca, S.-D., & Jäntschi, L. (2006). Pearson versus Spearman, Kendall's Tau correlation analysis on structure-activity relationships of biologic active compounds. *Leonardo Journal of Sciences, 5*(9), 179-200.

Bollinger, D., & Martindale, T. (2004). Key factors for determining student satisfaction in online courses. *International Journal of e-Learning, 3*(1), 61-67.

Bonk, C., & Graham, C. (2006). *The handbook of blended learning: Global Perspectives, Local Designs*. New York: John Wiley & Sons.

Bordoloi, R. (2012). Accessibility and Equity: A Challenge for Higher Education in India. *Journal of Economics and Sustainable Development, 3*(4), 67-78.

Briggs, A., & Coleman, M. (2009). *Research Methods in educational leadership and management* (2nd ed.). London: SAGE.

Brown, R. E. (2001). The process of community-building in distance learning classes. *Journal of asynchronous learning networks, 5*(2), 18-35.

Burgess, J. R. D., & Russel, J. E. A. (2003). The effectiveness of distance learning initiatives in organizations. *Journal of Vocational Behavior, 63*, 289-303.

Burke Johnson, R., & Christensen, L. (2014). *Educational Research. Quantitative, Qualitative and Mixed Approaches* (5th ed.): SAGE Publications.

Burke, M. (2007). Making choices: research paradigms and information management: Practical applications of philosophy in IM research. *Library review, 56*(6), 476-484.

Burnham, B. R., & Walden, B. (1997). *Interactions in distance education: A report from the other side.* Paper presented at the Annual Adult Education Research Conference Proceedings.

Burns, M. (2011). Distance education for teacher training: Modes, models and methods *Burns.– Washington: Education Development Center Inc*

Burrel, G., & Morgan, G. (1979). *Sociological paradigms and organizational analysis.* Brookfield, VT: Ashgate Publishing.

Byrne, B. M. (2013). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2nd ed.): Routledge.

Caracelli, V. J., & Greene, J. C. (1993). Data analysis strategies for mixed-method evaluation designs. *Educational evaluation and policy analysis, 15*(2), 195-207.

Carlson, J. (2010). Avoiding traps in member checking. *The Qualitative Report, 15*(5), 1102-1113.

Casey, D. (2008). A Journey to Legitimacy: The Historical Development of Distance Education through Technology. *Tech Trends, 52*(2), 45-51.

Cavage, C. (2012). Why Blended Learning May Be Just What You Have Been Looking For. Retrieved 15 February, 2016, from http://www.myenglishlab.com/docs/cavage_blended_learning_wp.pdf.

Cho, M.-H., & Kim, B. J. (2013). Students' self-regulation for interaction with others in online learning environments. *The Internet and Higher Education, 17*, 69-75.

Chou, C. (2003). Interactivity and interactive functions in web-based learning systems: a technical framework for designers. *British Journal of Educational Technology, 34*(3), 265-279.

Chou, C., Peng, H., & Chang, C. (2010). The technical framework of interactive functions for course-management systems: Students' perceptions, uses, and evaluations. *Computers & Education, 55*(2010), 1004-1017.

Chowdhury, M., & Khatun, K. (2013). Modeling E-Learning Assisted Distance Education System for Bangladesh. *International Journal of Advanced Science and Technology, 56*(2013), 131-142.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences. Hillside.* New Jersey: Lawrence Earlbaum Associates.

Cohen, L., Manion, L., & Morrison, K. (2011a). *Research methods in education* (7th ed.). New York: Routledge.

Cohen, L., Manion, L., & Morrison, K. (2011b). *Research methods in education* (7th ed.). Abingdon, OX: Routledge.

Collier, D., & Adcock, R. (1999). DEMOCRACY AND DICHOTOMIES: A Pragmatic Approach to Choices about Concepts. *Annual Reviews, 2*, 537-565.

Collis, B., & Wende, M. (2002). Models of technology and change in higher education: An international comparative survey on the current and future use of ICT in higher education. Retrieved 14 August, 2016, from http://doc.utwente.nl/44610/

Combrinck, M. (2016). Survey Education online Report - UODL (pp. 17). Potchefstroom: NWU.

Combrinck, M., Spamer, E., & Van Zyl, M. (2015). StUdeNtS'PercePtIoNS of the USe of INteractIVe whIte boardS IN the delIVery of dIStaNce learNINg ProgrammeS. *Progressio: South African Journal for Open and Distance Learning Practice, 37*(1), 99-113.

Commonwealth of Learning. (2000). An Introduction to Open and Distance Learning. Retrieved 11 Nov, 2011, from http://www.col.org/SiteCollectionDocuments/ODLIntro.pdf

Commonwealth of Learning. (2000.). An introduction to Open and Distance Learning., from http://www.col.org/resources/publications/trainingresources/Pages/intro. aspx/introODL.htm

Commonwealth of Learning. (2011). Introduction to open and distance learning (ODL): The Concept of Open and Distance Learning Retrieved 23 April 2011, 2011, from http://www.col.org/resources/publications/trainingresources/Pages/intro.aspx

Conrad, D., Mackintosh, W., McGreal, R., Murphy, A., & Witthaus, G. (2013). Report on the Assessment and Accreditation of Learners using OER. Retrieved 14 February, 2016, from http://oasis.col.org/handle/11599/232

Council on Higher Education. (2014). *Distance higher education programmes in a digital era: Good practice guide*. (1919856935).

Cramer, D., & Howitt, D. (2004). *The Sage dictionary of statistics: a practical resource for students in the social sciences*: SAGE.

Cresswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: SAGE.

Creswell, J. (2005). *Educational research: planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River NJ: Pearson.

Creswell, J. (2007). *Quality inquiry & Research design: Choosing among five approaches* (2nd ed.). USA: SAGE.

Creswell, J. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*: SAGE.

Creswell, J. (2013). *Qualitative Inquiry & Research Design* (3rd ed.): SAGE.

Creswell, J. (2014). *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*. USA: Pearson.

Csikszentmihalyi, M., & Wong, M. M.-h. (2014). Motivation and academic achievement: The effects of personality traits and the quality of experience *Applications of Flow in Human Development and Education* (pp. 437-465): Springer.

Dabbagh, N., & Kitsantas, A. (2011). Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. Retrieved 12 April, 2015, from http://www.sciencedirect.com/science/article/pii/S1096751611000467;

Dabney, K., Chakraverty, D., & Tai, R. (2013). The Association of Family Influence and Initial Interest in Science. *Science Education*, 395-409. Retrieved from

Daniel, J. (2012). Dual-mode universities in higher education: way station or final destination? *Open Learning: The Journal of Open, Distance and e-Learning, 27*(1), 89-95.

De Leeuw, D. (2005). To mix or not to mix data collection modes in surveys. *Journal of official statistics, 21*(2), 233.

De Vos, A., Strydom, H., Fouche, C., & Delport, C. (2011). *Research at grassroots. For the social sciences and human service professions* (4th ed.). Pretoria: Van Schaik.

De Vries, L., Gensler, S., & Leeflang, P. (2012). Popularity of Brand Posts on Brand Fan Pages: An Investigation of the Effects of Social Media Marketing. *Journal of Interactive Marketing, 26*(2012), 83-91.

Deb, S. (2012). *Multimedia Technology and Distance Learning Using Mobile Technology in Developing Countries* (2012 ed.). Rijeka, Croatia: Intech.

DeCoster, J. (1998). Overview of factor analysis.

DeCuir-Gunby, J., Marshall, P., & McCulloch, A. (2011). Developing and using a codebook for the analysis of interview data: An example from a professional development research project. *Field methods, 23*(2), 136-155.

Dede, C. (1989). The Evolution of Distance Learning:Technology-Mediated InteractiveLearning. *Journal of research on Computing in Education, 22*(3), 247-264.

Dede, C. (1996). The evolution of distance education: Emerging technologies and distributed learning. *American Journal of Distance Education, 10*(2), 4-36.

Dede, C. (2009). Immersive interfaces for engagement and learning. *science, 323*(5910), 66-69.

Del Campoa, J., Negrob, V., & Núñezc, M. (2012). *The history of technology in education. A comparative study and forecast*. Paper presented at the International Conference on Education and Educational Psychology (ICEEPSY 2012), Spain.

Denscombe, M. (2008). Communities of Practice. A Research Paradigm for the Mixed Methods Approach. *Journal of Mixed Methods Research, 2*(3), 270-283.

DHET. (2012). Draft policy framework for the provision of distance education in South African universoties (pp. 33). Pretoria.

Dictionary.com. (2014). Dictionary. from http://dictionary.reference.com/browse/structure

Dixon, K. (1987). Implementing Open Learning in Local Authority Institutions. London: Further Education Unit.

Dohmen, G. (1967). Das Fernstudien - Ein neues Pädagogisches Forschungs und Entwicklungsfeld. *Revue française de pédagogie, 1*(1967), 43-45.

Domagk, S., Schwartz, R., & Plass, J. (2010). Interactivity in multimedia learning: An integrated model. *Computers in Human Behaviour, 26*(2010), 1024-1033.

Donoghue, S. (2000). Projective techniques in consumer research. *Journal of Family Ecology and Consumer Sciences/Tydskrif vir Gesinsekologie en Verbruikerswetenskappe, 28*(1), 7.

Dourish, P. (2003). Computer Supported Cooperative Work 12 *The Appropriation of Interactive Technologies: Some Lessons from Placeless Documents* (pp. 465–490). Netherlands: Kluwer Academic Publishers.

Drost, E. (2011). Validity and Reliability in Social Science Research. *Education Research and Perspectives, 38*(1), 105-123.

Duke, B., Harper, G., & Johnston, M. (2013). *Exploring spaces for learning 2013.* Paper presented at the 2013 HETL Conference, Orlando, Florida.

Dunnion, B., & Knox, S. (2004). *Understanding and Managing Corporate Brands: A system Dynamics Perspective*. Paper presented at the Irish Academy of Management Annual Conference, Dublin.

Dzakiria, H., & Christopher, A. (2010). Interaction Issues in Malaysia Open Distance Learning(ODL). Retrieved 4 March, 2015, from https://scholar.google.co.za/scholar?q=Interaction+Issues+in+Malaysia+Open+Distance+Learning%28ODL%29&btnG=&hl=en&as_sdt=0%2C5

Ellis, L., & Mathis, D. (1985). College student learning from televised versus conventional classroom lectures: A controlled experiment. *Higher Education, 14*(2), 165-173.

Ellis, S., & Steyn, H. (2003). Practical significance (effect sizes) versus or in combination with statistical significance (p-values): Research note. *Management Dynamics: Journal of the Southern African Institute for Management Scientists, 12*(4), 51-53.

Evans, C., & Gibbons, N. (2007). The interactivity effect in multimedia learning. *Computers & Education, 49*(2007), 1147-1160.

Fägersten, K., & Dalarna, H. (2013). A Case Study of a Distance Degree Program in Vietnam: Examples from a Learner-Centered Approach to Distance Education. In J. Sullivan Hellgren (Ed.), *Cases on Professional Distance Education Degree Programs and Practices: Successes, Challenges, and Issues.* (pp. 22). Hershey: IGI Global.

Field, A. (2009). *Discovering statistics using SPSS*: Sage publications.

Finlay, L. (2009). Debating Phenomenological Research Methods. *Phenomenology & Practice, 3*(1), 6-25.

Flemming, S., & Hiple, D. (2004). Distance Education to Distributed Learning: Multiple Formats and Technologies in Language Instruction. *CALICO Journal, 22*(1), 63-82.

Fortin, D., & Dholakia, R. (2005). Interactivity and vividness effects on social presence and involvement with a web-based advertisement. *Journal of Business research, 58*(3), 387-396. doi: 10.1016/S0148-2963(03)00106-1

Fozdar, B., & Kumar, L. (2007). Mobile Learning and Student Retention. *International Review of Research in Open and Distance Learning, 8*(2), 18.

Fraenkel, J., & Wallen, N. (2008). *How to Design and Evaluate Research in Education* (7th ed.). New York: McGraw-Hill.

Fraenkel, J., & Wallen, N. (2009). *How to Design and Evaluate Research in Education* (7th ed.). New York: McGraw-Hill.

Fraenkel, J., Wallen, N., & Hyun, H. (2012). *How to Design and EvaluateResearch in Education* (Vol. 8th): McGraw-Hill.

Francis, J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M., & Grimshaw, J. (2010). What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychology & Health, 25*(10), 1229-1245. doi: 10.1080/08870440903194015

Franke, G. R. (1996). Basic Principles of Structural Equation Modeling: An Introduction to LISREL and EQS. *JMR, Journal of Marketing Research, 33*(2), 255.

Fraser, W., & Killen, R. (2005). The perceptions of students and lecturers of some factors influencing academic performance at two South African Universities. *Perspective in Education, 23*(1), 25-40.

Friese, S. (2014). *Qualitative Data Analysis with Atlas.ti* (2nd ed.): Sage.

Fulford, C., & Zhang, S. (1993). Perceptions of Interaction: The Critical Predictor in Distance Education. *The American journal of distance education, 7*(3), 8-21.

Gachago, D., Ivala, E., Backhouse, J., Bosman, J. P., Bozalek, V., & Ng'ambi, D. (2013). Towards a shared understanding of emerging technologies: experiences in a collaborative research project in South Africa. *The African Journal of Information Systems, 5*(3), 94-105.

Gall, M., Gall, J., & Borg, W. (2007). *Educational research: and introduction.* Boston: Pearson.

Garrett-Mayer, E. (2006). Statistics in psychosocial research lecture 8 factor analysis I. Retrieved 14 June, 2013, from http://ocw.jhsph.edu/courses/statisticspsychosocialresearch/pdfs/lecture8.pdf

Garrett, R. (2016). The State of Open Universities in the Commonwealth: A perspective on performance, competition and innovation. Retrieved 7 August, 2016, from http://dspace.col.org/handle/11599/2048

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The internet and higher education, 7*(2), 95-105.

Geray, C. (2007). Distance education in Turkey. *International Journal of Educational Policies, 1*(1), 33-62.

Ghosh, C., & Das, M. (2014). Selected Innovations for Open and Distance Learning System. *COMOSA Journal of Open Schooling, 5*(1), 29.

Ghosh, S., Nath, J., Agarwal, S., & Nath, A. (2012). Open and Distance Learning (ODL) education system: Past, Present and Future - a systematic study of an alternative education system. *Journal of Global Research in Computer Science, 3*(4), 53-57.

Gibbs, D., & Gosper, M. (2012). The upside-down-world of e-learning. *Journal of learning design, 1*(2), 46-54.

Gibson, C. (1998). The distance learner in context *Distance learners in higher education: Institutional responses for quality outcomes*. Madison, WI: Atwood Publishing.

Giorgi, A. (2006). Difficulties encountered in the application of the phenomenological method in the social sciences. *Análise Psicológica, 3*(XXIV), 353-361.

Glover, D., Miller, D., Averis, D., & Door, V. (2005). Leadership implications of using interactive whiteboards linking technology and pedagogy in the management of change. *Management in Education 18*(5), 27-30.

Golafshani, N. (2003). Understanding Reliability and Validity in Qualitative Research. *The Qualitative Report, 8*(4).

Graneheim, U., & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today, 24*, 105-112.

Gray, L., Mills, G., & Airasian, P. (2011). *Educational Research. Competencies for analysis and applications* (10 ed.). Upper Saddle River: Pearson Higher Ed.

Green, S., Jones, R., Pearson, E., & Gkatzidou, S. (2006). Accessibility and adaptability of learning objects: responding to metadata, learning patterns and profiles of needs and preferences. *Research in Learning Technology, 14*(1), 117-129.

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a conceptual framework for mixed-method evaluation designs. *Educational evaluation and policy analysis, 11*(3), 255-274.

Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough? An Experiment with Data Saturation and Variability. *Field Methods, 18*(1), 59-82.

Gunawardena, C., & McIsaac, M. (2004). Distance Education. In J. Jonassen (Ed.), *The handbook on education communities and technology* (2 ed., pp. 355-397). Mahwah, NJ: Lawrence Erlbaum Associates.

Hackman, M. Z., & Walker, K. B. (1990). Instructional communication in the televised classroom: The effects of system design and teacher immediacy on student learning and satisfaction. *Communication Education, 39*(3), 196-206.

Haller, A. (2014). *A Descriptive Study of Student Motivation in Online Distance Learning Environments.* Masters of Science, University of Arizona.

Harvey, L., & Green, D. (1993). Defining quality. *Assessment & evaluation in higher education, 18*(1), 9-34.

Harwell, M. (2011). Research Design in Qualitative/Quantitative/Mixed Methods *The Sage handbook for research in education* (2nd ed., pp. 147-182): sagepub.

Hersh, M. (2014). Evaluation framework for ICT-based learning technologies for disabled people. *Computers & Education, 78*(2014), 30-47.

Heydenrych, J., & Prinsloo, P. (2010). Revisiting the five generations of distance education: Quo vadis? Retrieved 01 March, 2015, from http://uir.unisa.ac.za/handle/10500/4998

Hillman, D. C., Willis, D. J., & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *American Journal of Distance Education, 8*(2), 30-42.

Hoffman, D., & Nova, T. (1996). Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations. *Journal of Marketing, 60*(3), 50-68.

Hoffman, D., & Novak, T. (1996). Marketing in hypermedia computer-mediated environments: conceptual foundations. *Journal of marketing, 60*, 50-68.

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods, 6*(1), 53-60.

Hope, A. (2006). Factors for success in dual mode institutions. Retrieved 14 February, 2014, from http://dspace.col.org/handle/11599/203

Huang, E. Y., Lin, S. W., & Huang, T. K. (2012). What type of learning style leads to online participation in the mixed-mode e-learning environment? A study of software usage instruction. *Computers & Education, 58*(1), 338-349.

IBM. (2016). IBM SPSS Statistics Version 23, Release 23.0.0,Copyright©: IBM Corporation and its licensors. Retrieved from http://www-01.ibm.com/software/analytics/spss/

Ilieva, J., Baron, S., & Healey, N. M. (2002). Online surveys in marketing research: Pros and cons. *International Journal of Market Research, 44*(3), 361.

Isman, A., Dabaj, F., Altinay, F., & Altinay, Z. (2003). Communication Barriers in Distance Education. *The Turkish Online Journal of Educational Technology, 2*(4), 5.

Ivankova, N. V., Creswell, J. W., & Stick, S. L. (2006). Using mixed-methods sequential explanatory design: From theory to practice. *Field methods, 18*(1), 3-20.

Jackson, S. (2016). *Research Methods and Statistics: A Critical Thinking Approach* (5th ed.). Boston, USA: Cengage Learning.

Jacobs, C., Sorensen, C., & Walker, D. (2014). *Introduction to Research in Education* (9th ed.). United Kingdom: Cengage.

James, F. (2012). Blended learning and learning communities: opportunities and challenges. *Journal of Management Development, 31*(4), 398-411.

Jenkins, M., Brown, T., Walker, R., & Hewitt, R. (2011). The development of technology enhanced learning: findings from a 2008 survey of UK higher education institutions. *Interactive Learning Environments, 19*(5), 447–465.

Jensen, J. (1998). 'Interactivity' Tracking a New Concept in Media and Communication Studies. Retrieved 11 March 2014, 2014, from http://www.organicode.net/jenson.pdf

Johnson, L. (2012). NMC Horizon Project Preview 2012 Higher Education Edition. Retrieved 10 August, 2016, from http://resolver.ebscohost.com.nwulib.nwu.ac.za/openurl?sid=google&auinit=L&aulast=Johnson&atitle=NMC+Horizon+Project+Preview+2012+Higher+Education+Edition&title=Higher+Education&date=2012

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). The NMC Horizon Report: 2015 Higher Education Edition. Retrieved 12 April, 2015, from http://eric.ed.gov/?id=ED559371

Johnson, R., Onwuegbuzie, A., & Turner, L. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research, 1*(112), 23. doi: 10.1177/1558689806298224

Johnson, R., & Onwuegbuzie, J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher, 33*(7), 14-26.

Joubert, I., Hartell, C., & Lombard, K. (2016). *Navorsing. 'n Gids vir die beginnernavorseer*: Van Schaik Uitgewers.

Juliana, B., & John, M. (2005). Origin and Trend of Distance Education in Uganda. *Journal of Social Sciences, 1*(3), 166-171.

Kale, U. (2008). Levels of interaction and proximity: Content analysis of video-based classroom cases. *The Internet and Higher Education, 11*(2), 119-128.

Kanuka, H., & Conrad, D. (2003). The name of the game--why "distance education" says it all. *The Quarterly Review of Distance Education, 3*(3), 385-393.

Kanwar, A., & Mishra, S. (2016). Can ODL reach the unreached? Lessons from the Commonwealth. Retrieved 7 August, 2016, from http://oasis.col.org/handle/11599/2378

Karoulis, A. (2011). On Motivation to Apply ODL in Adult Teachers' Education. *Informatics in Education-An International Journal, 10*(1), 37-45.

Karpenko, M. (2008). The Emergence and Development of Distance Education. *Russian Education and Society, 50*(3), 45-56. doi: 10.2753/RES1060-9393500304

Kaur, M. (2013). Blended learning - its challenges and future. *Procedia - Social and Behavioral Sciences, 93*(2013), 612-617.

Keegan, D. (1996). *Foundations of Distance Education* (3rd ed.). New York: Routledge.

Kember, D. (2007). Reconsidering Open & Distance Learning in the Developing World. *International Journal of Lifelong Education, 28*(5), 681-683.

Kennedy-Eden, H., & Gretzel, U. (2012). A taxonomy of mobile applications in tourism. *Research Online, 10*(2), 47-50.

Khodamoradi, S., & Abedi, M. (2011). Using of Distance Education in adult education. *Nature and Science, 9*(4), 112-117.

Kimberlin, C., & Winterstein, A. (2008). Validity and reliability of measurement instruments used in research. *Am J Health-Syst Pharm, 65*, 2276-2284.

Klímová, B. (2008). Blended Learning and Teaching Foreign Languages. *Problems of education in the 21st century, 5*(2008), 69-74.

Koerten, H. (2008). Assessing the organisational aspects of SDI: metaphors matter. *A Multi-View Framework to Assess SDIs. J. Crompvoets, A. Rajabifard, B. Van Loenen and T. Delgado. Melbourne*, 235-254.

KOTUR. (2006). Distance Education *50*(6), 427-429. Retrieved from http://medind.nic.in/iad/t06/i6/iadt06i6p427.pdf

Kuboni, O., Kinshuk, A., Lentell, H., Mackintosh, W., Victor, L., Webb, R., & West, P. (2014). *Achieving development goals innovation in education and development.* Paper presented at the Fourth Pan Commonwealth Forum on Open Learning, Ocho Rios, Jamaica.

Kumar, S., Chaudhary, N., & Shankar, G. (2008). Extending Open Distance Learning into Rural North-Eastern India. *Asian Journal of Distance Education, 6*(2), 17-31.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *International Biometrics Society, 33*(1), 159-174.

Leech, N., & Onwuegbuzie, A. (2009). A typology of mixed methods research designs. 265-275. Retrieved from http://www.kuleuven.be/avl/Zomerschool%202012/Typologie%20Mixed%20Methods_info.pdf doi:10.1007/s11135-007-9105-3

Levine, A. (2001). higher education; future; change. *Innovative Higher Education, 25*(4), 253-267.

Liang, T., Huang, Y., & Tsai, C. (2012). An Investigation of Teaching and Learning Interaction Factors for the Use of the Interactive Whiteboard Technology. *Journal of Educational Technology & Society 15*(4), 356-367.

Lim, D., Morris, M., & Kupritz, V. (2014). Online vs Blended Learning. Differences in instructional outcomes and learner satisfaction. Retrieved 06 April, 2015, from https://scholar.google.co.za/scholar?q=Online+vs+Blended+Learning.+Differences+in+instructional+outcomes+and+learner+satisfaction&btnG=&hl=en&as_sdt=0%2C5

Lindberg, J., & Olofsson, A. (2006). Individual and flexible: Working conditions in the practice of Swedish distance-based teacher education. *International Education Journal, 7*(5), 699-708.

Liu, Y., & Shrum, L. (2002). What Is Interactivity and Is It Always Such a Good Thing? Implications of Definition, Person, and Situation for the Influence of Interactivity on Advertising Effectiveness. *Journal of Advertising, 31*(4), 53-64.

Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer-Mediated Communication, 3*(2).

Lusted, D. (1986). Why pedagogy? *Screen, 27*(5), 2-16.

Maboe, K. (2013). *On-line learning among health studies' students at an open distance learning institution: prospects and challenges for interactivity.* Doctor of literature and philosophy, UNISA, Pretoria.

MacQueen, K. M., McLellan, E., Kay, K., & Milstein, B. (1998). Codebook development for team-based qualitative analysis. *Cultural anthropology methods, 10*(2), 31-36.

Malina, M., Norreklit, H., & Selto, F. (2010). Lessons Learned: Advantages and Disadvantages of Mixed Method Research. *ResearchGate*, 27. Retrieved from

Manouselis, N., Drachsler, H., Vuorikari, R., Hummel, H., & Koper, R. (2011). Recommender Systems in Technology Enhanced Learning *Recommended systems handbook* (pp. 387-415): Springer.

Maree, K. (2007). *First steps in research*. Paarl print: Van Schaik Publishers.

Maree, K. (2009). *First steps in research*. Pretoria: Van Schaik.

Maree, K. (2016). *First Steps in Research. Second Edition*. Pretoria: Van Schaik Publishers.

Marshall, M. N. (1996). Sampling for qualitative research. *Family practice, 13*(6), 522-526.

Marson, S. (1997). A Selective History of Internet Technology and Social Work. *Computers in Human Services, 14*(2), 8.

Mbwesa, J. (2011). Analysis of the instructional effectiveness of asynchronous e-learning environments in Kenia: A case study of the WEDUSOFT platform, University of Nairobi. *Journal of Continuing Open and Distance Education, 1*(2), 194.

McCusker, K., & Gunaydin, S. (2015). Research using qualitative, quantitative or mixed methods and choice based on the research. *Perfusion, 30*(7), 537-542.

McIsaac, M., & Gunawardena, C. (2001). Distance Education *The handbook of research for Educational Communications and Technology* (pp. 403-438).

McMillan, J. (2005). The researchers and the concept: Moving beyond a blind axamination of interactivity. *Journal of Interactive Advertising, 5*(2), 1-4.

McMillan, J., & Schumacher, S. (2014). *Research in Education. Evidence-Based Inquiry* (7th ed.). Boston: Pearson/Allyn and Bacon.

McMillian, S. J., & Schumacher, S. (2001). *Research In Education: A conceptual Introduction* (5 ed.). New York: Allyn & Bacon.

McNeil, S., Robin, B., & Miller, R. (2000). Facilitating interaction, communication and collaboration in online courses. *Computers & Geosciences, 26*(2000), 699-708.

Mdakane, M. (2011). *Student satisfaction in open distance learning in a BEd Hons programme.* Phd, North-West University, Potchefstroom.

Merriam, S. (1998). *Qualitative research and case study applications in education. Revised and expanded from*. San Francisco: Jossey-Bass Publishers.

Merriam, S. (2009). *Qualitative Research. A Guide to Design and Implementation*. USA: Jossey-Bass.

Merriam, S., & Tisdell, E. (2016). *Qualitative Research. A Guide to Design and Implementation*. San Francisco: Jossey-Bass.

Mertler, C., & Charles, C. (2011). *Introduction to Educational Research* (7th ed.). Boston: Pearson.

Mikropoulos, T. (2011). On the pedagogy of open and distance learning systems. Retrieved 2016/09/01, from http://earthlab.uoi.gr/earthlab_files/articles/ODLPedagogy.pdf

Miles, M., Huberman, A., & Saldana, J. (2014). *Qualitative Data Analysis. A Methods Sourcebook* (3rd ed.): SAGE Publications.

Miller, D., & Salkind, N. (2002). *Handbook of Research Design* (6th ed.): SAGE Publications.

Milojević, A., Kleut, K., & Ninković, D. (2013). Methodological Approaches to Study of Interactivity in Communication Journals. *Scientific Journal of Media Education, 41*(XXI), 93-102.

Mitchell, I. (2009). Distance Education: An International Journal: reflections on how it all began. *Distance Education, 30*(1), 143-156. doi: 10.1080/01587910902845998

Moore, M. G. (1989). Editorial: Three types of interaction. *The American Journal of Distance Education, 3*(2).

Moore, M. G. (1997). Theory of transactional distance. In D. Keegan (Ed.), *In Theoretical principles of distance education*. New York: Routledge.

Moskal, P., Dziuban, C., & Hartman, J. (2013). Blended learning: A dangerous idea? *The Internet and Higher Education, 18*(2013), 15-23.

Mouton, J. (2001). *How to succeed in your Master's and Doctoral studies: ASouth African guide and reseource book*. Pretoria: Van Schaik.

Mowery, D. C. (1999). The computer software industry. In D. Mowery & R. Nelson (Eds.), *Sources of industrial leadership: Studies of seven industries* (pp. 133-168). Cambridge: Cambridge University Press.

Msweli, P. (2012). Mapping the Interplay between Open Distance Learning and Internationalisation Principles. *The international review of research in open and distance learning, 13*(3), 97-116.

Mueller, R. O. (1996). Basic principles of structural equation modeling: An introduction to LISREL and EQS. *Statistics in Medicine, 18*(8), 757-758.

Mugo, F. (2011). Sampling In Research. 11. Retrieved from

Muijs, D. (2011). *Doing Quantitative Research in Education using SPSS*. MPG Books Group Great Britain: SAGE.

Muyinda, P. B. (2012). *Open and distance learning in dual mode universities: a treasure unexploited*: INTECH Open Access Publisher.

Muyinda, P. B., Mayende, G., & Kizito, J. (2015). Requirements for a Seamless Collaborative and Cooperative MLearning System *Seamless Learning in the Age of Mobile Connectivity* (pp. 201-222): Springer.

Neuman, W. (2014). *Social Research Methods: Qualitative and Quantitative Approaches* (7th ed.). Essex: Pearson Education Limited.

Newby, P. (2014). *Research Methods for Education, Second edition* (2nd ed.): Routledge.

Newman, W. (2007). *Social research methods: Qualitative and quantitative approaches* (3rd ed.): Needham Heights: Allan & Bacon.

Ngengebule, T. (2003). *An Overview and Analysis of Policy for Distance Education in South African Higher Education: Roles Identified for Distance Education and Developments in the Arena from 1948*. Pretoria: UNISA.

Njoroge, R. W., Wambiri, D. M., & Ogeta, N. (2015). *Physical security measures for computer-based information systems: A case study of selected academic libraries in Kenya.* Paper presented at the IST-Africa Conference, 2015.

North-West University. (2006). Institutional governance overview (pp. 113). Potchefstroom: North-West University.

North-West University. (2011). Teaching and Learning Policy of the NWU (pp. 4). Potchefstroom: NWU.

North-West University. (2012). Policy on the responsible use of Information and Communication Technology, Networks and Information Resources at the North-West University. Potchefstroom: NWU.

Service Level Agreement between NWU and Limpopo Department of Education (2015).

North-West University. (2016). Annual Performance Plan and Strategic Plan North-West University 2016 (pp. 76). Potchefstroom: North-West University.

Northrup, P. (2006). The power of five: interaction strategies that work. Retrieved 19 February, 2016, from https://scholar.google.co.za/scholar?q=The+power+of+five%3A+interaction+strategies+that+work.+2001&btnG=&hl=en&as_sdt=0%2C5

Onwuegbuzi, A., & Leech, N. (2006). Linking Research Questions to Mixed Methods Data Analysis Procedures 1. *Qualitative Report, 11*(3), 474-498.

Onwuegbuzie, A., & Leech, N. (2005). On Becoming a Pragmatic Researcher: The Importance of Combining Quantitative and Qualitative Research Methodologies. *international Journal of Social Research Methodology, 8*(5), 375-387.

Onwuegbuzie, A., Leech, N., & Collins, K. (2010). Innovative Data Collection Strategies in Qualitative Research. *The Qualitative Report 15*(3), 696-726.

Oprea, C. (2014). The Internet - a tool for interactive learning. *Procedia - Social and Behavioral Sciences, 142*(2014), 786–792.

Owston, R., York, D., & Murtha, S. (2013). Student perceptions and achievement in a university blended learning strategic initiative. *Internet and Higher Education, 18*(2013), 38-46.

Pace, R., Pluye, P., Bartlett, G., Macaulay, A., Salsberg, J., Jagosh, J., & Seller, R. (2012). Testing the reliability and efficiency of the pilot Mixed Methods Appraisal Tool (MMAT) for systematic mixed studies review. *International Journal of Nursing Studies, 49*(2012), 47-53.

Palme, A. (2009). Enhancing learning and teaching through the use of technology: A revised approach to HEFCE's strategy for e-learning. *HEFCE. United Kingdom.*

Pandor, N. (2004). *Promoting quality in state school.* Paper presented at the Boys only Principal Conference, Rondebosch. http://education.pwv.gov.za

Parsons, D., & Ryu, H. (2006). A Framework for assessing the quality of mobile learning. from http;//www.citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.108.2612

Patton, M. (2002). *Qualitative Research & Evaluation Methods* (3rd ed.). Thousand Oaks: Sage Publications.

Perraton, H. (2007). *Open and Distance Learning in the Developing World* (2nd ed.). New York: Routledge.

Petty, N., Thomson, O., & Stew, G. (2012). Ready for a paradigm shift? Part 2: Introducing qualitative research methodologies and methods. *Manual Therapy, 17*(2012), 378-384.

Picciano, A. (2009). Blending with purpose: The multimodal model. *Journal of the Research Center for Educational Technology, 5*(1), 4-14.

Picciano, A. G. (2002). Beyond student perceptions: Issues of interaction, presence, and performance in an online course. *Journal of Asynchronous learning networks, 6*(1), 21-40.

Pluye, P., Gagnon, M., Griffiths, F., & Johnson-Lafleur, J. (2009). A scoring system for appraising mixed methods research, and concomitantly appraising qualitative, quantitative and mixed methods primary studies in Mixed Studies Reviews. *International Journal of Nursing Studies, 46*(2009), 529-546. doi: 10.1016/j.ijnurstu.2009.01.009

Potter, J. (2013). Beyond Access: Student Perspectives on Support Service Needs in Distance Learning. *Canadian Journal of University Continuing Education, 24*(1), 59-82.

Prince, M., & Felder, R. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of engineering education, 95*(2), 123-138.

Punch, K. (2009). *Introduction to research methods in education*: SAGE Publications ltd.

Quiring, O., & Schweiger, W. (2008). Interactivity: A review of the concept and a framework for analysis. *Communications, 33*(2008), 147-167. doi: 10.1515/COMMUN.2008.009

Rabe, A., & Sieberhagen, H. (2013). *Die Ontwikkeling van Afstandsonderrig aan die Noordwes-Universiteit*. Bapsfontein: Credo.

Rafiq, N., Shoaib, M., & Arshad, S. (2014). Exploring the impact of flexibility on quality benchmarks in distance education. *Pakistan Journal of Science, 66*(4), 346-350.

Redelinghuys, J. (2012). *Management guidelines for the implementation of m-learning in an open distance learning model.* MEd Research, North-West-University, Potchefstroom.

Redelinghuys, J. (2015). Guidelines 2016 - Arrangement and information for Contact sessions in SA and Namibia (pp. 24). Potchefstroom: NWU.

Reinhard, C. (2011). Studying the interpretive and physical aspects of interactivity: Revisiting interactivity as a situated interplay of structure and agencies. *The European Journal of Communication Research 36*(2011), 353-374. doi: 10.1515/COMM.2011.018

Reiter, D., Lakoff, D., Trueger, N., & Shah, K. (2013). Individual Interactive Instruction: An Innovative Enhancement to Resident Education. *Annals of Emergency Medicine, 61*(1), 110-113.

Roberts, B. (2002). Interaction, reflection and learning at a distance. *Open Learning, 17*(1), 39-55.

Robson, C. (2011). *Real world research. A Resource for Users of Social Research Methods in Applied Settings* (3rd ed.). UK: Wiley & Sons.

Rodriguez, C. (2012). MOOCs and the AI-Stanford like Courses: Two Successful and Distinct Course Formats for Massive Open Online Courses. Retrieved 18 March, 2015, from http://www.eurodl.org/index.php?p=archives&year=2013&halfyear=2&article=516

Rolfe, G. (2006). Validity, trustworthiness and rigour: quality and the idea of qualitative research. *Journal of Advanced Nursing, 53*(3), 304-310.

Rosé, C., & Torrey, C. (2005). Interactivity and Expectation: Eliciting Learning Oriented Behavior with Tutorial Dialogue Systems. *INTERACT 2005*, 14. Retrieved from http://www.cs.cmu.edu/afs/.cs.cmu.edu/Web/People/cprose/pubweb/DialogueCamera.pdf

Rothman, S. (2014). Guidelines for Writing Dissertations and Theses in the Optentia Research Focus Area at the North-West University (pp. 40). NWU.

Rowntree, D. (1996). *Exploring Open and Distance Learning*. London: Routledge.

Saldana, J. (2009). *The Coding Manual for Qualitative Researchers*. Los Angeles: SAGE.

Saldana, J. (2013). *The Coding Manual for Qualitative Researchers* (2nd ed.): SAGE.

Sandelowski, M., Voils, C. I., & Knafl, G. (2009). On quantitizing. *Journal of mixed methods research, 3*(3), 208-222.

Sarantakos, S. (2005). *Social Research* (3rd ed.). New York: Palgrave MacMillan.

Scanlon, E., & Issroff, K. (2005). Activity theory and higher education: Evaluating learning technologies. *Journal of Computer Assisted Learning, 21*(6), 430-439.

Schenker, J. (2007). *The effectiveness of technology use in statistics instruction in Higher Education: A meta-analysis using hierarchical linear modeling.* PHd, Kent State University College.

Schlosser, C. A., & Anderson, M. L. (1994). *Distance education: Review of the literature*: ERIC.

Schlosser, L., & Simonson, M. (2009). *Distance Education. Definition and glossary of terms* (3rd ed.). Charlotte, North Carolina: Information Age Publishing.

Shahabadi, M., & Uplane, M. (2015). Synchronous and asynchronous e-learning styles and academic performance of e-learners. *Procedia - Social and Behavioral Sciences, 176*(2015), 129-138.

Shannon, S., Francis, R., & Torpey, G. (2012). *Barriers to adoption of blended learning and online feedback and assessment by sessional staff*. Paper presented at the 46th Annual Conference of the Architectural Science Association (ANZAScA), Queensland.

Sharma, R. C. (2005). Open learning in India: evolution, diversification and reaching out. *Open Learning, 20*(3), 227-241.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for information, 22*(2), 63-75.

Shin, N. (2002). Beyond interaction: The relational construct of'transactional presence'. *Open Learning, 17*(2), 121-137.

Silverman, D. (Ed.). (2011). *Qualitative Research. Issues of Theory, Method and Practice* (3rd ed.): SAGE Publishers.

Simonson, M., Schlosser, C., & Orellana, A. (2011). Distance education research: a review of the literature. *Journal of Computing in Higher education, 23*(2011), 124-142.

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2009). *Teaching and Learning at a Distance: Foundations of Distance Education* (4th ed.). United States of America: Pearson.

Singh, H., & Reed, C. (2001). A White Paper: Achieving Success with Blended Learning. Retrieved 29 April, 2015, from https://scholar.google.co.za/scholar?hl=en&q=A+White+Paper%3A+Achieving+Success+with+Blended+Learning&btnG=&as_sdt=1%2C5&as_sdtp=

So, H.-J., & Brush, T. A. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education, 51*(1), 318-336.

So, H., & Bonk, C. (2010). Examining the Roles of Blended Learning Approaches in Computer-Supported Collaborative Learning (CSCL) Environments: A Delphi Study. *Journal of Educational Technology & Society, 13*(3), 189-200.

Song, J., & Zinkhan, G. (2008). Determinants of Perceived Web Site Interactivity. *Journal of Marketing, 72*(2), 99-113.

Steuer, J. (1992). Defining virtual reality: dimensions determining telepresence. *Journal of Communication, 42*(4), 73-93.

Steyn, H. (2000). Practical significance of the difference in means. *SA journal of industrial psychology, 26*(3), 1-3.

Stickler, U., & Hampel, R. (2010). CyberDeutsch: Language Production and User Preferences in a Moodle Virtual Learning Environment. *CALICO Journal, 28*(1), 49-73.

Stoner, G. (1996). A conceptual framework for the integration of learning technology *Implementing learning technology* (Vol. 6, pp. 6-13). Edinburgh: Learning Technology Dissemination Initiative.

Suhr, D. D. (2006). *Exploratory or confirmatory factor analysis?* Paper presented at the SUGI 31 San Francisco, Carlifornia. http://www2.sas.com/proceedings/sugi31/200-31.pdf

Sundar, S., Xu, Q., & Bellur, S. (2010). *Designing Interactivity in Media Interfaces: A Communications Perspective*. Paper presented at the CHI 2010: Perspectives on Design, Atlanta, USA. http://dmrussell.net/CHI2010/docs/p2247.pdf

Szekely, G. J., & Rizzo, M. L. (2005). Hierarchical clustering via joint between-within distances: Extending Ward's minimum variance method. *Journal of classification, 22*(2), 151-183.

Talib, M., Rubin, L., & Zhengyi, V. (2013). Qualitative Research on Critical Issues In Halal Logistics. *Journal of Emerging Economies and Islamic Research, 1*(2), 20.

Taylor, J. (1998). *The death of distance: The birth of the global higher education economy*. Paper presented at the ICDE SCOP 98, Coolum, Australia.

Taylor, J. (2001). Fifth Generation Distance education. Retrieved 16 May, 2016, from https://scholar.google.co.za/scholar?q=Fifth+generation+of+distance+education&btnG=&hl=en&as_sdt=0%2C5

Teddlie, C., & Tashakkodi, A. (2009). *Foundations of Mixed Method Research*: SAGE.

Teddlie, C., & Yu, F. (2007). Mixed Methods Sampling: A Typology With Examples. *Journal of Mixed Methods Research, 1*(1), 77-100. doi: 10.1177/2345678906292430

Terrel, S. (2012). Mixed-Methods Research Methodologies. *The Qualitative Report, 17*(1), 254-280.

Tesch, R. (2013). *Qualitative research: Analysis types and software*: Routledge.

Timeline Beta. (2011). History-of-Distance-Education. Retrieved 13 April 2011, from http://www.xtimeline.com/timeline/History-of-Distance-Education

Torrance, H. (2012). Triangulation, Respondent Validation, and Democratic Participation in Mixed Methods Research. *Journal of Mixed Methods Research, 6*(2), 111-123. doi: 10.1177/1558689812437185

Townsend, E., Campbell, C., Curran-Smith, J., McGinn, F., Persaud, D., Peters, P., . . . Sheffield, S. L. M. (2007). Accessibility and interactivity in distance education programs for health professions. *International Journal of E-Learning & Distance Education, 17*(2), 1-24.

Towobola, W., & Raimi, L. (2011). Open Distance Learning (ODL): A catalyst for educational and entrepreneurship development in Nigeria. *Continental Journal for Education Research, 4*(3), 1-11.

Tripathi, P., & Mukerji, S. (2008). Access and equity to education in India through synergy of conventional and ODL systems: A step towards democratization of education. *Open Praxis, 9*(9), 25.

Tu, C., & McIsaac, M. (2002). The Relationship of Social Presence and Interaction in Online Classes. *The american journal of distance education, 16*(3), 131-150.

UNESCO. (2002). *Open and Distance Learning. Trends, Policy and Strategy Considerations*. Paris: UNESCO.

UNISA. (2008). Open Distance Learning Policy (pp. 13). Pretoria: UNISA.

UNISA.   (2009).   Our   History.   from
      http://www.unisa.ac.za/Default.asp?Cmd=ViewContent&ContentID=20555

Unit for Open Distance Learning. (2015). *Unit for Open Distance Learning: Quality manual.* North-
      West University. Potchefstroom.

UODL. (2016). *Dagbestuursvergadering van die Eenheid vir Oop Afstandsleer.* NWU. Potchefstroom.

Van der Westhuizen, P. C. (2009). *Effective Educational Management.* Pretoria: Creda
      Communications.

Van Deventer, M., & Blignaut, A. S. (2013). Taking the Plunge from Classroom Teaching to
      Technology Enhanced Learning at a Residential University. *Journal of Information Technology
      and Application in Education, 2*(3), 105-116.

Van Ryneveld, L. (2005). *Surviving the game: Interaction in an adult online learning community.* PHd,
      University of Pretoria.

Varadarajan, R., Srinivasan, R., Vadakkepatt, G., Yadav, M., Pavlou, P., Krishnamurthy, S., & Krause,
      T. (2010). Interactive Technologies and Retailing Strategy: A Review, Conceptual Framework
      and Future Research Directions. *Journal of Interactive Marketing, 24*(2010), 96-110.

Varao-Sousa, T., & Kingstone, A. (2015). Memory for Lectures: How Lecture Format Impacts the
      Learning Experience. *PLoS ONE*, 11. Retrieved from doi:10.1371/journal.pone.0141587

Veletsianos, G. (2010). *Emerging technologies in distance education.* Ahtabasca University: AU press.

Venkatesh, V., Brown, S., & Bala, H. (2013). Bridging the Qualitative-Quantitative Divide: Guidelines
      for conducting Mixed Methods Research Information Systems. *MIS Quarterley, 37*(1), 21-54.

Venkatesh, V., & Carswell, A. (2002). Learner outcomes in an asynchronous distance education
      environment. *International Journal of Human-Computer Studies, 56*, 475-494.

Visser, L., Visser, Y., Amirault, R., & Simonson, M. (2012). *Trends and Issues in Distance Education*
      (2nd ed.). Greenwich: Information Age.

Voorveld, H., Neijens, P., & Smit, E. (2011). The Relation Between Actual and Perceived Interactivity.
      Journal of Advertising, 40(2), 77-92.

Vrasidas, C. (2000). Constructivism versus objectivism: Implications for interaction, course design, and
      evaluation in distance education. *International Journal of Educational Telecommunications,
      6*(4), 339-362.

Wagner, E. D. (1994). In support of a functional definition of interaction. *American Journal of Distance
      Education, 8*(2), 6-29.

Wang, H. (2014). *Challenges for Distance Education A cultural analytic perspective on asynchronous
      online courses in Sweden.* Master of Applied Cultural Analysis, Lund University, Sweden.

Wei, H., Peng, H., & Chou, C. (2015). Can more interactivity improve learning achievement in an
      online course? Effects of college students' perception and actual use of a course-
      management system on their learning achievement. *Computers & Education, 83*(2015), 10-21.

Williams, C. (2007). Research Methods. *Journal of Business & Economic Research, 5*(3), 65-72.

Williams, C. (2011). Research methods. *Journal of Business & Economics Research (JBER), 5*(3).

Yacci, M. (2000). Interactivity Demistified: A Structural Definition for Distance Education and Intelligent
      CBT. from http://www.ist.rit.edu/~may/interactiv8.pdf

Zachariadis, M., Scott, S., & Bearret, M. (2013). Methodological implications of critical realism for mixed-methods research. *MIS Quarterley, 37*(3), 26.

Zhan, Z., & Mei, H. (2013). Academic self-concept and social presence in face-to-face and online learning: Perceptions and effects on students' learning achievement and satisfaction across environments. *Computers & Education, 69*, 131-138.

Zitter, I., De Bruijn, E., Simons, R., & Cate, O. (2012). The role of professional objects in technology-enhanced learning environments in higher education. *Interactive Learning Environments, 20*(2), 119-140.

Zupancic, B., & Horz, H. (2002). Lecture recording and its use in a traditional university course. *ACM SIGCSE Bulletin, 34*(3), 24-28.