



UNIVERSITY OF KWAZULU-NATAL

**ASSESSING THE INFLUENCE OF E-LEARNING ON THE
PERFORMANCE OF HEALTHCARE PROFESSIONALS: A CASE
STUDY OF UKZN-NORHED COLLABORATION**

by

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DECLARATION

I, **Oluwadele Oluwaseun Deborah** (student number **214584163**), declare that:

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DEDICATION

I dedicate this dissertation to my Lord Jesus Christ. The Same yesterday, today and forever. The one who gives strength to the weak and grace to the humble. The one who raise up beggars from the dunghill and set them up to dine and wine with kings and princess in high places. This indeed is my testimony; The Lord is good at all times, and his love towards me is forever.

ABSTRACT

HIV/AIDS, tuberculosis and some other antibiotic resistant infections are the top causes of morbidity in South Africa and sub-Saharan Africa generally. There is dire need to carefully examine cross-disciplinary approaches to combat the burden of diseases in South Africa and other sub-Saharan African countries. One of such approaches is e-learning. This study assesses the influence of e-learning on the individual and organizational performance of Healthcare Professionals by adopting a descriptive and exploratory approach. This study adopted a purely qualitative case study approach because it sought to understand the problem relative to existing contexts especially since there exist very few body of knowledge in this domain. The census non-probability sampling technique was used to select participants for the study with thoughtful consideration of the size limitation of the case-study to allow for exhaustive inclusion. In-depth semi-structured interview was conducted amongst seven (7) healthcare professionals who took a pure e-learning module; Antimicrobial Stewardship and conservancy in Africa.

The study revealed that in sub-Saharan Africa, e-learning could be used to strengthen the capacity of HCPs to combat the high burden of diseases if attention is paid to the alignment between the learning task demands of the e-learning module and the technological infrastructures provided to enable the accomplishment of such learning tasks, while adapting the learning process to cater for the individual diversity and contextual limitations of HCPs. Participants felt that there existed a solid task-technology fit between the task requirements of the module and the learning management system technology (UKZN Moodle). The program accommodated HCPs' individual and contextual diversities. Therefore, their individual and organizational performance were enhanced. HCP were satisfied with the program and acquired the set of knowledge and skills which helped them to pass the module. Both practicing clinical physicians and non-practicing clinical physicians could transfer the knowledge and skills acquired to their daily clinical/work practices. Knowledge transfer to practice was revealed to have benefitted HCPs work organizations in diverse ways. Furthermore, HCPs acquired technological skills which they stated to have been of benefit to them and their work organizations even much more than the module content knowledge and skills which they

acquired. This study is an eye opener to the potentials and challenges of e-learning in medical education in South Africa, and other sub-Saharan African countries.

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LIST OF ACRONYMS

AMR	Antimicrobial Resistance
ASC	Antimicrobial Stewardship and Conservancy
AU	African Union
HCP	Healthcare Professional
HE	Higher Education
HIV	Human Immunodeficiency Virus
ICT	Information Communication Technology
IT	Information Technology
LMICs	Low and Middle-Income Countries
LMS	Learning Management System
MDG	Millennium Development Goals
MOOC	Massive Open Online Course
NORAD	Norwegian Agency for Development
NORHED	Norwegian Programme for capacity Development in Higher Education and Research for Development
NPC	Non-Physician Clinicians
TB	Tuberculosis
TTF	Task Technology Fit
UK	United Kingdom
UKZN	University of KwaZulu-Natal
UN	United Nations
USA	United States of America
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 INTRODUCTION

This chapter presents the background of the study and the research problem. This is then followed by research questions after which is the research objectives. Then the justification for the study and the significance of the study is presented after which the research methodology for the study is briefly introduced. The later part of the chapter presents the definition of terms used in the study, an outline for the chapters and lastly, a summary of the chapter.

1.2 BACKGROUND TO THE STUDY

The course being assessed is the HLSC 804W1; Antibiotic Stewardship and Conservation; hosted on the UKZN learning platform Moodle and taken by postgraduate students at the school of pharmaceutical sciences in the first semester of the 2015 session as part of the requirement for a master's degree in Pharmacy. The e-learning platform that forms the basis of this evaluation is located at UKZN and forms part of a joint research initiative, which falls under N ORHED (The Norwegian Programme for capacity Development in Higher Education and Research for Development).

NORAD; the Norwegian Agency for Development Corporation is a directorate under the Norwegian Ministry of foreign affairs. Under its umbrella is NORHED; a programme launched in 2012 by NORAD. The purpose of the programme is to strengthen capacity of higher education institutions in Low and Middle-Income Countries (LMICs) within six areas which include; Education and training; health; Natural resource management, climate change and environment; Democratic and economic governance; Humanities, culture, media and communication; and Capacity development in South Sudan.

NORHED aims to educate more people to make them better qualified in a bid to increase the quantity and quality of research steered by researchers in their own countries. It believes that this investment will be justified in terms of benefits such as significant

contributions to the LMICs' intellectual resources, competent workforces, gender equality and human rights, to mention a few.

The title of the NORHED project being considered for this study is Antibiotic Stewardship and Conservancy in Africa. The programme resides under the health sub-programme of NORHED. The premise upon which this module is developed is that communicable diseases are key origins of morbidity and mortality in the NORHED-targeted LMICs in the sub-Saharan Africa. Increasingly, Antibiotic resistance is recognized as a major obstacle in the successful management of infectious disease particularly in LMICs where the burden of disease which requires Antibiotic treatment is very high and there is restricted access to appropriate diagnosis services and second-line management.

Given this profile, an intervention to enhance the management of infection in terms of Antibiotic stewardship and conservancy and with respect to research and evidence-based best practice seems practical and speaks to the African Union's (AU) Africa Health Strategy: 2007-2015. This, overtly, states the need for locally driven research, which creates information to inform policy and plans and strongly presents the capacity development and empowerment of local researchers as important to the invention of context-specific interventions and innovations.

It is vital to equip African health systems and capacitate African health workers and health policy makers, to carry out and utilize evidence-based clinical practice and policy. The project bridges this skills and capacity gap with the long-term objectives of generating improved Antibiotic use and surveillance and statistics, and reduced AMR in Malawi and Mozambique especially. Young and research-naïve faculty and graduate students at Universities and Research Institutes as well as healthcare professionals in the public sector, specifically women, are the target groups.

1.3 RESEARCH PROBLEM

The South African National Department bid to make the status of health of the entire population better has put into place, strategies in alignment with the Millennium Development Goals (MDGs), the anticipation of United Nations (UN) is that all countries

of the world would accomplish these goal by 2015. However, TB continues to rank as the foremost cause of death in the country and HIV was the seventh leading cause of death (Dorrington et al., 2013; Statistics South Africa, 2013; South Africa Yearbook, 2013/2014). The human resources and healthcare facilities needed to combat the burden of disease in South Africa are not adequate given the ratio of 1 doctor to 244 patients, 1 nurse to 202 patients and 13 718 people per clinic; exceeding the WHO guideline of 10 000 per clinic. There is thus great pressure on the health care services, and a high demand for skilled healthcare professionals.

Literatures have explored the possibilities of utilizing e-learning to increase the capacity of healthcare professionals especially in LMIC. The core reason being that e-learning facilitates learning without taking healthcare professionals from their locations or working environment; an action which could further burden the already burdened system (Bagayoko et al., 2013). This afford them the flexibility to study across borders at remote locations, at their individual convenience, while giving them access to a huge array of academic resources (Boye et al., 2012). Sears et al. (2008) found that individuals involved in e-learning had a better ability to apply knowledge and skills and to retain learned concepts in a professional setting over a long period of time. With this claim, e-learning seems to present as a powerful and timely pedagogical tool as HCPs in Sub-Saharan LMICs are generally confronted with resource and geographical constraints.

Therefore, there is a need to asses existing e-learning platforms for healthcare professionals that exist in South Africa with a view to assess its influence on the continued professional development of Healthcare Professionals (HCP) and the healthcare system in South Africa. This will shed more light on the possible outcomes of e-learning interventions in medical education, suggest a framework for the evaluation of e-learning outcomes in medical education, contribute to the limited body of knowledge that already exist in literature and open space for further research through a constructive critique of the research process and procedure by other researchers.

1.4 DEFINITION OF THEORETICAL FRAMEWORK CONSTRUCTS

To address the stated research problem, this study draws on the theoretical perspectives of Task-Technology fit (TTF) theory (Goodhue & Thompson, 1995a). This stipulates that

technology is required to be readily accepted and fit seamlessly with the users and the tasks that they perform to ascertain its efficiency. Task-technology fit proposes constructs that assist in understanding the influence of technology on performance. Table 1.1 presents the definition of TTF constructs used in this study

Concept	Definition
HCP's Task Characteristics	This implies the actions taken by HCPs to ensure that learning objective pre-determined by module facilitators are achieved.
e-learning Technology Characteristics	Technology characteristics are the features of the entire tools, e-learning applications, facilitating infrastructure and services that allow task implementation by HCPs.
HCP's Individual Characteristics	This describes the abilities, proficiencies, or competences of HCPs which affect how well they use the e-learning technologies to implement their tasks
Contextual Characteristics	This describes the cultural and social impacts and the enabling circumstance of HCP's study environment which impacts HCWs' perceptions on the suitability of e-learning in their study setting
HCP's Perceived Task Technology fit (Performance)	Performance entails enhanced effectiveness, efficiency and quality in HCWPs task achieved because of the alignment between HCP's task requirements, individual abilities, contextual factors and the functionalities of the available e-learning technologies. This is operationalized using the Kirkpatrick's evaluation model.

Table 1.1: Definition of Task-Technology Fit Constructs

(Goodhue, 1995; Goodhue & Thompson, 1995b; Tariq & Akter, 2011) adapted to the context of this study context.

The Task-Technology Fit construct is operationalized as individual and organizational performance using the Kirkpatrick model. The Kirkpatrick's evaluation model (Kirkpatrick & Kirkpatrick, 2006) is integrated with TTF to operationalize the individual level (reaction, learning and behavior constructs) and the organizational level (behavior and result constructs) performances construct of the Task-Technology Fit Model. Table 1.2 presents the definition of constructs of the Kirkpatrick evaluation model as used in this study.

Levels	Construct	What to measure
1	Reaction	<ul style="list-style-type: none"> • HCP's Satisfaction with the e-learning module • Utility judgement
2	Learning	<ul style="list-style-type: none"> • Enhanced knowledge and skills of HCPs because of the participation in the e-learning module
3	Behavior	<ul style="list-style-type: none"> • Knowledge transfer from e-learning to daily clinical practice from HCPs' point of view
4	Results	<ul style="list-style-type: none"> • Advantages or disadvantages of the e-learning module to HCPs' work Organization from HCPs point of view

Table 1.2: Definition of Kirkpatrick's Evaluation Model Constructs

(Kirkpatrick & Kirkpatrick, 2006; Lahti, 2014) adapted to the context of the study

The role of the TTF model is to present context-related factors which could impact the outcomes of e-learning in medical education while the role of the Kirkpatrick model is to present factors which can be evaluated to determine both the individual (process-based) and the organizational (outcome-based) outcomes of e-learning in medical education.

1.5 AIM OF THE STUDY

This study aims to assess the influence of e-learning on the performance of Healthcare professionals (HCPs) in South Africa.

1.6 RESEARCH QUESTIONS

To help understand this problem, the following research questions are posed:

- What is the influence of task characteristics of the Antimicrobial Stewardship and Conservancy module on the performance of HCPs?
- How do the technology characteristics of the Antimicrobial Stewardship and Conservancy module influence the performance of HCPs?
- To what extent do individual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module?
- How do contextual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module?

1.7 RESEARCH OBJECTIVES

The study set out to attain the following objectives;

- To understand the influence of task characteristics of the Antimicrobial Stewardship and Conservancy (ASC) on the performance of HCPs
- To understand how the technology characteristics of the Antimicrobial Stewardship and Conservancy module influence the performance of HCPs?
- To determine to what extent the individual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module?
- To ascertain how the contextual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module?

1.8 JUSTIFICATION FOR THE STUDY

The satisfaction of HCPs with e-learning has been studied (Bagayoko et al., 2013), however, this study goes further to assess the influence of e-learning on the performance of HCPs at individual and organizational levels. This study will provide a thorough understanding on the impact of e-learning on both the teaching-learning process and the clinical practice in the medical environment.

The organizational level performance will consider feedback from HCPs regarding the influence of the e-learning module in their workplace. This study will thus provide feedback to healthcare organizations, which may be considering sponsoring their employees on online training in a bid to strengthen their capacity, in terms of the return on investment for the course. In the same light, this study will help in gaining more detailed insights into the perceptions of HCPs in terms of the values of e-learning in medical education.

Secondly, it will help stakeholders in education and promoters of e-learning in medical education understand the importance of proper alignment between the Information Technology (IT) made available to HCPs participating in e-learning programmes and their task requirements. In addition, it will also help system designers in designing learning management systems in such a manner that the learning tasks of users will be catered for and supported by the technologies provided by the system designers; thereby enhancing HCPs' performance both at individual and organizational levels.

Thirdly, as a study using data from a larger (multinational) study, it also provides feedback into the NORHED programme. This provides insights about the outcomes of the programme from a subset of the participants- which can inform future iterations of the e-learning module. This study will also be piloting a specific conceptual view of the process, which may inform the broader research study. It will also pilot instrument within the case study which may provide insight into research instrument design for other aspects of this study or related studies. Also, there is a limited body of literature available on the influence of e-learning on the individual and organizational performance of HCPs in South Africa. This study will contribute to the body of knowledge available on the influence of e-learning in medical education in South Africa, and generally, Sub-Saharan Africa.

Finally, the participants of this programme were foreign nationals. This will provide insights into the potential influence that contextual factors may have on the outcomes of programmes of this nature. Consequently, the study will contribute towards a better understanding of the actual impact of e-learning in medical education towards

strengthening capacity of healthcare professionals to combat the burden of diseases in South Africa and generally, sub-Saharan Africa.

1.9 BRIEF INTRODUCTION TO THE RESEARCH METHODOLOGY

To ensure a comprehensive and in-depth investigation, case study research design was adopted for this study. A qualitative approach was used to ensure that a detailed analysis is achieved. The study site was University of KwaZulu-Natal (UKZN), Westville Campus in Durban although participants of the module were resident in Malawi and Mozambique. Census sampling was used to select samples of the participants to ensure total inclusion of all the module participants. Nine (9) HCPs were selected and data was collected using semi-structured in-depth interviews. Data gathered was analyzed using thematic analysis. The use of key research ethical principles met the requirements of the research office at the University of KwaZulu-Natal (UKZN).

1.10 LIMITATIONS OF THE STUDY

The major limitation of this study is a lack of prior research studies on the organizational implication of e-learning on the performance of HCPs in South Africa. Citing prior research studies forms the basis of the literature review and helps lay a foundation for understanding the research problem being investigated. To address this limitation, the researcher conducted an exploratory and descriptive rather than an explanatory research design.

Another limitation to this study was the small population of students who participated in the Antibiotic Stewardship and Conservancy in Africa module. This limitation was addressed by the research design being qualitative, focusing on providing detailed depth on the phenomenon, rather than breadth.

1.11 OUTLINE OF THE DISSERTATION

This dissertation has six chapters as presented below:

- Chapter One: Introduction and Background to the Study

This chapter presents the introduction to the study, the background to the study, research problem, the conceptual basis of the study, the purpose of the study, research questions and objectives, the justification for the study, research methodology and the limitations of the study.

- Chapter Two: Literature Review

This chapter presents previous studies on e-learning, the need for e-learning in medical education in South Africa, features of Learning Management systems in universities, the current state of e-learning in South Africa, why Learning Management Systems fail and factors to consider mitigating against LMS failure. It also discusses learner's diversity in e-learning in terms of individual and cultural/contextual diversity.

- Chapter Three: Conceptual Framework

This chapter presents the theoretical frameworks used to guide the study and proposes a new conceptual framework for the assessment of e-learning systems. This conceptual framework is a thoughtful combination of two frameworks. It discusses the critiques of the framework and justification for the conceptual model developed for the study. In conclusion, the chapter discusses the previous studies on e-learning which relates to the two theoretical frameworks.

- Chapter Four: Research Methodology

This chapter presents the research design and principle, the methodology adopted for the study, the study site, population, target population, sampling methods, and the sample size. It further presents the data collection instruments and technique used for data analysis. In conclusion, it presents ethical consideration that informed the study.

- Chapter Five: Data Presentation

This chapter presents the key findings; the perceived task and technology alignment of the e-module and the influence of individual and contextual characteristics of respondents on their performance. Data presented is aligned with the research objectives which underprops the study.

- **Chapter Six: Data Analysis and Discussion**

This chapter presents and discusses findings in detail theorized around the conceptual framework of the study. Themes discussed and analyzed include Task-Technology perception of the learners for the e-module, their individual and contextual characteristics and how it influences HCPs' performance.

- **Chapter six: Conclusion and Recommendations**

The chapter presents conclusion and recommendations based on key findings of the study.

1.12 SUMMARY

This study assesses a post-graduate e-learning course for Health Care Professionals (HCPs) with the sole purpose of assessing its influence on the individual and organizational performance on Healthcare professionals in South Africa. The Task-technology Fit (TTF) framework together with the Kirkpatrick model is used as theoretical frameworks to form the conceptual framework for the study. This chapter outlined the problem to be studied and gave an overview of the methodology used. The next chapter provides literature review on e-learning and the role of e-learning in medical education.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The previous chapter motivated the need for the study, the objectives and the theoretical and conceptual framework adopted for the study. It also identified the research problems. In this chapter, literature review on e-learning and the role of e-learning in medical education is presented. Literature has affirmed that e-learning has the potential to increase the capacity of healthcare professionals especially in low-and middle-income countries. This is especially so because e-learning facilitates learning without taking Healthcare Professionals (HCPs) from their locations or working environment; an action which could further burden the already burdened system (Bagayoko et al., 2013). This study is relevant in that it assesses the influence of e-learning on the performance of Healthcare professionals in South Africa.

2.2 MEANING OF E-LEARNING

E-learning has been defined as learning instructions delivered on digital devices such as desktop computers, laptops computers, tablets or smartphones with the intention to support learning (Clark & Mayer, 2016). E-learning may also be defined as the utilization of internet to carry out an extensive collection of solutions which improve knowledge and performance (Zhang et al., 2015). Hong et al. (2013) defined e-learning system as an information system having system quality, information quality and service quality. Evidently, e-learning is utilized in modern day teaching and learning process to support learning, improve knowledge, advance performance and consequently, improve the learning outcomes of students.

The most popular e-learning system among universities is the Learning Management System (LMS). The LMS is a software hosted on the web which contains features for online collaboration, learning material distribution, training and largely to manage, support and improve teaching-learning process (Limayem & Cheung, 2011). LMS has been extensively accepted and utilized by universities and has become a vital tool for either distance education or to support class-room based teaching. It is believed that using LMS to support classroom-based teaching gives teachers the opportunity to take

advantage of the benefits provided by both classroom learning and online learning. According to Islam (2016), there are several literatures that looked into e-learning adoption and usage in education but completely ignored the outcomes of the use of e-learning systems. There is a dire need to investigate the impact of e-learning system on the academic performance of students to be able to appreciate the role of e-learning in education, evaluate the success or otherwise, of e-learning intervention in education and plan for the achievement of better learning outcomes. Hence, Islam (2016) called for more research to explore the performance results of the use of e-learning system.

There are several advantages of using LMS for full online learning. Arkorful and Abaidoo (2015) identified several of benefits of implementing e-learning in higher education; these include technical benefits such as reduction in travel expenses, provision of just-in-time learning to make it possible to keep abreast of recent development in courses and modules, time and setting flexibility, individualized instruction, accessibility for all, interactivity, prompt feedback from computerized quizzes and exams, and documented and communicated expert knowledge.

Despite these benefits, there are some common challenges associated with the use and stability of LMSs. These has been identified by previous authors to include learners' isolation, inability to provide detailed explanation of tasks and learning concepts by lecturers compared to face-to-face methods, lack of assessment quality control, negative impact of learners' social skills, and inappropriateness of use in fields such as engineering and medicine learning (Black et al., 2008; Kember et al., 2010; Malikowski, 2010; Mott, 2010; Alhazmi & AbdulRahman, 2012). Technical problems include technical support, accessibility, system crashes, difficult navigation, infrastructure upgrading, bandwidth (Arkorful & Abaidoo, 2015). There are also organizational challenges such as lack of time available for training. Research shows that educators in medical schools are currently investigating the advanced ways of using e-learning in medical education (Zhang et al., 2015).

2.3 LEARNING MANAGEMENT SYSTEM IN HIGHER EDUCATION

Each LMS is quite unique based on the criteria that the organization needs to be satisfied, however, LMSs have certain features which are common to them. These were classified

by Ramesh and Ramanathan (2013) into basic features such as resources, quizzes and assignments; learning management features such as activity statistics, grade management and student portfolio; technical features such as cross platform features, client software, server software, and user load; content management features; assessment features and security features.

Academic institutions, especially tertiary institutions have shifted towards incorporating e-learning into their teaching-learning processes. The Learning Management System (LMS) is used by most university to support online learning. Every LMS is different and unique depending on the requirements in terms of the number of users (students and facilitators), the fund available, and the availability of technical support. For instance, corporate organizations may use LMS to conduct trainings spanning between a day to a month for their employees while educational institutions typically use LMS to offer courses to students for longer duration. Even then, within the same university, the requirements for each faculty or colleges may be different (Ramesh & Ramanathan, 2013).

A Learning Management System (LMS) is defined as software system application which is used for educational training, administration, assessment and feedback (Ellis, 2009). Popular LMSs include Blackboard, Desire2Learn, Moodle and ATutor to mention just a few (Ramesh & Ramanathan, 2013). LMS streamlines the delivery of course contents, manage knowledge creation, assessments and provision of feedback. Although the time investment at the initiation phase of LMS could be high, it is almost always a once-off effort which leads to reduce effort in administrative activities, and more spare time to be used on actual teaching and learning. Instructors find out that once time has been invested into the LMS for content creation and assessment structuring at the initial phase, they would only need incremental updates to the content during successive teaching of the course (Sclater, 2008).

One of the often-stated benefit of using the LMS is the possibility of sharing, updating and reusing its content. To achieve this, it is pertinent to ensure that the contents of LMSs conform to certain standards. Organizations look for LMS that are compliant with internationally accepted standards such as SCORM and IMS (Hagen et al., 2006). They

also look for LMS that aligns to their cost and technical support. There are over 250 providers of LMSs available, 45 of these are open source (Ramesh & Ramanathan, 2013).

2.4 ANTIMICROBIAL STEWARDSHIP AND CONSERVANCY MODULE ON UKZN LMS; MOODLE

The e-learning platform that forms the basis of this evaluation is located at UKZN and forms part of a joint research initiative which falls under NORHED. NORHED aims to educate more people to make them better qualified in a bid to upsurge the number and value of research conducted by researchers in their own countries. It believes that this investment will be justified in terms of benefits such as significant contributions to the LMICs' academic reserves, capable labor force, gender equality and human rights, to mention a few.

The title of the NORHED project being considered for this study is Antimicrobial Stewardship and Conservancy in Africa. The programme resides under the health sub-programme of NORHED. The premise upon which this module is developed is that infectious illnesses are major causes of sickness and death in the NORHED-targeted LMICs in the sub-Saharan Africa. Increasingly, antimicrobial resistance (AMR) is recognized as a major obstacle in the successful management of communicable disease particularly in LMICs where the burden of disease, which requires antimicrobial treatment is very high and there is restricted access to appropriate diagnosis services and second-line management.

Given this profile, an intervention to enhance the management of infection in terms of antimicrobial stewardship and conservancy and with respect to research and evidence-based best practice seems practical and speaks to the African Union's (AU) "Africa Health Strategy: 2007-2015". This, overtly, states the need for locally driven research, which creates information to inform policy and plans and strongly presents the capacity development and empowerment of local researchers as important to the invention of context-specific interventions and innovations.

It is vital to equip African health systems and capacitate African health workers and health policy makers, to carry out and utilize evidence-based clinical practice and policy.

The project bridges this skills and capacity gap with the long-term objectives of generating improved antimicrobial use and surveillance and statistics, and reduced AMR in Africa. Young and research-naïve faculty and graduate students at Universities and Research Institutes as well as healthcare professionals in the public sector, specifically women, are the target groups.

The current University of KwaZulu-Natal Learning Management System (LMS); Moodle evolved from the UKZN OLS (Open Learning System) which was deployed in 2002 as a replacement to WebCT, a proprietary learning management system. UKZN moved away from using WebCT mainly due to cost constraint. UKZN school of Humanities and Social Sciences initiated the introduction of the open-source based LMS; Moodle in 2006 Jackson (2008). Moodle presents electronic notes and lecture materials to students, translating students learning experience to from paper-based notes into electronic age. UKZN adopted the use of Moodle with the intention to help students obtain the essential aids to use various automated media with confidence. Lecturer upload their learning materials on Moodle while students access and download the learning materials. Moodle facilitates lecturer-to-student interaction and student-to-student interaction. From 2016, UKZN migrated totally from the paper-based learning format to the electronic-based learning format, students are required be in possession of a personal computer or mobile devices to download learning materials. All UKZN campuses have competent wireless access to the internet anywhere in the campus.

The adoption of the Moodle system comes with different benefits to students. The overall cost of each module will be reduced because lecture notes will no longer be paid for. The cost reduction can be leveraged to purchase laptops by students. UKZN makes funding to students through Student Funding Services for the purchase of a laptop. UKZN has also joined the Student Technology Program, which negotiates reasonably priced transactions on the purchase of laptops to participating Universities.

Users access UKZN Moodle by typing the address into the browser, this takes users to UKZN Moodle Home page as in figure 2.1.

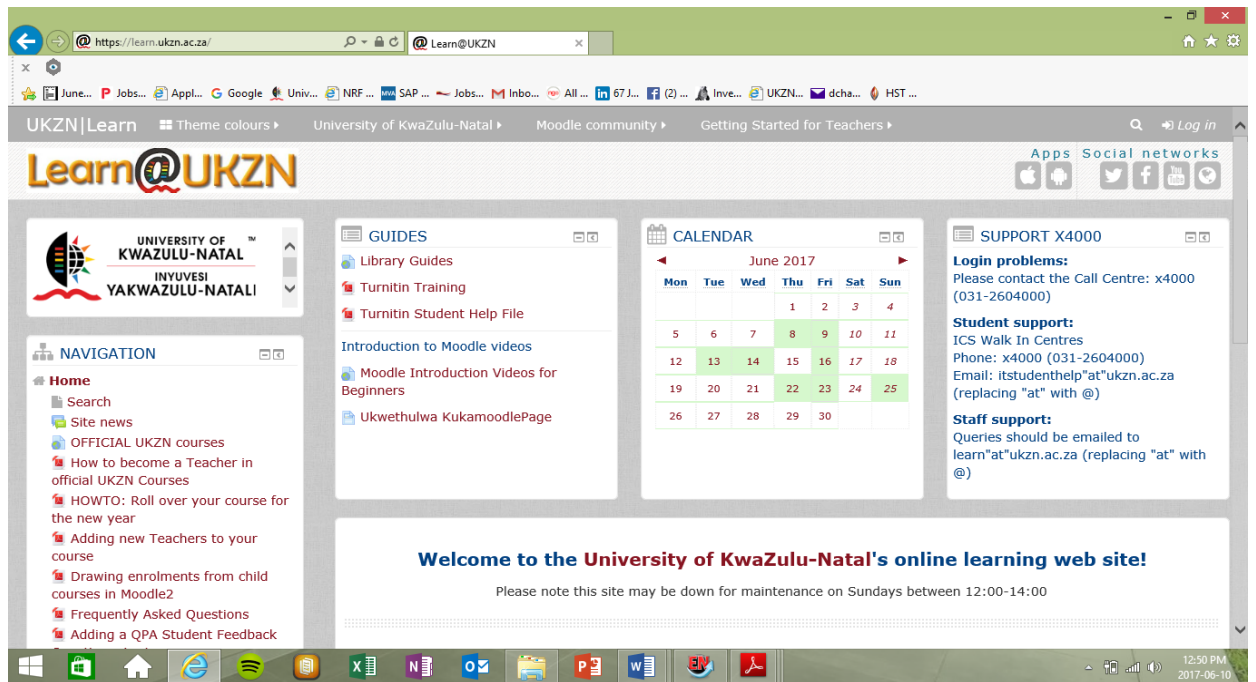


Figure 2.1: UKZN LMS; Moodle Welcome page

(source: learn@ukzn.ac.za)

By clicking on the Log in tab on the top right corner of the page, the Log in page where registered users input their student number as username and their password opens as in figure 2.2.

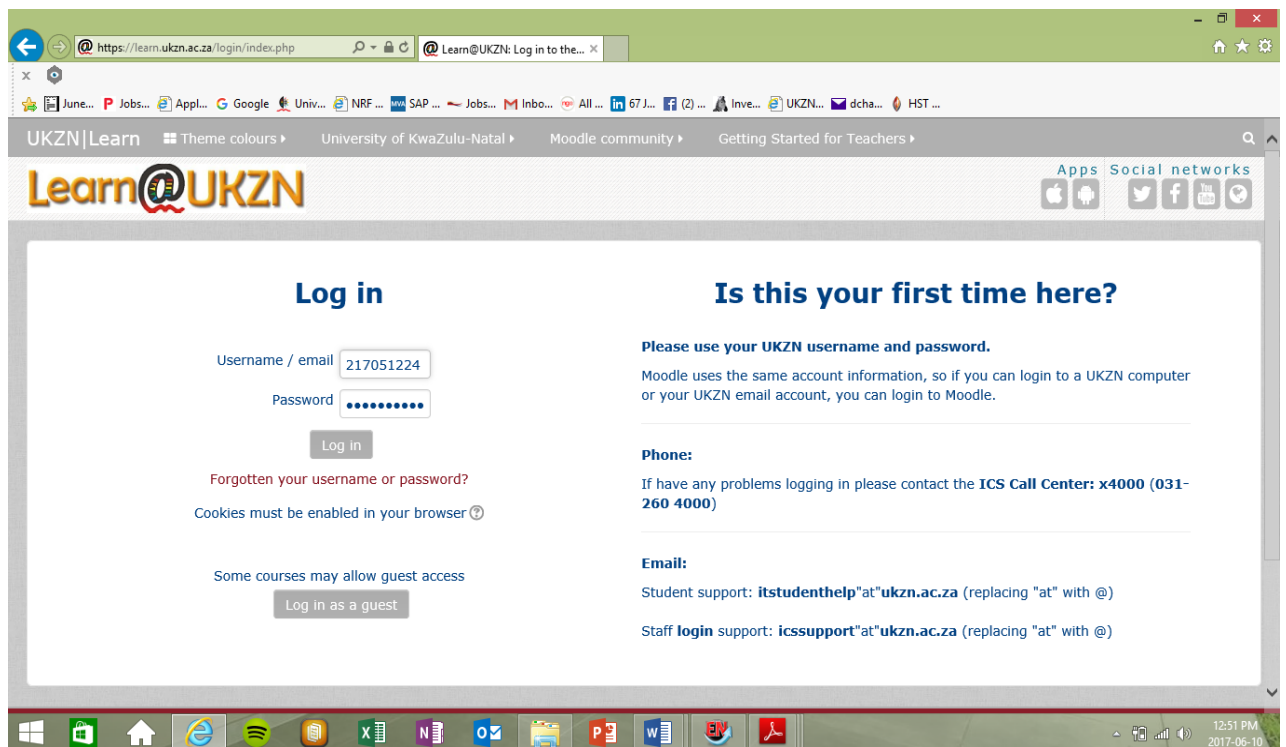


Figure 2.2: UKZN LMS; Moodle Log in page

(source: learn@ukzn.ac.za)

Figure 2.3 shows the page which is displayed after registered users input their username and password.

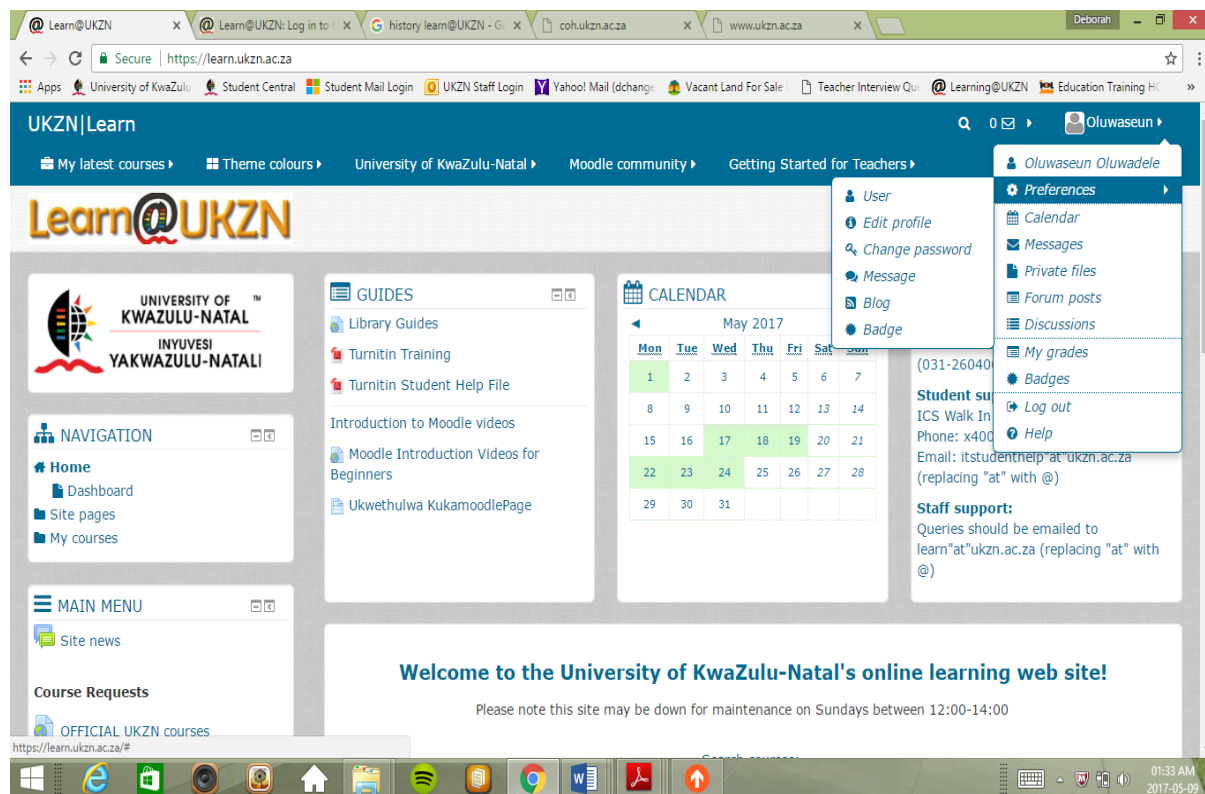


Figure 2.3: UKZN LMS; Moodle User Home page

(source: learn@ukzn.ac.za)

The user Home page has user's personal name at the top right corner of the page. This serves as a hyperlink to access user's personal preferences such as Calendar, messages, Discussions, private files and Log out option. The navigation column on the far-left side of the page helps users to navigate Moodle with ease by providing hyperlinks which link users to their desired page.

By clicking on Dashboard icon under the navigation column at the mid-left corner of the user home page, user's course overview is displayed as in figure 2.4.

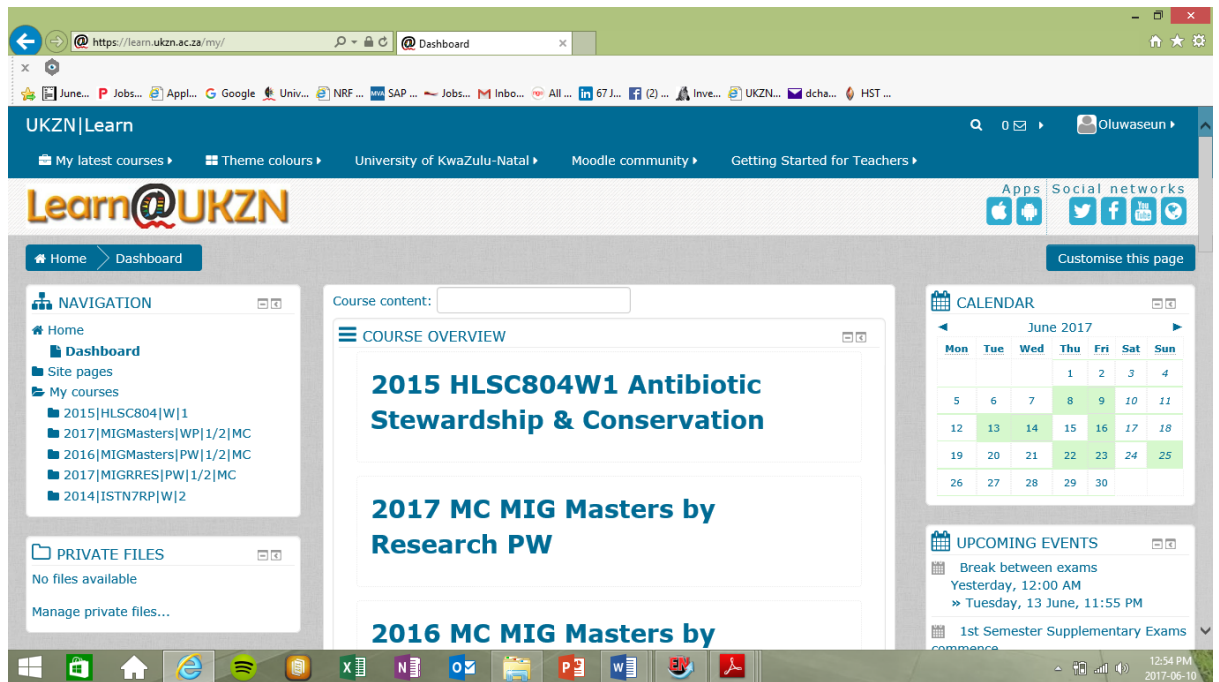


Figure 2.4: UKZN LMS; Moodle User's Course Overview page
(source: learn@ukzn.ac.za)

The course overview page displays information about the programmes which user registered for in previous years and the ones currently registered for. Each programme serves as a hyperlink which takes user to a page that displays information about the modules registered for during the programmes. For instance, clicking on 2015 HLSC804W1 Antibiotic Stewardship & Conservation takes user to the module content/information page as in figure 3.6, where detailed information about the module such as News forum, discussion forum, Latest announcements, upcoming events and module contents; sectioned per week are displayed.

The Antimicrobial Stewardship and Conservation module content/information page on UKZN Moodle in figure 2.5 contains the navigation bar on the left section. This assists user to navigate the page with ease. The middle section contains the module title and course code, the news forum icon which updates students about current happenings about the module, the General Discussion and Support Forum icon where students post queries and questions and share information.

Scrolling down the middle section displays module contents sectioned by week, assessment information and reading resources. The right section contains the search icon

where students can search for information of interest, latest announcements, upcoming events and recent activity to keep user abreast happenings and recent developments regarding the module. The colors used on Moodle are plain and easy on the eyes, they are programmed to be changed by users according to personal preferences and the page layout looks quite easy to navigate.

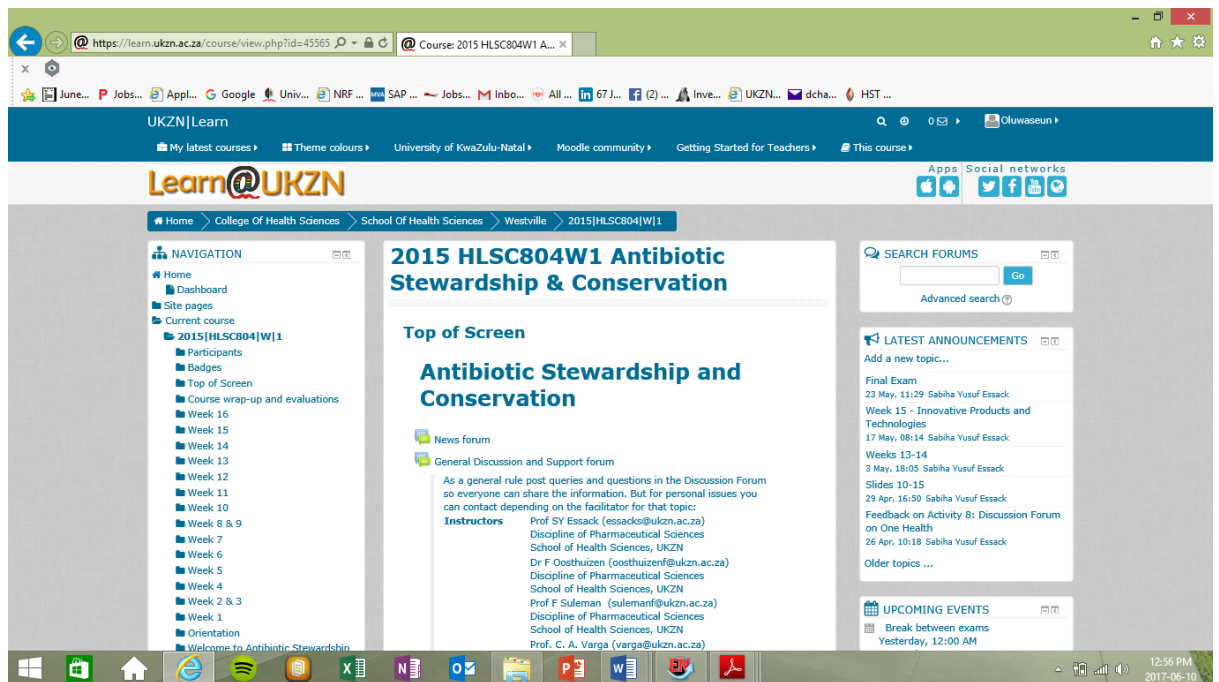


Figure 2.5: Antibiotic Stewardship and Conservancy Module Content page

(source: learn@ukzn.ac.za)

2.5 BENEFITS OF E-LEARNING

E-learning is evolving as a common learning method being used in many organizations (Jia et al., 2011). E-learning is not just a tool used in universities, many organizations use e-learning to deliver data and information to individuals. One often stated benefit of using e-learning in organizations is its potential to enhance the training process without taking employees away from their working organization. E-learning also has the ability to increase employee's commitment to solve organizational challenges (Shamsul, 2016). Employee commitment is a term used by the human resource department of organizations to realize employee's performance and their commitment to the realization of the vision of the organization. The benefits of e-learning include but are not limited to the following:

Learner's Satisfaction: The adoption of e-learning in organization comes with a cost implication especially at the set-up stage. This investment should be justified by increased user satisfaction (Cheok & Wong, 2015). Previous studies on learner satisfaction found that the technical characteristics of LMS, educational content, and self-efficacy had a positive influence on learner's satisfaction (Hassanzadeh et al., 2012; Ko & Ko, 2012; Rubin et al., 2013; Roh, 2015). User satisfaction can be defined as an aggregate of both positive and negative answers to a set of factors (Islam, 2014). The effectiveness and efficiency of an e-learning system cannot be of advantage to learners if they do not feel comfortable using the system (Grinberg & Hristova, 2012). Educational technologies are tools such as media, machines and networking hardware used in learning. While educational content is the quality of system output and semantic success. Increased satisfaction leads to increased usage, reduced user complaints, and subsequently, improved performance (Violante & Vezzetti, 2015).

Personalized Learning: With the need for knowledge update and life-long learning given this present dispensation of knowledge explosion and increasing bandwidth of internet, there has been a huge explosion of Massive Open Online Course (MOOC) (Lee et al., 2014). People want personalized learning which caters for their need for enhancements and professional development, e-learning proffer such solution. Personalization of learning promotes life-long, learner-centered and content-sensitive approach to learning thereby promoting effective, active, efficient and satisfactory learning in which the learner is more in control of his own learning (Henning et al., 2014).

Efficiency: The efficiency of the LMS is related to the way the system enhances productivity as work achieved per unit time This could be measured in the number of time employees or users generally need to click on the system to either access learning materials, obtain information, or the time required to achieve some level of aptitude (Grinberg & Hristova, 2012). When employees are vastly engaged, they constantly deliver beyond expectations and they feel the need to be retained in their organization. Employee retention in an organization is key in keeping the organization on track (Hong et al., 2012).

24/7 Access to training Materials: E-learning enable students to access learning materials anywhere and anytime without necessarily taking them away from their place of work (Arkorful & Abaidoo, 2015). Even though the continuous professional development of employee is paramount to the success of their organization in achieving organizational goals and visions, it burdens the organization when employees must be absented from their workplace in order to attend trainings or further education by pursuing higher degrees. Also, e-learning can help multinational organizations to deliver training to their employees dispersed across different countries and time zones in a consistent and effective way (Jia et al., 2011).

2.6 LEARNER DIVERSITY IN E-LEARNING

E-learning opens tons of potentials for enhancing effective teaching and learning process. One majorly stated advantage of e-learning is its potential to ensure access to life-long learning across geographical boundaries (Bagayoko et al., 2013). On the other hand, the use of e-learning in institutions introduce some form of complexity because of diversity in the contextual and cultural backgrounds of learners. However, the solution to this challenge is also imbedded in Information and communication technologies (ICT) itself. ICT provide a wide array of methods for adjusting learning settings to the individual and contextual characteristics diversity of students.

To ensure that e-learning is successful, it should put into consideration the diversity in individual learner's characteristics and needs. The LMS design should be learner-centered, and the e-environment needs to meet the needs and expectations of the learners. Dimitrova et al. (2013) carried out a study which assessed the differences in the learning styles of both distance and classroom students in a University. The study showed that students' individual learning styles and learning strategies influence their preferences on various resources and the different ways in which they use LMSs. It was also discovered that the University LMS's current design was not able to support the diverse learning approach of the students. To improve the flexibility of LMSs to accommodate diversity in students, the study suggested that LMSs should present redundant materials using visual and audio media to match textual representation of course content for students to choose which best suits their styles and preferences of learning. LMSs need to be tailored to meet individual learners' learning needs and enable active learning based on student's

learning style (O'Donnell et al., 2015). This presents students a wide selection of learning tools and resources that enable them those that fit their learning strategy the most.

LMSs should utilize learning objects which can be categorized, styled and manipulated through well-defined LMSs to loosen structure and provide more control on the learner's part and less control on the part of the instructor while promoting deep strategy to learning. This is by evolving learning activities to engage the learners in active processing of the subject matter, rather than mere knowledge acquisition.

2.7 LMS FAILURE

LMSs provide a wide array of tools which help both instructors and students in the teaching and learning process. Even though many institutions have adopted LMSs to facilitate learning, LMSs are not golden bullets to solve all educational problems, and the LMSs if not utilized correctly may not facilitate an interactive and collaborative learning experience; the sole reason for which it is advocated. To enhance the success of LMSs, it is pertinent to understand the problems and failure aspects of the system, also factors that need to be taken into consideration to ensure that a LMS does not fail. Failure in this context does not only refer to the system crashing or having more down-times than necessary, it also referred to the LMS not functioning for the purpose for which it was intended.

Literatures have found that LMSs are mostly used as administrative tools and not as interactive and collaborative tools which should facilitate student-to-student and student-to-instructor interaction, and improve the teaching and learning process (Black et al., 2008; Kember et al., 2010; Malikowski, 2010; Mott, 2010; Alhazmi & AbdulRahman, 2012). Also, LMS failure could also mean that students are not achieving the learning outcomes effectively. For instance, a study conducted to examine the effectiveness of LMSs in improving learning outcomes using over twenty modules highlighted that e-learning did not appear to be of assistance to students in effectively achieving their learning outcomes (Kember et al., 2010).

A review study Alhazmi and AbdulRahman (2012) summarized the failure aspects of LMS into four, these include content management (using the LMS as a content holder or

a transmitting file), features utilization (leaving interactive features unused), teaching and learning methods (one-way information flow from teachers to students), and assessment management (lack of alignment between assessments and learning objectives).

2.7.1 Reasons behind LMS Failure

The reasons why LMS fail include mismanagement of content, ill-use of LMS features, low level of user engagement, and rigidity in learning and assessment process, and mainly due to LMS design structure and theoretical principle (Alhazmi & Rahman, 2012). Alhazmi and Rahman (2012) suggested three main reasons of LMS problems; these are theoretical, pedagogical and technological issue.

- **Theoretical Issues**

The conventional structure of LMS is teacher-centered; both in design and performance. This disturbs the usage of the system, the benefit of the system for both students and instructors and impedes the achievement of learning outcomes. In this form of approach, student's role becomes limited to information recipient, rather than knowledge constructor. Theoretical issues are the genesis and foundations of many LMS related problems such as content management, misuse of features and learner involvement.

The rigid and static structure of LMS leads to students' inability to effectively use the system features to perform their learning activities to achieve the pre-stated learning outcomes. LMSs are supposed to be designed to be learner-centered such that learners' individual characteristics are catered for. However, LMS design norm is such that the systems features tend more towards being controlled and supervised by instructors. Because of this, students' interaction and collaboration on LMSs is limited. To support this statement, previous studies found out that most students who use LMS limit its use more for transmitting files and lesser for collaboration and interaction online (Black et al., 2008; Malikowski, 2010; Kember et al., 2010; Mott, 2010; Alhazmi & AbdulRahman, 2012).

The learner-centered and social learning philosophy should be the guiding principle of interactive and collaborative feature design of LMS. This offer learner the freedom to identify their needs and to make their choice of communication and collaboration method

which suits them the most. Moreover, Alhazmi and Rahman (2012) states that theoretical basis also impacts assessment and results in misalignment between e-learning processes, activities and feedback, because of this, learning theories can be used to understand and analyze e-learning processes.

- **Pedagogical Issues**

Pedagogical issues are those related to learning theories which impacts the manner in which instruction is planned (Alhazmi & Rahman, 2012). E-learning systems are typically structured to support both instructors in teaching and learners in learning by using technological features such that learning objectives are achieved efficiently and flexibly. The main function of LMS is course management in a manner which will ensure that learning outcomes are achieved by helping to organize course content, manage activities, and improve evaluation process.

When pedagogical principles are considered in e-learning, learning is facilitated, so also is the evaluation process of the curriculum, the instructor and the learner. However, when pedagogical principles are not imbedded into e-learning systems, misalignment between the course and learning occur, the content quality is affected and learner's performance is repressed (Govindasamy, 2011). There are five crucial pedagogical features for the execution of e-learning system (Govindasamy, 2011), these are content development, content storage and management, content packing, student care and evaluation.

- **Technological Issues**

Technology certainly plays a pivotal role in improving teaching and learning process. Usually, the purpose of using technology in education is to explore answers to existing educational challenges so that performance is improved (Alhazmi & Rahman, 2012). However, technology if not utilized appropriately and effectively may introduce barriers to learning. This is especially so if the user interface is considered to be unfriendly to users (Alhazmi & Rahman, 2012). It becomes even more complicated when there is no handshake between the development process of technology such that philosophical and theoretical foundation do not relate to technological functions. Most LMS features fail because their design principles have not been based on users' requirements and the dynamism of change in the learning environment. Furthermore, LMS technology need to

foster motivation so that the level of usage and engagement is enhanced. To this end, there is need for further development in the technological aspects of e-learning.

Jafari et al. (2006) summarizes many technology related issues in LMS. Stakeholders in 59 faculties using different LMSs such as WebCT, Blackboard, E-College and ANGEL Learning were interviewed to find out the advantages and disadvantages of these systems. Participants reported that they had problem with user interface, navigation system, user profile, compatibility, transportability and generally difficulty in handling the system. and required many steps and the system neither supported smart messages or dynamic profile which enable students to manage and trail their activities across the system tools. Also, teachers were burdened by the need to monitor and track students' activities and their progress online on a continuous basis; a task which they perceived as laborious and time.

Despite these limitations, it is noteworthy that online learning has its advantage which is beneficial for both instructors and learners. Online learning provides learners the advantage of collaborative and life-long learning which is crucial for learner's capacity development or further professional enhancement. Importantly, web 2.0 tools offer the prospect of Personal Learning Environment (PLE) which allow learners find collaborative ways of learning (Rosen & Nelson, 2008; Grosseck, 2009). Web-based technologies including LMS and web 2.0 evidently add value to educational systems. However, the challenge is how these technologies can enable educational processes such as content management, activities management and assessment management in distinct, well-defined and integrated functions (Alhazmi & Rahman, 2012). Moreover, since LMS are designed to be used it is necessary to determine how the technical features can be more dynamic and flexible so that users' needs and preferences are met.

2.7.2 Guidelines to mitigate LMS failure

To mitigate LMS failure issues and ensure the effective use of technology to enhance student learning, Alhazmi and Rahman (2012) proposed two principles, these are design and implementation principles. Design principles are crucial in supporting innovative teaching and learning processes. They also facilitate learner-centered knowledge construction as well as social, collaborative and interactive learning; all of which ensure

that learning outcomes are achieved. Design principles of the LMS however should draw upon features such as dynamic tools, rich content, resource classification, personalization, collaboration, interactivity, and integration. While implementation principles involve the consideration of institutional issues which play pivotal roles in the implementation process so that learners are satisfied and learning outcomes are achieved. Implementation issues that need to be considered include content design and management, training for continuous improvement and rewarding, Alhazmi and Rahman (2012).

2.8 EVALUATING E-LEARNING PROCESSES AND OUTCOMES

E-learning necessitates the involvement and contribution of different group of people including content providers, instructional designers, teachers, technical support, trainers, database administrators and several other group of people who come together to provide learning platform and services to a community of learners. E-learning technologies has the potential to give opportunity of quality education to those who aspire to have one but have been impeded by the barriers of traditional education while giving educational and training institutions the opportunity to improve their pedagogical standards. Despite these possibilities, incorporating e-learning into higher education requires detailed analysis to ensure that the user requirement is complete, and the system is running as planned. E-learning provides opportunity for users to learn and improve upon their skills regardless of their geographical location at any time they wish.

E-learning enables the delivery of learning instructions on digital devices such as desktop computers, laptops computers, tablets or smartphones with the intention to support learning (Clark & Mayer, 2016). Evidently, the use of e-learning in higher education is not without an objective; usually this is to increase knowledge and consequently enhance performance of the system users. The use of e-learning needs to be evaluated from time to time to ensure that the pre-stated purpose of adopting e-learning technologies is achieved. The adoption of e-learning for use in higher education is capital intensive and there is need to establish that the Return on Investment is positive. To justify the investment in e-learning, there is need for its evaluation. Usually, there are two main approaches to evaluating e-learning programmes; these are process and outcomes evaluation. While process evaluation assesses the strength and weaknesses of e-learning

interventions, outcome evaluation assesses the changes in learners' acquisition of knowledge because of their participation in the e-learning course.

2.8.1 Contextual Diversity in E-learning

Contextual factors are environmental factors which are outside of the control of individuals. These might be materials, budget, working conditions, or socio-economic conditions which impact the performance of an individual (Hameed et al., 2016). The impact of e-learning on the performance of its users cannot be understood outside the context of cultural setting of LMS users. Cultural diversity has been identified as a major factor which could present as a disruptor to learning if e-learning systems are not designed to accommodate this diversity. Sadly, majority of existing LMSs have not been designed with learner diversity in mind (Hameed et al., 2016).

Kirkwood and Price (2014) states that there has been lack of practical clarity regarding the significance of investments in technology to enhance teaching and learning in higher education. Kirkwood believes, "Rather than just considering technical issues and/or the idealized promises made about technologies, 'joined-up thinking' is required to integrate the multiple contextual factors that all influence how technology is actually used in teaching and learning". Higher Education (HE) sector in various countries keep making massive investments in technology with the expectation that it provides the benefit of enhancing student's learning. While there have been pronouncements by institutions that IT has enhanced their students' learning, it is not clear what this actually signifies in practice (Kirkwood & Price, 2014). The deployment of e-learning technologies in education should be approached with caution and informed by inquiry and evidence rather than assertions, hyperbole and reductive interpretations (Kirkwood, 2014). Enquiry and evidence should be context-based rather than being technology-led and focused mainly the technology or applications.

It should be noted that while technology and its applications are subject to constant change, educational issues are long-lasting, therefore, practitioners are decision-makers should rather consider basic human behavior over the potentials of a new technology. While Kirkwood (2014) agrees that technology influence changes in HE as it does in the wider society, He argues against "technological determinism"; the opinion that

technological innovations and developments are the main agent of social change, rather than individuals and social contexts informing the way technology is used. This is stating that as much as technology influences changes in HE, it should not be perceived as the main/primary driver of change in education.

Kulier et al. (2012) suggests that the teaching of evidence-based medicine (EBM) should be clinically integrated for evidence-based practices to embed culturally in the workplace. He conducted an international cluster randomized trial in 2010 to evaluate the effects of a clinically integrated e-learning EBM course using post-graduate trainees in obstetrics and gynecology in 7LMICs (Argentina, Brazil, Democratic Republic of Congo, India, Philippines, South Africa, Thailand) using an e-module in Reproductive Health Library. He found out that in a group of LMICs, a clinically integrated e-learning EBM curriculum compared with self-directed EBM curriculum in Reproductive Health results in higher knowledge and skills retention and better educational environment.

2.8.2 Evidence of effective and efficient e-learning

evaluating an e-learning intervention, one of the positive responses which experts expect is the evidence that e-learning has helped to enhance the teaching-learning process. There are several documents that establishes the effectiveness and efficiency of e-learning in higher education, government and corporate organizations (Hameed et al., 2016). However, there are always limitations in these studies which may present in form of inconsistency in design, inadequately defined content quality and technology characteristics, and ineffective description of the specific e-learning intervention being examined.

Walker et al. (2003) went through several literatures on the usefulness of the e-learning method in medical education. While most of the literatures demonstrated that learners could gain knowledge through web-based learning in a manner which could be equated to the traditional teacher-led instruction method, a few reported that e-learning proffers a more efficient means of knowledge accumulation to students. Kinuthia and Dagada (2008) revealed that the effective incorporation of technologies into teaching and learning processes of institutions have assisted in transforming education and has generated new paradigm such as e-learning, networked learning or distance education. Whatever

paradigm the incorporation of technologies into education comes in, it has the potential of supporting teaching and learning processes (Dagada, 2009). This is because e-learning supports instructors in their practices as well as learners in their learning process (Bingimlas, 2009). Even though learners differ in their learning style, when these differences are put into consideration by instructors in their teaching styles, it could assist learners in having a clear understanding of the subject matter and enhance their satisfaction with the course while improving their learning outcomes (Arora et al., 2013).

The integration of technology into education is one which has been emphasized in higher education for more than a few decades in developed countries such as USA (Kobayashi, 2012) but now is gaining much popularity as higher education institutions are encouraging their faculties to incorporate technology into the teaching and learning processes. Alkharang and Ghinea (2013) argue that the adoption of e-learning in higher learning institutions are as a result of growing trend in the society in which rapid change in technology is associated with equivalently rapid change to learning environment, culminating in an increase in pressure mounted on educational institutions to accommodate students' learning needs using information technologies.

The use of e-learning in higher education is not without its own challenges, barriers and limitations. Teacher efficacy, computer self-efficacy, lack of technical know-how, lack of knowledge of technological pedagogical knowledge (Moore-Hayes, 2011), curriculum planning, technical support and budget amongst others. Notably, cultural and technological barriers have been identified as major barriers to the use of e-learning in higher education (Panda & Mishra, 2007). While these barriers in technology adoption and usage in education cannot be glossed over, literature (Alkharang & Ghinea, 2013) affirms that whereas the opponents of technology constantly contend for a stable evaluation of any technology, less attention is paid to the barriers and challenges brought about by technology itself. The focus should not be on the barriers of technology adoption and use in education as this might have negative effects of discouraging users from using e-learning systems, but rather on barriers in e-learning should be perceived as exposure of system users to challenges which might be encountered from using the system.

2.9 INTEGRATING E-LEARNING INTO MEDICAL EDUCATION

The development of a well-devised plan should precede the adoption of e-learning in medical education. To do this, the first step is the assessment of needs which will dictate the system requirement for the e-learning system, and hence, the eventual use of the system (Khasawneh et al., 2016).

The needs and requirements of the system will need to consider factors like the medical education level being catered for. For instance, in undergraduate medical education, e-learning offers learning resources which learner usually use for self-paced and interactive learning while in graduate medical education, there are six core competencies which have been identified by the Accreditation Council for Graduate medical education towards which e-learning can be practiced. Asynchronous e-learning methods can be used in this regard to replace synchronous methods, especially in situations where duty hours are restricted and curriculum demands are high (Ruiz et al., 2006). In continuing medical education, healthcare practitioners can attend e-conferences and even participate in virtual classes to update their knowledge and keep abreast of latest medical discoveries.

Medical education contents are wide and very complex, more complicated is the fact that medical experts are very limited, so are the resources for e-learning in medical education. Therefore, there is need to research into new and innovative mode of learning delivery for healthcare professionals to provide them with practically workable means of continuing education. E-learning proffer such innovation (Greysen et al., 2011). Medical schools and healthcare organizations are producing high-quality e-learning resources such as virtual patient simulations and these could very much be within the reach of educators and learners of medicine.

2.9.1 E-learning in Medical education

E-learning is established in many medical schools, albeit it has been difficult to evaluate its effectiveness. Clinical skills have been considered a difficult area for online learning and there is need for a body of evidence which validates the use of e-learning in medical education. Gormley et al. (2009) assessed undergraduate medical students' perception of the level of accessibility and attitudes towards e-learning in basic clinical skills education

compared to other methods and reported that majority of students stated that they had good access to computers and internet both while on campus and while off campus. They were also confident in their ability to use IT. These students believed e-learning positively impacted their learning of clinical skills in manners which are comparable to the traditional classroom setting. Also, they noted that students who portrayed deep learning traits when using e-learning performed better in their clinical skills. This study highlights that although undergraduate medical students are different in the way they utilize e-learning, they accept and appreciate the use of e-learning in clinical education.

The use of technology has advanced in medicine over the past few decades, not only for e-learning in medical education but also in other field of telemedicine for the delivery of healthcare services. This is especially so because e-learning offers the possibilities of providing effective, resourceful and economical learning environment irrespective of the geographical location and distribution. It is therefore considered a worthwhile investment by universities for undergraduate medical education (Gormley et al., 2009). E-learning has gained approval and acceptance in medical education and is now well used in several medical, even though e-learning is widely used in medical education, it is difficult to measure its success (Cook, 2007). There is also the concern that e-learning might have been used in medical education because of its popularity and novelty rather than for pedagogical evidences (Cook, 2007). Whereas other domains may easily lend themselves to e-learning, clinical skills have been a challenging area for e-learning (Knutson et al., 2006).

Khasawneh et al. (2016) assessed the impact of e-learning on the medical knowledge, satisfaction, and perceived confidence of third year pediatric medical students using an e-module about infection control and congenital infections. The e-module was hosted on Blackboard Learn and content was present in three formats; a text monograph, a PowerPoint presentation and a narrated PowerPoint lecture. Pre- and post-tests specifically relating to the e-module content and National Board of Medical Examiners (NBME) pediatric exam scores were recorded. It was found that although the e-module was perceived as satisfactory by the students, it neither improved students' medical knowledge nor their performance on NBME or post-test. However, taking the e-module boosted the confidence among those who used them.

E-learning is being used in education as it has been established that it has the potential to encourage individualized learning (McGready & Brookmeyer, 2013), independent and insightful thinking (Alemán et al., 2011) and flexible self-paced learning (May et al., 2009). Literatures comparing e-learning to traditional face-to-face learning have affirmed that e-learning is at least as efficient as traditional teaching methods in many disciplines, and across both undergraduate, graduate and postgraduate levels (Bye et al., 2009; May et al., 2009; Beale et al., 2014). Also, several researchers investigated the level of satisfaction of students with e-learning. The results have shown varying level of satisfaction; some stated equal, some increased and others; decreased level of satisfaction compared to traditional lecture methods (McCann et al., 2010; Kim et al., 2012; Lyke & Frank, 2012; McGready & Brookmeyer, 2013; Mancini et al., 2015).

Khasawneh et al. (2016) states that e-modules are not a generally effective teaching tool and their implementation in established curricula should be carefully evaluated. Furthermore, he emphasized that to determine the impact of e-learning, it is important to evaluate the impact of e-learning in each instance of setting because of the uniqueness in design and cofounder of each study depending on the institution, the nature of the module, assessment and the target population of the participants. In conclusion, Khasawneh et al. (2016) states the need for further studies for the examination of e-modules as the benefit of each e-module might depend on the setting, subject matter, and delivery.

The burden of disease in sub-Saharan Africa is generally high. This is partly due to high level of poverty in these countries. Also, the doctor-patient ration in most sub-Saharan countries are also not as stipulated by World Health Organization (WHO) as is the case in South Africa. Besides from socio-economic factors that needs to be catered for, there is a dire need to address human resource related issues associated with the high burden of disease in sub-Saharan Africa, and in this case, South Africa. Mars (2012) affirmed this by stating that there is need to develop capacity in the South African healthcare system in such a way that the trained personnel will also train others in a sequence which will ensure that several medical capacities are developed. This will ensure that there are so many hands on medically to combat the burden of disease in South Africa. The challenge however to this proposal is that the medical system is already witnessing shortage,

therefore, taking medical practitioners away from their place of work to train them or have them train others will further deplete the already depleted healthcare system. Therefore, there is need to explore ways in which capacity of healthcare practitioners can be developed or strengthened while they are still able to provide their services to the ailing masses.

The major advantage of e-learning is that it provides access to education while keeping learners in their location. This seem to be the answer to the shortage of skills in healthcare. However, there is need to assess e-learning platforms that have existed in medical education to examine if e-learning leads to the achievement of pre-stated learning outcomes in medical education. Ellard et al. (2014) evaluated the implementation and change in practice of 54 Emergency Obstetrics and New-born Care (EmONC) non-physician clinicians (NPCS) who were trained as advanced clinical leaders clinicians during their participation in the ‘Enhancing Human Resource and the use of Appropriate technologies for Maternal and Perinatal Survival in sub-Saharan Africa’ (ETATMBA) project using rural and urban hospitals in 8 districts Northern and central Malawi. ETATMBA is a European commission (FP7) funded project which provided advanced clinical and leadership training between November 2011 and June 2014 to non-physician clinicians (NPCs) to provide emergency obstetric and new-born care (EmONC).

The trainees worked in different context of maternal and neonatal deaths between districts over the two years plus training which consisted of classroom, training and mentorship. Colleagues and district officers of trainees were reported to observe change in practice of the trainee during the early implementation days of the project. Colleagues stated that they had witnessed cases where trainee displayed life-saving skills for postpartum hemorrhage and eclampsia. Generally, the process evaluation of the project suggests that trainees have made positive changes in their practice because of the training, even though there were no clear impacts on maternal and perinatal mortality. (non-e-learning intervention).

2.9.2 State of Medical education in sub-Saharan Africa

Greysen et al. (2011) conducted a review of literatures on medical education in sub-Saharan Africa and found that despite the incredible variation of languages in the region,

most literatures are published in English and the first Authors of such literatures are usually from South Africa, United Kingdoms (UK) and United States of America (USA). Most importantly, it was discovered that attention was paid to topics like human resource planning, curricula innovations such as problem-based and community-based learning, topics with key importance such as solution implementation, programme outcomes and development of medical education as a specialized field of inquiry were neglected.

Sub-Saharan African (SSA) countries are generally characterized with health delivery situations such as scarcities of healthcare professionals, inequalities in healthcare and largely, inadequate capacity in medical education (Omer, 2005; Gukas, 2007). The emergence of newly independent African states from the rule of the colonial powers saw a substantial development in medical education in SSA from five before 1960 to 47 in 1980. However, several medical schools were closed due to unfavorable situations such as civil unrest, corruption, famine and lack of political will power between late 1980s and early 1990s. These and other structural adjustment programmes to decentralize government spending reduced the healthcare workforce in SSA leading to shortage of HCPs in the region. Late 1990s brought about another upturn in medical education, this expansion has continued till date. Despite these improvement, SSA is still afflicted by healthcare inequities, shortages of HCPs and generally, inadequate capacity in medical education (Greysen et al., 2011).

To mitigate the disparity in healthcare workforce, there are seemingly three steps which could be taken. These include; building capacity for increased training of HCPs, inventing or adopting innovations in training of HCPs and retention of HCPs once they have been trained (Greysen et al., 2011). Furthermore, there is dire need for research in medical education to highlight what has been done, what is being done and what needs to be done to ensure that capacity is built and strengthened for medical education in SSA.

Greysen et al. (2011) conducted a review of articles on medical education in sub-Sharan Africa published between 1965-2010. It was discovered that literature on medical education in SSA is growing rapidly even though dominant journals in this literature tend to be published in English with most of them based in either UK or the USA. These literatures also represent countries with older medical schools such as South Africa,

Nigeria and Uganda in a disproportionate order. While Sudan was largely under-represented despite that it has witnessed recent expansion in medical education. Many medical schools in SSA were not mentioned at all in the literatures. It was noted that SSA is under-represented in global literature on medical education and this has contributed to the North-South disparity in knowledge and scientific publications about how HCPs are trained worldwide.

Furthermore, the review by Greysen et al. (2011) portrayed that medical education as a field of enquiry and practice in SSA is underdeveloped and there is no medical journal dedicated exclusively to medical education in SSA. While literatures highlight description and assessment of area such as problem-based learning, community-based education, human resources for health capacity planning, causes of brain-drain, and strategies for workforce retention, they did not focus on aspects such as technology, financing in medical education, scaling up of human resources for health, and outcomes including postgraduate training and primary care.

This study fills the gap in literature that exist in SSA, and specifically in this context, South Africa; in two aspects of the weakness of the review of literatures in medical education in SSA conducted by Greysen et al. (2011) focusing on the perceived outcome of use of technology for postgraduate training in medical education. Although this study cannot lay claims of its output being a general representative of all e-learning interventions in medical education, it sheds more light on the possible outcomes of e-learning interventions in medical education, suggests a framework for the evaluation of e-learning outcomes in medical education, contributes to the existing body of knowledge that already exist in literature and opens up space for further research through a constructive critique of the research process and procedure by other researchers.

Information technology has revolutionized medical education in many countries in SSA while promising greater access to high-quality education (Adeogun, 2007). Web-based course tools (WebCT) have enabled and improved communication and interaction between instructors and students and provided better access to learning resources. Unfortunately, these introduction and adoption of technology introduces start-up and maintenance costs which are discouraging to most medical schools. However, some

instructors have employed technologies which are affordable such as video-conferencing for teaching and clinical consultation (Hadley & Mars, 2008) and video-projected structured clinical examination . Other problems in the use of e-learning technologies in medical education include high student: computer ratio, slow internet connections, and digital divide between resource-constrained countries and developed countries (Williams et al., 2010). While some literatures stated large deficiencies in basic computer skills of students (Ameh et al., 2008), some have shown that students were able to adapt quickly to technology usage irrespective of their previous knowledge and experience .

Apart from the inability to build capacity in medical education in SSA (Mars, 2012), there are two factors that contribute further to the shortages of medical workforce in SSA. One major factor is the burden of disease in SSA countries. These countries are characterized by HIV/AIDS and TB crises. This introduces a two-way strain in the workforce by increasing the need for care of the populace while decreasing manpower available to provide healthcare as healthcare workers themselves are infected (Dovlo, 2005). Literature has described the HIV/AIDS pandemic as ‘the straw that broke the camel’s back’ in the human resource for health crisis and stated that the rates of HIV/AIDS infection in HCPs are even higher than that of the general populace (Africa Working Group, 2006). Another factor which contributes to the shortage of medical workforce in SSA is the migration of HCPs trained in SSA countries to developed countries such as USA, UK, Canada and Australia. Statistics show that at least one in eight trained HCPs in SSA are lost to developed nations (Mullan, 2005). HCPs state reasons such as civil unrest, personal health risk, higher income, job satisfaction and career development as reasons for migrating.

Building capacity in medical education in sub-Saharan African countries is core to the improvement of healthcare service delivery in these countries. There is need to recruit and retain academic and support staff who can build capacity in a ripple effect; such that the built capacity themselves go further to build more capacities so that the burden of disease in SSA is combated. Literature has documented efforts to build research infrastructure so that the recruitment and retention of academic faculty staff are increased. These efforts are more often than not, a result of some international collaborations (Burdick et al., 2006) from several western universities to partner with SSA to increase

training for HIV research and care (Einterz et al., 2007; Sande & Ronald, 2008) but opportunities to develop skills in medical education as a specialty are not frequently described.

2.9.3 State of Medical Education in South Africa

The major and deliberate move toward the enrolment of more black African and female enrollees in medical education in South Africa brought about an annual medical students enrolment increase of 34% between years 2000 and 2012 (Karim, 2014). This has allowed students from previously disadvantaged backgrounds to be admitted even though they may have scored relatively lower scores (Gauld, 2012). Physicians in the public health sector have also been improved in a new training scheme through M.B., Ch.B./Ph.D. programmes to sustain academic medicine (Mayosi et al., 2009; Mayosi et al., 2012; Katz et al., 2014). The South African government provides funds to support medical research (Mayosi et al., 2009; Mayosi et al., 2012; Senkubuge & Mayosi, 2012). These moves have resulted in 18% increase in the numbers of graduating doctors between years 2000-2012; this percentage being more of women, more black Africans and mixed races, and fewer whites and Indians (Mjamba-Matshoba NB, 2013). This increase however does not keep up to the ratio of physician per 100 population which is pretty much the same between 2004 (0.77) and 2011(0.76) (Global health workforce statistics, 2013).

In the mid-1990s, President Nelson Mandela initiated a programme to train medical doctors in Cuba. This was intended to encourage the Cuban orientation towards primary healthcare. Most doctors enrolled for the programme are South African from rural areas and the aim of the programme is to produce 1000 graduates annually into the healthcare system from 2018 onwards. Although this approach seem genius, it has been questioned by people who perceive that the local resources being used to train the future workforce of South African healthcare professionals could have been used to strengthen the training capacity of medical schools in the country. Healthcare professionals are quite reluctant to practice in rural areas in South Africa, hence nurses are central to the running of most community health centers. Notably, the number of nurses in all categories on the Nursing Register has increased by over 40% between 2003 and 2012 (South African Nursing Council, 2014).

To strengthen the healthcare workforce of the South African health system, there needs to be rigorous, well-laid down line of actions to be taken to ensure the management of chronic, infectious and antibiotic-resistant diseases and cultivate a national surveillance system for efficient and cost-effective prevention and management of diseases across the entire populace. South Africa has need of more than three times of its current workforce to be able to adequately combat its burden of disease. There have been commendable moves to strengthen capacity of healthcare professionals in South Africa, part of which is the recent training of community health workers and a successful development of front-line worker-based programs to control tuberculosis and HIV infections. South Africa has the need to strike a balance between the health, wealth and education of its citizens. There are short term measures such as strengthening public healthcare services and training adequate healthcare professionals which can be considered (Mayosi & Benatar, 2014).

2.9.4 Utilizing e-learning to improve learning outcomes in medical education

The integration of e-learning into medical education has the potential to shift medical education from teacher-centered to being learner-centered, making educators to be facilitator of learning rather than being distributors of learning content. Recent changes in healthcare delivery and advances in medicine has placed demands on academic faculty and reduced the time available for teaching (Ellard et al., 2014). Also, healthcare delivery has witnessed a change from being acute care institutions to being community-based setting for chronic care; this has also demanded a new adaptation in teaching venues. This has led to a shift in teaching paradigm from instructor-centered to learner-centered model where learners are in control of their own learning (Hameed et al., 2016). The recent move in education advocates competency-based curricula which lay emphasis on the learning outcome, and not the learning process. In the wave of social, scientific and pedagogical challenges making the round in medical education, e-learning can be used by medical educators to advance and enhance knowledge and improve the efficiency of educational interventions.

E-learning is used by most medical students and several studies have shown that e-learning has the potential to improve learning outcomes in small scale interventions (Boye et al., 2012). In a study conducted by Boye et al. (2012), all second year students of a Norwegian University of Science and Technology (NTNU) medical school offering

an e-learning course in form of blended learning were examined to determine the effect of the e-learning intervention on their satisfaction and learning outcomes. It was found out that the use of e-learning in this medical course improved learning outcomes for intermediate-range students. This is consistent with other studies that shows that e-learning intervention improves examination outcomes in students (Romanov & Nevgi, 2007; Botezatu et al., 2010).

E-learning has been proven in some circumstances to be more effective than the traditional face-to-face method of teaching in medical education (Kröncke, 2010) mostly because it is usually easily accepted by students and instructors (Gormley et al., 2009), it has the potential of facilitating cross-border learning regardless of learners and instructors' location (Ruiz et al., 2006), and it has been found to improve learning outcomes in medical education. Some studies have been conducted to find out the level of short-term knowledge retention in e-learning by looking at test taken by students shortly after the e-learning intervention and other studies to find out the long-term level of knowledge retention in learners with test taken several months after the e-learning intervention. Peroz et al. (2009) found out that the knowledge retention on long term basis for e-learning is comparable to that of the traditional face to face method of learning. While Botezatu et al. (2010) conducted his research five months after the e-learning intervention and found that knowledge retention in e-learning is superior to that of traditional face to face approach.

2.10 THE NEED FOR E-LEARNING IN MEDICAL EDUCATION IN SOUTH AFRICA

Despite the acclaimed benefits and limitless possibilities of e-learning, it should be noted that the success of any e-learning intervention is not only technology-based but also context-based. Therefore, there is need to consider the justification for and suitability of e-learning in South Africa.

2.10.1 State of Health and Healthcare in South Africa

South Africa consists of an estimated population of 52,776,000 people with an estimated annual population growth rate of 4.1%, 64% of this population lives in the urban area

(World Health Organization 2014). The average life expectancy in South Africa has reached 62 years, increasing by 8 years since its lowest at 2005. The improvement in life expectancy has been attributed to the drop in the level of child mortality and young adult mortality. When compared to levels in 2011 and 2012, infant and under-five mortality rates appear to have stagnated at 29 and 41 per 1 000 live births, respectively (Dorrington et al., 2013).

The National Department of Health South Africa developed strategies to improve the status of health of the entire population and ensure a long and healthy life for all South Africans. These strategies align with the Millennium Development Goals (MDGs) which the United Nations (UN) expects nations of the world to attain by 2015 (United Nations, 2013) and focus on increasing life expectancy, decreasing maternal and child mortality, combating HIV and AIDS and decreasing the burden of tuberculosis and strengthening the health system effectiveness (South Africa Yearbook, 2013/2014).

Even though there has been significant decline in the mortality rate, TB continues to rank as the leading cause of death in the country. In 2010, 543 856 deaths occurred in South Africa, this figure was lower than that of 2009 by 6.2% with TB accounting for 12% of these deaths and ranking as the number one leading cause of deaths in 2010. HIV was the seventh leading cause of death, accounting for 3.4% of all deaths (Statistics South Africa, 2013).

To combat the burden of disease and create a healthy community, the South African Service-delivery Agreement goal set by the National Department of Health for all South African citizens emphasizes that 80% of eligible people living with HIV and AIDS must access ARV treatment (ART) and new infections must be reduced by 50% by 2014 (South Africa Yearbook, 2013/2014). To achieve this goal, the capacity of healthcare professionals needs to be strengthened in a manner which allow them to render their services to the nation and its people while still participating in programmes and trainings which ensure their continuous professional development. However, this is not the case with regards to the human resources and healthcare facilities needed to combat the burden of disease in South Africa.

Over 216 191 medical Professionals are registered with the HPCSA, these figures include those working in the state, private practice and specialists, a higher population of these doctors work in the private sector. South Africa has 260 698 registered nurses; this includes registered, enrolled and auxiliary nurses but excludes students and pupils (Health Systems Trust, 2014). Given the above statistics, the ratio of HPCSA registered doctors to patients will therefore be 1:244 and nurses to patients; 1:202. Furthermore, there are 4200 public health facilities in South Africa and the number of people per clinic is 13 718, these numbers and ratios exceed the WHO guideline of 10 000 per clinic (South Africa Yearbook, 2013/2014).

The South Africa's National Strategic Plan (NSP) on HIV, AIDS, STIs and TB care 2012-2016 is the integration of HIV, AIDS and TB into the NSP, this bothers on a 20-year vision to combat HIV/AIDS and TB with main emphasis on; addressing the social structural drivers of HIV, STIs and TB care, prevention and support; preventing new HIV, STI and TB infection; sustaining health and wellness; ensuring the protection of human rights and improving access to justice (South Africa Yearbook, 2013/2014). However, the health system in South Africa is extremely understaffed to achieve these strategic plans.

The South Africa Department of Health recognizes the need to create training programmes to strengthen the capacity of its healthcare Professionals and achieve its National Strategic Plan. In 2013, the Minister of Health launched the Albertina Sisulu Executive Leadership Program in Health (ASELPH) with the sole purpose of strengthening human-resource capacity needed to provide "high-quality, cost-efficient services through strengthened executive-level training of health leaders and managers" (South Africa Yearbook, 2013/2014). The ASELPH training strategies include targeted training of executive, district and hospital managers who are responsible for services related to the NHI, strengthened management capability of current and emerging district, health-related leaders who are responsible for the implementation of the NHI and the re-engineering of the PHC system. In addition, the strategies also include the advancement of sustainable, relevant, educational and training capacity for health executives responsible for the management of large public health programmes such as HIV, STIs and TB (South Africa Yearbook, 2013/2014).

South Africa is a country characterized by huge disparities in the wealth and health of its people, this disparity has been recorded as being one of the widest in the world (Benatar, 2013). This is evident by the statistics which shows that in 2008, for instance, 54% of South Africans had an income below R45/day; and 10% of South Africans account for 58% of annual national personal income (Leibbrandt et al., 2010). South Africa comprises almost 17% of the world's population living with HIV/AIDS, the country has the largest antiretroviral treatment programme in the world, yet only 40% of eligible adults are receiving treatment (Bekker, 2009). The prevalence of HIV infection among those older than 19 years ranges from 16.1% in the Western Cape to 38.7% in KwaZulu-Natal (Bekker, 2009). These disparities and burdens of disease are evidence of dysfunction and disorder within the South African healthcare system and nation, and do not create a favorable atmosphere for the development and stability of the nation.

2.10.2 The potentials of e-learning in rural South African Community

In South Africa for instance, the introduction of e-learning in rural areas has been stated to have made a huge difference to the life of rural communities (Hay, 2007). Dally (2004) affirms that through e-learning, Information communication technology has the potential to deliver management skills which are knowledge-intensive management skills to rural dwellers. E-learning is a “flexible form of education that allows participants with different schedules in different locations to interact and learn in a collaborative, online environment” (Hay, 2007). The advent of the internet and the world-wide web has seen an exponential growth in e-learning. E-learning is not a new concept, although it is not well used in the rural areas in South Africa. The major reason for this is that there are limited communication media available for rural communities.

Hay (2007) conducted a research using multiple case study to investigate the opportunities that e-learning present to rural communities in South Africa. The study investigated three community centres in the Limpopo and Gauteng provinces of South Africa. These community centres; Thusuluo learning centre in Limpopo, Memelodi and Legae la kitso- both from Gauteng; were chosen from disadvantaged area because they accommodate many of the population in the disadvantaged area, offer basic services to their community and are community driven. The main purpose of the study was to

develop a model for sustainable implementation of e-learning in rural communities. The research opined that community centres are the only way through which rural dwellers access information communication technology or e-learning, and sometimes information on employment opportunities, and government services.

The perception of participants were sought to assess the role of e-learning in enhancing knowledge sharing in rural communities, the frequency of learners' use of e-learning materials, the role of e-learning in supporting knowledge sharing in rural communities, availability of e-learning access points, the possible influence of e-learning on the economic growth and opportunities of rural communities, the community's perceptions on the factors causing barriers for e-learning and on the benefits of e-learning, learners' perceptions of e-learning, the number of students that can be accommodated on a given time by each community centre, and the elements of a model to implement e-learning in rural areas.

In the research conducted by Hay (2007), participants were of the opinion that e-learning makes it easy for rural dwellers to access learning, interact and collaborate with urban dwellers and even eradicate social isolation which characterizes most people who dwell in rural areas. Participants emphasized that e-learning helped them to share knowledge and skills that they have, while connecting globally and sharing skills without incurring huge travelling expenses. Most of the learners use the community e-learning system at least twice in a month. Participants believed e-learning can influence economic opportunities in a positive way and stated that the major barrier to e-learning were lack of knowledge about e-learning, lack of computer skills, lack of broadband connection and lack of internet connections among others.

E-learning provides innovative ways through which learning can be delivered in higher education. With e-learning, students do not have the need to attend classes as in the usual traditional method. Students are able to access course information regardless of their geographical locations and time-zone variation (Al-Samarraie, Selim, et al., 2017).

2.10.3 Can e-learning be used to strengthen capacity of Healthcare Professionals in South Africa?

Benatar (2013) draws attention to the disparity in the state of health in South Africa identifying vital factors that influence health for most South Africans. He stated that though antiretroviral drugs have been made available through activism and donations from abroad to save many lives, bio-medicine might not be the ultimate solution to the pandemic of HIV and tuberculosis which are deeply grounded in the social conditions affecting health (World Health Organization 2014).

Benatar (2013) identified social forces, lack of systematic information on the impact of local cultural values and traditional healers as factors that further complicate the state of health in South Africa. However, Benatar stated that to ensure impartial to high-quality health care, dysfunctional public healthcare infrastructure had to be revived and extended, the effectiveness of management practices enhanced, transparencies and accountability put in place to ensure optimal utilization of resources than presently obtainable in both private and public healthcare facilities and most importantly, tens of thousands of additional skilled and motivated healthcare workers trained and retained.

Recruiting and sustaining human resource for health is a huge challenge in healthcare organizations especially in sub-Saharan African countries. E-learning might present a solution to strengthen the health system workforce in developing countries by presenting platforms to build knowledge base and providing prospects for continuous learning (Mars, 2012). Technology-based learning enables flexible and maintainable means of life-long learning using various strategies such as distance learning, blended learning, real-time and self-paced e-learning. E-learning furnishes HCPs with the opportunity for continuous learning, improved skills and continued professional development (Frehywot et al., 2013). In resource constrained countries, e-learning needs to be developed and implemented relative to the context of the environment. The e-learning model should be sensitive to barriers such as lack of infrastructure for ICT, inadequate computer skills among most of the population, and lack of clear policy on implementation and evaluation of the curriculum (Omwenga et al., 2004).

It has been demonstrated that e-learning initiative can be used to strengthen healthcare professionals especially in LMICs. For example, the K4Health (Knowledge for Health) project based at Johns Hopkins Bloomberg School of Public Health's Center for Communication Programs (JHU-CCP), with support from the United States Agency for International development (USAIDS) developed, implemented, and evaluated several asynchronous eLearning initiatives (Mwaikambo et al., 2012).

The K4Health Project courses are hosted on the Global Health eLearning platform (GHeL) Center; K4Health's longest running eLearning activity used for demonstrating the use of e-learning for individual capacity building. K4Health also build organizational capacity to induct wide-ranging eLearning activities by developing and integrating asynchronous eLearning courses into larger capacity building and training activities. K4Health trains staff within partner organizations to plan, develop, manage, monitor and evaluate eLearning activities. This increases capacity of organizations to provide continuous training and mentoring of staff and others and ensures that eLearning activities are responsive and relevant to on-the-ground realities of public health training in various organizations and geographic locations (Mwaikambo et al., 2012).

HCPs from sub-Saharan Africa are huge fans of e-learning for continuing professional development. GHeL in April 2010 consulted Cekan Consulting to analyze their registration data from October 2005 to April 2010. The analysis showed that there were 50,197 registered learners from 184 countries. Of the top 30 countries earning certificates for successful completion of GHeL course, most of the learners were located in sub-Saharan African countries, followed by Europe and North America and Asia (Mwaikambo et al., 2012). The sub-Saharan Africa region continues to witness severe HIV/AIDS epidemic due to factors such as multiple sexual partners, unprotected sex, and weakening Health System (South Africa Yearbook, 2013/2014). The sustainability and success of Several capacity building strategies employed by K4Health highlight the potentials of e-learning for building and strengthening capacity of Health Care Professionals in sub-Saharan Africa.

The high rates of infection in South Africa constitute a major health challenge which requires the enhancement of practical education of HCPs in the country. A module which

thus focuses on antimicrobial treatment is well placed not only to improve the training of HCPs in antimicrobial stewardship because of experience of dealing with the disease – but also well placed to offer it on the African continent in terms of geographical location.

E-learning has been identified to facilitate the training of healthcare workers for the sole advantage of enhancing continuous professional development of the healthcare professionals without further depleting the already challenged workforce by providing training to workers without removing them from their working location (Cook et al., 2008).

Several literatures have highlighted the potentials of e-learning to guarantee continuing education and development of healthcare professionals in developing countries. Bagayoko et al. (2013) evaluated the impact of distance learning as a way in which capacity can be built, satisfaction increased and performance of healthcare professionals in isolated health care facilities enhanced. This was achieved using an organizational framework and computer-based tools developed within RAFT: Réseau en Afrique Francophone pour la Télémédecine; a telemedicine network in French-speaking Africa. Bagayoko's study, carried out in Mali, found that preliminary results suggest that the accessibility of eHealth, particularly continuous education, increases retention and enables the recruitment of young health care professionals to isolated healthcare facilities.

Frehywot et al. (2013) conducted a review of literatures which revealed how e-learning has been utilized in resource-constrained settings. He found out that of the various reasons presented for investing in e-learning in medical education, expanded access to education was core and that the approach or methodology utilized the most was blended learning; an approach which utilizes the mixture of various learning approaches and environment, including face-to-face classroom method and computer-mediated activities. Conclusively, Frehywot et al. (2013) is of the opinion that e-learning in medical education is a means to an end and not an end in itself and the effect of e-learning on the health of country populations can only be realized when the suitability, viability and the true cost of e-learning tools and methodologies are understood in the context of low-to-middle income countries.

Mars (2012) extends this idea by suggesting that there are already few healthcare professionals and specialists to relieve this burden of disease and adding the challenge of training more medical professionals to the few on the ground will further burden the already burdened system. Presenting a case study of tele-education at the UKZN, Mars is of the view that e-health offers potential solutions to some of the health problems faced by sub-Saharan Africa. Mars (2012, p. 33), proposed a new model; “Developing the capacity to develop capacity”, which stipulated the necessity to train healthcare Professionals using e-learning methodologies so that these trained Professionals will further train healthcare Professionals in a cycle which will ensure that capacity is developed to combat the burden of disease in Sub-Saharan Africa.

This study addressed issues specified by Frehywot et al. (2013) examining the impact of an e-learning module on the clinical practices and the healthcare organizations of HCPs who participated in the module. The study further examined the Mars’ model (Mars, 2012), using the NORHED’s “Antimicrobial Stewardship and Conservancy Module”; a pure e-learning module initiated at UKZN Westville. The main intention of NORHED and the programme developers at UKZN Westville for this module is building these HCPs’ capacity; so that they may also build capacities in a ripple effect in their respective countries to alleviate the burden of diseases, (especially related to Antimicrobial Resistant diseases) after their participation in the module.

2.11 SUMMARY

Chapter two provided a review of the literature relevant to this study. The chapter began with an overview of e-learning and thereafter examined the use of Learning Management Systems (LMS) in higher education. Following this, the benefits and challenges of e-learning were discussed. The diversity of learners was then highlighted as factors which could impede the achievement of learning outcomes in e-learning. Next, the factors which could cause LMS failure was discussed and guidelines to mitigate against such failure examined. Factors which can be evaluated for evidence of effective and efficient e-learning were analyzed. Thereafter the chapter looked at the integration of e-learning into medical education. Specifically, the state of medical education in sub-Saharan Africa, and in South Africa was examined and the ways in which e-learning has been previously utilized to improve learning outcomes in medical education were explored. Pen

ultimately the chapter considered the rationalization for e-learning in South Africa and the potentials of e-learning in the context of South Africa. Lastly, the chapter asked a rhetorical question which explored previous authors' attempt at utilizing e-learning to strengthen capacity of HCPs in Africa with the view to assessing the feasibility of such attempts within the South African context.

CHAPTER THREE

THEORETICAL AND CONCEPTUAL FRAMEWORK

3.1 INTRODUCTION

This study examined the influence of e-learning on the performance of Healthcare Professionals (HCPs) both at Individual and Organizational levels. At Individual level, the study assesses whether HCPs acquired knowledge and skills by participating in the pure e-module “Antimicrobial Stewardship and Conservancy” ran on UKZN Moodle in 2015, if they were satisfied and felt that UKZN Moodle helped them to achieve their learning aims, what roles their personal proficiency in using technology for learning and the contextual factors of their study location played in their performance. At Organizational level, the study assesses if the knowledge and skills acquired were relevant in their work place such that they were translated to use in their work environment and whether the fact that they took a pure e-module enhanced their performance in their workplace.

3.2 PERFORMANCE

Performance is defined as the degree of efficiency and effectiveness with which an individual carries out his assigned tasks. Efficiency in this context refers to the ability to obtain results with limited resources, while effectiveness means the ability to achieve the desired goals (Bravo et al., 2015). Globally, organizations invest heavily on information technology. These investments have been constantly on the increase over the years. In 2013, (Gartner, 2013) predicted global investment on information technology will reach 3.7 trillion dollars, this is a 4.2% increase over 2012.

Organizations invest in technology usually with the sole purpose of individual’s performance enhancement (Gable et al., 2008) so that the organization’s aim is achieved (Petter et al., 2012). However, there are repeated report that information technology fail to realize its expected benefits (Sun et al., 2009; Fadel, 2012). Even though a number of models have been developed which describe the effect of technology on performance, the contradiction in realization of the expected benefits of technology call for the need for a deeper understanding of this effect (Bravo et al., 2015). While some researchers in the

field of industrial psychology suggest that the knowledge and motivation of individuals affect their performance, some other group suggest that in addition to individual factors, Contextual factors may also affect performance (O'Donnell et al., 2015; Hameed et al., 2016).

On the surface, the evaluation of e-learning intervention seems to be concerned with just the technology, or at most the technology together with the task requirements for which the technology was adopted. However, there are other factors that may influence user's performance both on individual level and organizational level. Most research that study performance focus mainly on a single component (technology, or task, or individual). This study considers the technology, task, Individual and contextual characteristics and their influence on performance. This research hypothesizes that the technology provided to assist in completing a certain task, the requirement of the task, an individual's abilities and cultural setting will determine performance.

3.3 THEORETICAL FRAMEWORK

To establish a solid theoretical background for the study, Task-Technology Fit model (Goodhue & Thompson, 1995b) along with Kirkpatrick's evaluation model (Kirkpatrick, 1996 (b); Kirkpatrick & Kirkpatrick, 2006) were used as the theoretical conceptual framework. The task-technology fit model stipulates that technology needs to be readily accepted as well as fit perfectly with the users and the tasks that they perform to attempt to ensure its effectiveness. The adoption of the technology could thereby lead to an increased performance at individual and organizational level. The Kirkpatrick's evaluation model includes four levels of evaluations of the outcomes of e-learning which include; reaction, learning, behavior and result. These were used to assess HCPs' satisfaction, knowledge acquired, change in practice and organizational level impact of the e-learning module respectively.

The Task-Technology Fit model (TTF) was used to explore the technological dynamism of the e-learning module using the constructs adopted from Tariq and Akter (2011). These are HCPs' perceived task technology fit relative to their task characteristics, technology characteristics, individual characteristics and contextual characteristics, and how these influences the performance of HCPs. The Kirkpatrick's evaluation was used to

operationalize the individual level (reaction and learning constructs) and the organizational level (behavior and result constructs) performances construct of the Task-Technology Fit Model.

3.3.1 Task Technology Fit Model

Task-technology fit is defined as the extent to which technology provides features and functionalities which fits, or adequately align with the requirements of individuals, thereby assisting them to perform their tasks (Al-Samarraie, Teng, et al., 2017). Also Tariq and Akter (2011) defines task-technology fit (TTF) as the fitness or appropriateness of technology to an individual's task, determined by the extent to which technology assists an individual to accomplish his task. In e-e-learning, task-technology fit is the ability of the e-learning system to support users in performing their learning tasks such as accessing learning materials, answering online assessments, interacting with their peers and instructors in ways which suits their individual abilities (McGill & Klobas, 2009). Al-Samarraie, Selim, et al. (2017) found that TTF is one of the major factor which affect students' continued satisfaction with e-learning systems.

Figure 3.1. shows Task-Technology Fit model (TTF) model, its constructs and perceived relationship between these constructs. TTF Model shall be used to explore the technological dynamism of the e-learning module using constructs adopted from Tariq and Akter (2011), which are HCPs'; task characteristics, technology characteristics, individual characteristics, and contextual characteristics, relative to perceived task-technology fit. TTF is operationalized as their individual and organizational level performance in the e-learning module. Task-technology fit proposes constructs that assist in understanding the influence of technology on individual performance.

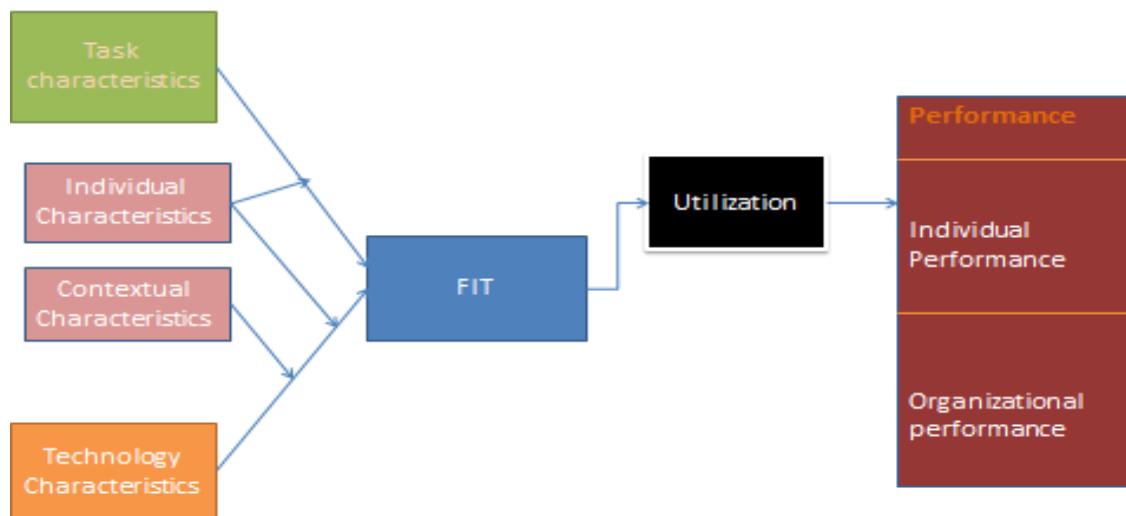


Figure 3.1: Task-Technology Fit Model

(Goodhue, 1995; Goodhue & Thompson, 1995b; Tariq & Akter, 2011)

Tariq and Akter (2011) identifies seven factors that influence community healthcare workers' perception of task-technology fit in m-health context, these factors include community healthcare worker's task characteristics, individual characteristics, technology characteristics, contextual characteristics, perceived task technology fit, m-health utilization and performance. Although Tariq and Akter (2011) used the task-technology fit framework from the m-health perspective, several of the factors identified in the study could be related to this study and therefore will be adopted. In a more concise term, TTF model presents a framework which portrays that information technology will be utilized by an individual if the functions it presents supports and enhances the user's activities.

The lack of fit or alignment between the technology and individual's task would yield impaired performance. For this study, the performance construct had been sectioned into individual level performance and organizational level performance. Table 3.1 presents the summary of definition of the task-technology fit model constructs as adapted to the context of this study, adopted from Tariq and Akter (2011).

Concept	Definition
Task Characteristics	This implies the actions taken by HCPs to ensure that learning objective pre-determined by module facilitators are achieved
Technology Characteristics	Technology characteristics are the features of the entire tools, e-learning applications, facilitating infrastructure and services that enable task execution by HCPs
Individual Characteristics	This describes the abilities, proficiencies, or competences of HCPs which affect how well they use the e-learning technologies to implement their tasks
Contextual Characteristics	This describes the cultural and social impacts and the enabling circumstance of HCP's study environment which impacts HCWs' perceptions on the suitability of e-learning in their study setting
Perceived Task Technology fit (Performance)	Performance is used to conceptualize TTF. This refers to effectiveness and efficiency in HCWPs task achieved because of the alignment between HCP's task requirements, individual abilities, contextual factors and the functionalities of the available e-learning technologies

Table 3.1: Definition of Task-Technology Fit Constructs

(Goodhue, 1995; Goodhue & Thompson, 1995b; Tariq & Akter, 2011) adapted to the context of this study context

- **Task Characteristics**

Tariq and Akter (2011) defines task as the actions which students involve in to turn inputs to outputs; in the context of e-learning this could be used to refer to the array of activities that students engage in on the LMS such as quizzes, downloading of lesson notes and content, assignments, examination and even collaboration with module facilitators, technicians and other students. For this study, Tasks are considered as the activities related to learning processes that an individual carries out totally using the Learning management system.

Task ease or complexity is one of the main determinants of performance. The task characteristics can be perceived as either easy or complex by individuals based on two perspectives as stated by literatures. The first is objective complexity. This perspective consider that task characteristics de5termines the complexity of tasks regardless of individual characteristics (Gill & Hicks, 2006). Task complexity arises from three sources; task components (number of acts that must be carried out and amount of information to be processed), task coordination (relationship between the inputs – acts and information – and the products) and dynamic complexity (change in the relationship between inputs and products). The second perspective; subjective complexity considers task complexity as a one which is determined by the executor or individual's characteristics such as previous experiences (Gill & Hicks, 2006).

- **Technology Characteristics**

Technology refers to the information system application adopted for use to capture, transmit, store, retrieve and manipulate learning information. This is popularly called Learning Management Systems (LMS) in e-learning. Technology could also refer to available computer systems such as hardware, software, data, internet connection and support services for students such as training and help lines which help students to carry out the task of learning using the LMS (Al-Samarraie, Selim, et al., 2017).

Several literatures on the influence of technology on performance have examined the ease of use and usefulness of the information system as the major factor which motivate users to utilize it. Ease of use of information system is the extent to which technology is perceived as relatively simple for users to understand and use (Bravo et al., 2015). An individual perceives technology as useful if it improves his/her performance. Technology can facilitate or inhibit individual and organizational performance and the impact of information systems on performance is evident in the extent to which the system assist the user to be better in what they do (Al-Samarraie, Selim, et al., 2017).

Literatures consider the influence of technology on performance from two perspectives. First of which is objective ease, which implies that the features of technology could enhance performance based on its design features, regardless of the user's abilities or proficiencies (Venkatesh & Davis, 1996). The second; subjective ease believe that ease

is dependent on the perception of the user, depending on the individual's experience or previous experience in the use of technology (Venkatesh & Davis, 1996). Davis asserts that ease of use is a great predictor of increased performance through the use of an information system. Bravo et al. (2015) defines ease of use of Information systems as the extent to which users perceive a certain technology to be easy to understand and utilize.

- **Individual Characteristics**

An individual is a person who uses the Learning Management System to carry out his or her learning task (Tarhini et al., 2017). An individual will perceive technology as being fit for task or otherwise depending on their personal attributes, abilities and proficiencies. This is in line with what earlier researchers defined as subjective complexity; states that complexity lies in the perception of the executor, based on that individual's experience of carrying out the task (Gill & Hicks, 2006). Task cannot be examined independently of an individual's characteristics such as level of memory, degree of attention, skills, previous training or experiences. Different individuals carrying out the same task can have different experiences, therefore, the complexity experienced by the individual is influenced by the objective characteristics of the task and by subjective factors, such as familiarity with the task, assessment of knowledge, availability of tools or time (Tarhini et al., 2014). In this study, individual characteristics is operationalized as HCPS' previous experience, computer self-efficacy and ease of use/usefulness of LMS.

Previous Technology Experience: An individual's technology experience explains an individual's acquaintance to technology and the skills and proficiencies acquired by using a technology (Thompson et al., 2008). When a learner has previously used a LMS, he/she might be more comfortable using the same or similar technology again, thereby realizing its benefits in learning. A Learner's previous experience in the use of technology has an important effect on learning procedures and, subsequently, learning outcomes (Wan et al., 2007). Al-Busaidi (2009) found that Technology experience is significant on the usage of LMS in technology-associated learning, the more familiar they become to it, the more likely it is that they are going to continue using it use it for both blended learning and e-learning.

Self-efficacy: Self-efficacy can be defined as a user's self-assessment of the ability to utilize his technological skills in accomplishing a specified task or a user's judgement of judgments of their competences to arrange and accomplish courses of action essential to complete selected types of actions (Cheng, 2011). Computer self-efficacy is suggestively associated to the adoption of e-learning (Roca et al., 2006). The higher the learners' computer self-efficacy of LMS, the more likely they feel in control of the technology and anticipate use it again for learning.

Ease of Use/ Usefulness of the LMS: Perceived ease of use of the LMS is the extent to which LMS users expect the use the system requires little-to-no effort (Limayem & Cheung, 2011). When students think that using the LMS is hassle-free and easy to interact with, it builds a sense of efficacy in them (Fadel, 2012) and they are more likely to have a better learning outcome. A system user may perceive that using the system might increase their productivity and performance and as such utilize the system. This is referred to as the perceived usefulness of a system. It has been stated that there exist positive relationship between a system's perceived usefulness, students' intention to use and continued intention to use (Limayem & Cheung, 2011).

- **Contextual characteristics**

Contextual factors are environmental factors which are outside of the control of individuals. These might be materials, budget, working conditions, or socio-economic conditions which impact the performance of an individual (Hameed et al., 2016). The impact of e-learning on the performance of its users cannot be understood outside the context of cultural setting of LMS users. Models such as Technology Acceptance Model (TAM) has been used by explore the factors that determine the acceptance of e-learning (Alshare et al., 2011; Hu & Hui, 2012). Aside from the fact that most of these studies are focus on the developed world, TAM has been criticized for its lack of cultural insight because most studies did not seek to define their sample relative to their specific cultural context.

Research into the influence of user's cultural setting in their acceptance of e-learning, their satisfaction with e-learning, and if the knowledge and skills acquired through the e-learning intervention is useful in their local setting is crucial (O'Donnell et al., 2015).

Countries in Sub-Saharan Africa are characterized by erratic power supply, poor bandwidth policies, high data cost, slow internet speed and even lack of appropriately trained staff to support e-learning. Despite the benefits that technology use in education provides, the most crucial proof of technological appropriateness is cultural. This study considers factors such as language of instruction, social norm, and workplace value or relevance of e-learning as contextual factors which could enhance or inhibit learning in the African context. Contextual factors such as access to computer, availability of internet connection, bandwidth policies, data bundle affordability, and electrical power supply are factors which can induce context-based satisfaction in LMICs.

Language of Instruction: The cross-boundary nature of e-learning introduces diversity in the individual personality, background and context of learners. E-learning is not location-dependent; therefore, learners have the privilege to learn across borders. The ASC e-module was hosted on UKZN Moodle platform in South Africa and presented in English language to participants from Malawi and Mozambique. This study will assess the influence of the language of instruction on HCPs who participated in the module.

Social Norm: This study considers the effect of social norm on the Antimicrobial stewardship and conservancy in Africa module by assessing the influence of students' families, friends, and instructor's perception of the use of e-learning systems. Social Norm is the feeling that an individual has about whether the people who are important to him or her thinks he should perform a certain behavior or not (Lahti et al., 2015). Previous researches have associated social norm as an antecedent to the behavioral intention to use e-learning and perceived ease of use (Abbasi et al., 2015), however, this is still very controversial .

Quality of Work life/ Workplace value of e-learning module: This refers to the relevance of ASC module being an e-module for working organization, motivation to use skills and knowledge in daily practice. Tarhini et al. (2017) defines quality of work life as the perception of students about the fact that using technology will eventually be of benefit to HCP's place of work by improving the quality of their work-life.

This study assessed the elements that influence the adoption of e-learning by HCPs and the eventual performance of HCPs using e-learning to pinpoint factors that need to be catered for to strengthen the performance of HCPs so that the inventions presented by e-learning will translate into a sustainable Return on Investment (ROI) in medical education for developing countries.

3.3.1.1 Previous Studies on Task-Technology Fit

Several researchers have validated the task-technology fit model. For example, a study by Pentland (1989) studied a group of auditors whose utilization of personal computers had no positive impact on their task even though they were positively predisposed to utilizing these personal computers. The study found out that the personal computers were not used for the appropriate tasks, therefore, there was a task-technology misfit; a mismatch between the auditors' task requirements and the technology utilized. Where there exists a misfit of task-technology in an information system, a beautiful user interface becomes useless and will neither make up for, nor encourage the utilization of the system. This statement is supported by Keil et al. (1995), where in their study, a company launched an expert support system for its employees in the sales department. After finding out that the utilization of the system was low, due to system complexity, a new user interface was developed yet the adoption of the system for usage was still low. Based on a feedback survey, it was discovered that although the system had a user-friendly interface, there was a misfit between the tasks that the users required the system for, and the actual tasks that the system performed. Zigurs and Buckland (1998) carried out a study that used the TTF model in coordinating the features of group support systems with the demands of group tasks; Mathieson and Keil (1998) later extended the TTF model by incorporating the Technology Acceptance Model (TAM) into it.

Another important factor that cannot be overlooked in a bid to ensure task-technology fit is the cultural implications for task-technology fit. Massey et al. (2001) examined two global organizations with the aim of assessing how communication tasks are enabled by technology. The study samples were geographically dispersed across the US, Europe and Japan. It was discovered that there existed significant cultural differences in the samples'

perception of task-technology fit. They concluded that there is the possibility that technology could induce varied responses among individuals with different cultural backgrounds and this cultural perception of fit should form an important feature of task-technology fit and information system evaluation. Several other studies have been carried out using the TTF model in information systems. The TTF has also been applied to the mobile information systems (Judith & Mark, 2009; Tariq & Akter, 2011).

3.3.1.2 Task-Technology Fit Model Critique

Dishaw and Strong (1998) believes TTF model is general and hence does not address a specific task or technology. However, to operationalize the TTF model to the context of a study, a review of relevant literature can be embarked on since it has been noted by previous researchers that the TTF model should be adopted and adapted in the context of the specific task for which it is needed (Dishaw & Strong, 1998).

Critiques of the TTF model states that the theory provides very little direction as to how to define and operationalize fit for some certain instances of task and technology (Judith & Mark, 2009). To fill this gap in literature, this study operationalizes fit using the Kirkpatrick evaluation model as a framework to measure the individual and Organizational performances of healthcare professionals who took the e-learning module.

3.3.2 Kirkpatrick's Evaluation Model

The Kirkpatrick's evaluation model (Kirkpatrick, 1996 (b); Kirkpatrick & Kirkpatrick, 2006) shall be used as one of the theoretical framework of the study. Figure 3.1 shows the Kirkpatrick model which has four levels of evaluation of a training program. These are reaction, learning, behavior and result.

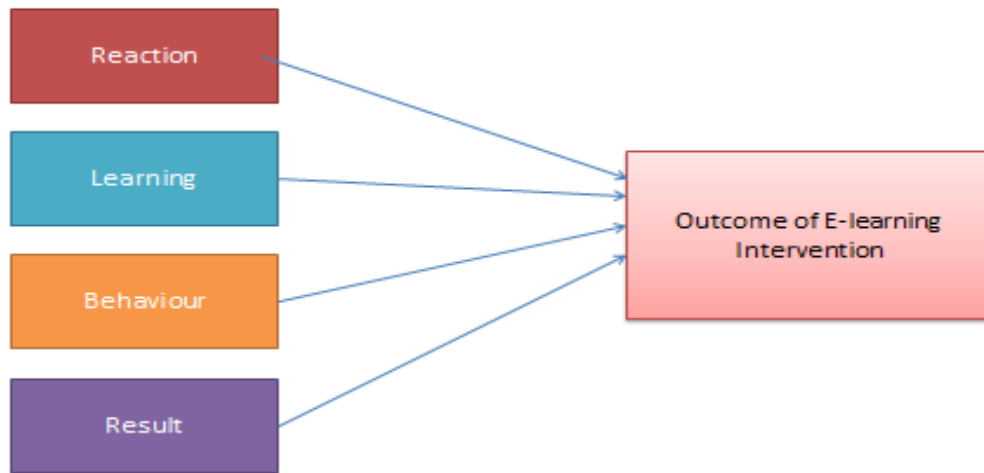


Figure 3.2: Kirkpatrick's Evaluation Model

(Kirkpatrick, 1996 (b); Kirkpatrick & Kirkpatrick, 2006)

Reaction and learning is used to operationalize the individual level while behavior and result is used to operationalize organizational level performance construct of the Task-Technology Fit Model. Kirkpatrick's four level evaluation framework has been used substantially since it was first published, and it has quickly become a typical model for evaluating training programmes. Recently, Lahti (2014) employed the Kirkpatrick model to assess an e-learning module "Coercion Practices in Psychiatric Nursing". Table 3.2 shows the summary of definition of Kirkpatrick's constructs adapted for this study

Levels	Construct	What to measure
1	Reaction	<ul style="list-style-type: none"> • HCP's Satisfaction with the e-learning module • Utility judgement
2	Learning	<ul style="list-style-type: none"> • Enhanced knowledge and skills of HCPs because of their participation in the e-learning module

3	Behavior	<ul style="list-style-type: none"> • Knowledge transfer from e-learning to daily practice from HCPs' point of view
4	Results	<ul style="list-style-type: none"> • Advantages or disadvantages of the e-learning module to HCPs' work Organization from HCPs point of view

Table 3.2: Definition of Kirkpatrick's Evaluation Model Constructs

(Lahti, 2014)(pp. 28, 29) adapted to the context of the study

- **Reaction**

Reaction describes students' satisfaction or how well students like the training (Kirkpatrick, 1996 (a)). This is to examine students' perception of the programme. It is noted that if students are favorably disposed to the programme, they will learn from it (Kirkpatrick & Kirkpatrick, 2006). It is important to ensure that honest responses to student's reactions to the learning programme is measured. In many literatures, Satisfaction has been used in place of reaction. Cook et al. (2008) showed that the statistical significance of HCPs' satisfaction with e-learning is low and that HCPs favor short, high quality studies and courses over on-going ones.

Sears et al. (2008) highlighted that HCPs liked the interactivity of e-learning and are satisfied on the overall. MacDonald and Walton (2007) indicates that e-learning had the ability to increase turnover of HCPs evident in the 20% employee turnover in the year of the e-learning programme implementation compared to the year before. Connolly et al. (2007) reported that students' satisfaction with e-learning will result in recommending it to others. User Satisfaction is the users' approval of a system arising from the feeling of fulfilment from using the system. Satisfaction in e-learning is a reflection of the value which tertiary institution students attach their learning experiences. Al-Samarraie, Teng, et al. (2017) opined that the level of satisfaction of students with an e-learning system could further affect the overall level of their university experience. Student satisfaction with e-learning systems is a strong determinant of the success of the e-learning system.

There are quite a few e-learning systems that have been discontinued shortly after their implementation (Sun & Jeyaraj, 2013). Various factors in e-learning are capable of influencing the level of satisfaction of students. McGill et al. (2014) discovered that a substantial number of discontinued learning initiatives and investigated and addressed users' satisfaction with e-learning sustainability conditions for continued and non-continued initiatives. They concluded that it is important for technology to be up to date but stable for sustainable e-learning initiatives. User satisfaction of e-learning system can be measured by the user's post evaluation of the training and is a major determinant of the success of e-learning systems.

Al-Samarraie, Teng, et al. (2017) conducted a systematic review of literature to identify the possible forecasters of e-learning continuance satisfaction in higher institutions and identified several factors which could continually influence e-learning system users some of which are utility value, information quality, system quality, ease of use, social influence, and most importantly, task-technology fit. Using the fuzzy DEMATEL approach, the causal relationship between these factors was investigated based on unified causal relation diagram. It was discovered that information quality, task-technology fit, system quality, utility value and usefulness were perceived as the core factors which determine the continual satisfaction of e-learning system users in higher institutions. The quality of information in information systems is measured by semantic success such as timeliness, relevance and the consistency of the information provided by the system, the higher the level of information quality of an information system, the greater the level of satisfaction of the system users (Ghasemaghaei & Hassanein, 2015). Al-Samarraie, Teng, et al. (2017) discovered that information quality rated highest among the core factors which determine users' satisfaction with the e-learning system.

- **Learning**

Learning is used to describe the principles, facts and values that students acquired from the programme (Lahti, 2014). This also include the knowledge, skills and attitudes (Kirkpatrick & Kirkpatrick, 2006; Hamtini, 2008). This can be achieved by measuring new level of knowledge of students towards the subject matter, the skills improved upon and attitudes that were changed. Student's acquisition of knowledge precedes their ability to use the knowledge and skills in relevant situations, therefore it is very key to measure

the level of learning. E-learning increases knowledge, skills, and attitudes of HCPs (Feng et al., 2013). Lu and Li (2009) showed that the skills acquired through e-learning compared to a control group was higher.

Learning also refers to the knowledge gained or skilled acquired by an Individual because of participating in an e-learning intervention. An individual's knowledge of the task to be carried out and technology to be used for carrying out such task plays an important factor in the eventual performance of such individual. Bravo et al. (2015) defines an individual's knowledge of task as the level of understanding of an individual about the requirements of a task and the processes involved in carrying out the task and hypothesized that individual performance is directly proportionate to individual knowledge of task.

- **Behavior**

Behavior refers to the level of skills and knowledge that students acquired relative to the extent to which such knowledge and skills have been utilized in relevant situations. It measures if students have been able to act on the skills and knowledge they acquired through a training intervention a programme (Lahti et al., 2014). Behavior can also be defined as the level of knowledge transfer from theoretical perspectives to practical workplace perspectives (Kirkpatrick & Kirkpatrick, 2006; Hamtini, 2008). For learning transfer to take place, there needs to be opportunity created for students to transfer the knowledge and skills they have acquired (Kirkpatrick & Kirkpatrick, 2006; Hamtini, 2008). Where necessary, Kirkpatrick suggests pre-training and post-training evaluation of behavior and recommends different measurements such as surveys and interviews (Al-Samarraie, Teng, et al., 2017).

Most Literatures describe Behavior as knowledge transfer to clinical practice after participating in an e-learning course. Curran and Fleet (2005) reported the performance of HCPs improved as a result of a change in their behavior after participating in an e-learning course. Cook et al. (2008) investigated the changes in patient care practices of HCPs as a result of change in their behavior and found that the results were more in favor of e-learning compare to other methods of learning. Sears et al. (2008) confirmed that almost 60% of his study participants reported that they were able to transfer their

knowledge from an e-learning course into practice, Gruson et al. (2013) noted that e-learning efficiently assist in the transfer of knowledge to daily practices while Feng et al. (2013) showed that e-learning has the potential to improve performance in all participants especially in medical education.

- **Results**

Results is used to describe student's organization's expectation of the training programme. It describes what exactly the organization expects as the end result benefit of the training intervention (Kirkpatrick & Kirkpatrick, 2006). This may be enhanced productivity, cost reduction, or sustainable advantages. There needs to be proper alignment between the goals and objectives of the training programme and the eventual outcome of the programme for a training programme to be described as successful. The impact of e-learning organizations can be determined by comparing the actual outputs of a training to the pre-defined objectives. Not so many literatures are available on the impact of e-learning on patients (Cook et al., 2008). Curran and Fleet (2005) found that most studies did not go to the level four evaluation of e-learning going through 86 studies which evaluated e-learning. One review evaluated patient health outcome together with behavior (Cook et al., 2008) however, it is high time the scope of evaluation turned from reaction, learning and behavior to the final outcome evaluation of e-learning such that the benefits are not only considered from the participants' perspectives, but also from stakeholders and organizations' perspectives.

3.3.2.1 Critique of the Kirkpatrick's Model

As much as the Kirkpatrick's model has been largely used in training program evaluation, there are critiques of the model. For instance Sufflebeam (2001) in his evaluation and narrative of 22 models of program evaluation does not reference Kirkpatrick. Critique of the Kirkpatrick's model also point to the fact that the Kirkpatrick framework is usually referred to as model while it does not meet the usual benchmarks for a model. Holton (1996) shares this opinion and hence proposed a new model that he feels met criteria for a model. However, this study uses the Kirkpatrick model to explain the performance construct of the TTF framework because the constructs of Kirkpatrick model has the capability to explain both process-based outcomes and outcome-based outcomes of e-learning in medical education.

3.4 CONCEPTUAL FRAMEWORK

This study combines the TTF model with the Kirkpatrick's evaluation model using the TTF framework to serve as antecedents to the Kirkpatrick model. Figure 3.3 presents the fusion of TTF and Kirkpatrick model to form the conceptual framework of this study. The conceptual framework hypothesizes that the TTF perception of HCPs about the e-learning module, relative to their individual and contextual characteristics will influence their performance at the individual and organizational level.

The role of the TTF model is to present context-related factors which could impact the outcomes of e-learning in medical education while the role of the Kirkpatrick model is to present factors which can be assessed to determine both the individual (process-based) and the organizational (outcome-based) outcomes of e-learning in medical education.

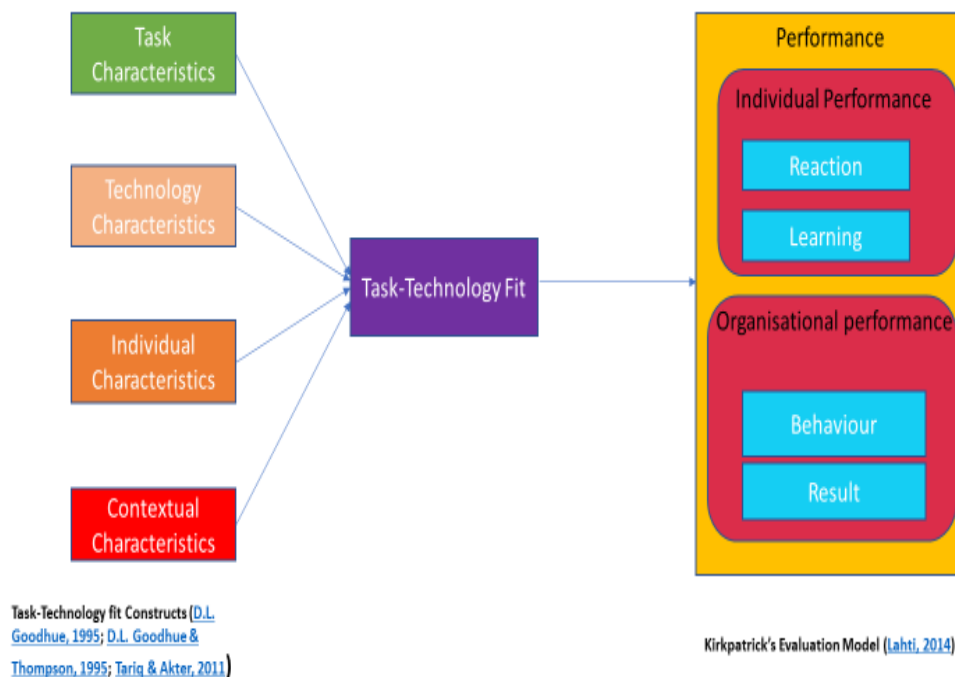


Figure 3.3: Conceptual Framework

(Kirkpatrick, 1994; Goodhue, 1995; Tariq & Akter, 2011)

Utilization is not considered as a construct in the conceptual framework since utilization of the e-learning technology in this context is mandatory and not by choice because the module is a pure e-learning module.

3.4.1 Application of Conceptual Framework to the study

This study assessed the influence of e-learning on the performance of HCPs using the conceptual framework developed by infusing Kirkpatrick's model into task-technology fit framework. The four constructs of TTF framework were used to inform the four research questions and objectives of the study. To establish how each of the four TTF constructs influence performance in medical e-learning, the four constructs of Kirkpatrick's model were used to conceptualize performance. Reaction and learning were used to determine individual level performance relative to all four TTF constructs, while Behavior and Results were used to establish organizational level performance.

3.5 SUMMARY

This chapter presented the theoretical framework underpinning the study. The chapter began with an overview of performance, following which task technology fit framework was discussed with focus on the constructs which are considered for this study. Next, Kirkpatrick model was considered after which the contextual framework for the study was discussed.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 INTRODUCTION

This study assessed the influence of e-learning on the performance of Healthcare Professionals who took an online module at the University of KwaZulu-Natal Westville campus. This chapter presents the research methodology which underpin the study. The research design, methodology, study site, population, target population, sampling methods, and the sample size are presented. Also, the chapter presents data collection instrument, data analysis technique used and ethical principles that guided the study and then the summary.

4.2 RESEARCH PARADIGMS

A paradigm is fundamentally described as a worldview, framework of beliefs, values and methods within which researchers work. Creswell (2013) states that research paradigm could be used to refer to an array of philosophy, opinions, values and conventions which is shared by a group of researchers with regards to the nature and conduct of research. Research paradigm can be categorized into three, which are positivism, interpretivism and critical postmodernism (Saunders, 2011).

This study adopted the interpretivism research paradigm. Saunders et al. (2009) stresses that the purpose of the interpretive approach in information science is to create an understanding of the context and the process whereby information science influences and is influenced by the context. This paradigm is reinforced by the collection of information about events and deduction of meaning from such information. Myers (2009) debates that principle of interpretivism is that admittance to actuality is only through social constructions such as language consciousness and shared meanings. This paradigm does not perceive reality as neutral and autonomous, but as constructed through communication and interaction over an extended period. Qualitative research favors detailed communication and interaction so that knowledge is gleaned about reality. Within this paradigm, questions are answered and mysteries unraveled through in-depth

dialogue and engagement between the researcher and the researched, findings are however interpreted subject to the opinion of the researcher (Saunders et al., 2009).

This paradigm seems most suitable for this study because it focuses on the experience of Healthcare Professionals with e-learning which could only be gathered through conversational interaction through in-depth interviews, which is later interpreted by the researcher. Moreover, this study approached the assessment of the influence of e-learning in medical education from the perspective of the fact the evidences of suitability or otherwise of e-learning in medical education in Africa need to be presented. This is to add to the body of evidence that exist concerning the potentials of e-learning to combat the high burden of disease in South Africa and other sub-Saharan African countries. Thus, this rigorous and in-depth exploration is accommodated within the interpretivist paradigm.

4.3 RESEARCH APPROACH

Myers (2009) described the research method as an approach of investigation, which translates from causal assumptions to research design, and data collection. Research methodology is categorized into three broad groupings; quantitative, qualitative, and mixed methods research. Quantitative research collects data using questionnaires, surveys and experiments. This data is revised and tabulated in numbers and statistically analyzed (Hittleman & Simon, 1997). According to Domegan and Fleming (2007, p. 24), “Qualitative research aims to explore and to discover issues about the problem on hand, because very little is known about the problem. There is usually uncertainty about dimensions and characteristics of problem, while mixed method research makes use of the combination of both quantitative and qualitative methods.

A qualitative research approach was used in this study to ensure a detailed analysis so that an in-depth understanding of the performance impact of e-learning in medical education; both on individual and organizational level; was provided. The qualitative research approach helped the researcher comprehend and understand the influence of the e-learning module on HCPs relative to the social and cultural contexts in which they live This according to Myers (2009) is a major aim of qualitative research. The focus of this study was to assess the influence of e-learning on the performance of HCPS in South

Africa. This is to establish if e-learning could be used as a tool to strengthen the capacity of HCPs to combat the burden of diseases in South Africa.

4.4 RESEARCH DESIGN

A research design is a map for getting from here to there; from the initial set of questions to be answered and to set of answers to such questions (Yin, 2009). This study will employ the use of case study research design. According to Yin (2009) a case study design should be considered when the emphasis of the study is to answer “how” and “why” questions, you cannot manipulate the behavior of those involved in the study, you want to cover contextual conditions because you believe they are relevant to the phenomenon under study, or the boundaries are not clear between the phenomenon and context. This study assessed the influence of e-learning on the performance of Healthcare professionals in South Africa. The case study design ensured that the factors that influence the outcome of e-learning in medical education, within South African context, were understood.

This design was chosen because it is a suitable methodology when a comprehensive and in-depth investigation is needed on a subject. This is necessary as review of literatures reveal that there are very few studies showing the organizational performance influence of e-learning in health education in South Africa.

4.5 STUDY SITE

The study site has been described as the physical place where the study is to be conducted so as to collect the desired data (Mutinta, 2014). In this study, the study site was University of KwaZulu-Natal (UKZN), Westville Campus in Durban. UKZN Westville campus was selected as the study site although the module being studied is an e-learning module; the department hosting the module is the Pharmaceutical department, UKZN Westville in collaboration with NORHED. The module is hosted on the UKZN LMS popularly referred to as Learn@UKZN, supported on the open source Moodle platform.

The researcher met with the principal investigator (PI) of the NORHED programme; Professor Sabiyah Essack who is the Dean of Pharmaceutical Sciences on the 27th July

2015. The study aim was presented, and consent sought to use the Antimicrobial Stewardship and conservation in Africa module as a case study. The PI gave consent for use of the module for this study, confirmed in an email on the 3rd of August 2015. The University provided access to the module online platform on the UKZN Moodle site, after the consent of Professor Essack was obtained. The Antimicrobial stewardship and conservancy module ran in semester 1 2015.

4.6 TARGET POPULATION

Trochim (2006) defines a target population as the aggregation of units or people with specific characteristics the researcher is interested in. The study used the participants of the “Antimicrobial Stewardship and Conservation in Africa” module; a pure e-learning module developed for the NORHED project for Masters students in the discipline of Pharmaceutical Studies. The participants of the module; nine in total; geographically dispersed in Malawi and Mozambique formed the target population for the study.

4.6.1 Sample

Tabachnick and Fidell (2007) describe a sample as a subset of the entire population from which data is to be collected by the researcher. The sample for this study were all the participants (9) of the Antimicrobial Stewardship and Conservation module for the 2015 class. All the participants of the module are geographically located in Malawi and Mozambique.

4.6.2 Sampling method

This study used census sampling to select the samples of the participants of the module. Census sampling is a method where a researcher selects all the units in a given group (Sprague, 2005). Census sampling was used as the method for selecting samples of the module participants because the detailed opinion of all the participants were needed.

4.6.3 Sampling and sample size

According to Yin (2009), sampling is a process of selecting a small portion or part of the population to represent the entire or target population while a sample size is the total number of units or people selected to participate in the study. For this study, the

Antimicrobial Stewardship and Conservancy in Africa module participants (9) were selected. All the participants were selected using census sampling method as they were believed to be key factor and major role-player in the study.

4.7 DATA COLLECTION INSTRUMENTS

Data is defined as information collected in the process of research while data collection instruments refer to devices used to collect data (Strauss and Corbin, 1998). This study used semi-structured in-depth interviews to generate data. The researcher viewed it as strategic to use this technique to collect different data useful to the research project. The main reason for choosing this research instruments was that it agrees with the research methodology and designs selected for the study, and effectively enabled the researcher to have access to participants' views or experiences of the research problem.

4.7.1 Semi-structured in-depth interviews

Interviews are methods of data collection, which offer the interviewer the liberty to trail some particular issues, which are of concern and may lead to constructive recommendations (Shneiderman & Plaisant, 2005). Using the interview method of data collection, the interviewer is able to directly contact the participants, which ensures that specific opinions and suggestions are obtained even though few participants are needed to obtain in-depth, thorough and comprehensive data (Shneiderman & Plaisant, 2005). To realise the objectives of this study, semi-structured in-depth interview was used due to the many inherent qualities, including collecting rich data and allowing research participants to be free when answering research questions. In addition, they allowed interviewees to share their own experiences not influenced by any answers. The other quality that justified the choice of semi-structured in-depth interviews is the possibility to compare across research interviews due to the fact that some research questions used were standard (Rubin, 2008).

The main reason of using semi-structured in-depth interviews was to allow the collection of both focused and rich data. Also, the researcher used the semi-structured in-depth interview to clarify aspects which were confusing from the study. This is especially beneficial given the geographical variation of the study participant.

To allow in-depth data collection, interview questions were given to respondents a week before the in-depth interviews to ensure that they have enough time to reflect on the questions for richer responses. The participants were interviewed via skype because of their geographical locations.

The interview schedule was sectioned into two. Section 1 asked questions concerning the demographic information of participants while section 2 presented a brief introduction to the study and presented four main questions according to the themes of the study; the influence of task characteristics, technology characteristics, individual characteristics and contextual characteristics on the performance of Healthcare Professionals.

4.8 DATA QUALITY CONTROL

Data quality control in qualitative studies can be enforced by ensuring credibility transferability, dependability and conformity (Cohen & Crabtree, 2006). The trustworthiness of this study was established by ensuring high level of credibility and objectivity. To ascertain the dependability of this study, the instruments designed for data collection were sent to the Dean of pharmaceutical sciences who is also the Principal Investigator of the NORHED programme. The alignment between the instrument design and the ASC Module learning outcomes and expectations was established by the Dean after which the instruments were sent to qualitative research specialist employed by the University to assess the quality of the instruments.

To ensure trustworthiness of the study, Validity, objectivity and reliability are crucial measures in qualitative research (Schreier, 2012). The principles of objectivity entail that the interpretations and findings of a study is the same no matter who carries out the study. To ensure high trustworthiness, this study followed the four criteria suggested by Krefting (1991) which are truth value, applicability, consistency and neutrality. The truth value of this research was established by ensuring the credibility of the study, which entails that the study identified recurrent pattern in the data which can be accurately recognized and confirmed. Applicability was ascertained by embedding transferability which entails that the findings of the study could be applicable in similar situation. The researcher eliminated bias from this study by making sure she dissociated herself and her emotions

from the data and methods of the study, thus, ensuring that she could demonstrate how the interpretation and findings of the study were reached (Mauthner & Doucet, 2003).

4.9 DATA ANALYSIS

According to Creswell (2012), data analysis is the art of examining raw data with the aim of drawing conclusions about that information. Data collected via semi-structured in-depth interview was analysed using thematic analysis. Thematic analysis according to Braun and Clarke (2006) recognises, assesses, and describes patterns within data. This method was deemed suitable for the analysis of data collected through semi-structured in-depth interviews because the technique succinctly arranges collected data and describes the data sets in detail.

This study analysed data from the semi-structured in-depth interview by applying six guidelines prescribed by Braun and Clarke (2006); these include familiarization with the data, coding, searching for themes, reviewing themes, defining and renaming themes and writing up. The researcher familiarized herself with the data by listening to and transcribing recorded audio from the interview, reading the transcript and immersing herself in the data from the interview. After being familiar with the data, the researcher identified meaningful and interesting data which formed the initial codes. The researcher then searched for themes by extracting and sorting relevant codes and indicating the relationship between codes. Next, the researcher redefined and renamed themes and subthemes, eliminated redundancies and repetitions, and identified new themes from participants' discussions and suggestions. Four themes were identified from this study which related to the main framework (Task-Technology Fit) of the study and four subthemes were identified under each theme according to the sub-framework (Kirkpatrick's Evaluation Model) of the study and by thoroughly considering previous literatures on the subject matter. Finally, the researcher produced report on the themes and related the extracted themes to the research questions and objectives of the study while validating the analysis by presenting empirical evidences that support and or oppose the findings of this study.

4.10 ETHICAL CONSIDERATIONS

Ethical approval for this research was obtained from the University of KwaZulu-Natal Ethics Committee. A gate keeper's letter was requested from the Office of the Registrar at the University of KwaZulu-Natal after formal permission was granted by the module coordinator/ PI for the NORHED project, Prof Fatima Suleman. The researcher ensured that the rights, values and needs of the respondents are respected by seeking the informed consent of the respondents, affirming to them that the study will pose no harm or risk to any participant and assuring them that the researcher will be truthful and honest in presenting the data.

Respondents' human dignity was upheld by the researcher seeking informed consent from respondents and allowing them to make the decision to participate based on adequate information about the study they will be provided. Privacy and confidentiality was upheld by reminding participants of their right to keep certain information about themselves private and an agreement to limited access to private information. Respondents remained anonymous and no names except pseudonyms was used in this study.

4.11 LIMITATIONS OF THE STUDY

The major limitation of this study was a lack of prior research studies on the organizational implication of e-learning on the performance of HCPs in South Africa. Citing prior research studies forms the basis of the literature review and helps lay a foundation for understanding the research problem being investigated. To address this limitation, the research was conducted as exploratory and descriptive rather than as explanatory research design. Another limitation was the study sample which was not large enough. Several organizations were approached to enquire about their use of e-learning in medical education but it was discovered that most organizations were still in the implementation phase of deploying a full e-learning system for medical education. This study made use of the UKZN-NORHED where HCPs participated in a full e-learning module because it was the only organization that could be accessed as at the time of the study.

4.12 SUMMARY

This chapter presented the research methodology which underpin the study. The research design, research approach and paradigm, study site, target population, sampling methods, and the sample size were also presented. The chapter further presented data collection instruments and analysis techniques, ethical measures that guided the study and the summary.

CHAPTER FIVE

DATA PRESENTATION

5.1 INTRODUCTION

Chapter four discussed the research methodology underpinning this research. This chapter presents and discusses the empirical findings of data collected from the in-depth interview. Data presentation and analysis in this chapter is divided into four sections. The first section deals with the first theme which is the influence of the task characteristics of the e-module; Antimicrobial Stewardship and Conservancy on the performance of Healthcare Professionals. The section presents data regarding the influence of the characteristics of the Learning Management System; UKZN Moodle on the performance of HCPs. The third section presents data on the influence of the individual characteristics of HCPs on their performance and the fourth section presents data on the influence of the contextual characteristics of HCP on their performance. After which is the summary of the chapter.

5.2 SPECIFIC OBJECTIVES OF THE STUDY

- To understand the influence of task characteristics of the Antimicrobial Stewardship and Conservancy (ASC) on the performance of HCPs.
- To understand how the technology characteristics of the Antimicrobial Stewardship and Conservancy module influence the performance of HCPs.
- To determine to what extent the individual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module.
- To ascertain how the contextual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module.

5.3 SUMMARY OF THE RESEARCH PROCESS FOLLOWED

Before the commencement of the study, the researcher met with the principal investigator (PI) of the NORHED programme; Professor Sabiyah Essack who is the Dean of Pharmaceutical Sciences. The study aim was presented, and consent sought to use the Antimicrobial Stewardship and conservation in Africa module as a case study. The PI gave consent for use of the module for this study. The university provided access to the

module online platform on the UKZN Moodle site, after the consent of Professor Essack was obtained. The Antimicrobial stewardship and conservancy module ran in semester 1 2015.

The researcher sought and obtained the gatekeeper's permission and ethical clearance approval from the University of KwaZulu-Natal, Westville campus to conduct the study. The researcher then mailed the gatekeeper's approval letter, ethical clearance approval letter and the interview schedule to the NORHED PIs in South Africa. The NORHED PIs contacted the module support staff Ms. Kathy Murrell and Dr. Lyn and instructed them to contact the PIs for Malawi and Mozambique for permission to contact HCPs who took the ASC module and to introduce the researcher and the research intentions to them and request for their consent. HCPs were forwarded the ethical clearance approval letter, the gatekeeper's letter, the informed consent form and the interview schedule. HCPs who consented to participate in the semi-structured in-depth interview were connected to the researcher via email and the researcher collected their signed informed consent before proceeding with the interview one week after the HCPs received all necessary documents.

The interviews were in-depth with each lasting an average of one hour. Data were collected on different themes using the main research questions. Data presentation is a research process of revealing information collected in the field in a thoroughly and accurate manner to tell a story emanating from the study. Data presentation in this study is based on the four research objectives of the study by thoroughly assessing the influence of the ASC module on the performance of HCPs who took the module.

5.4 DATA PRESENTATION

This section presents the findings of the study from the semi-structured in-depth interviews conducted with seven healthcare professionals who took the ASC e-module. Findings from the study are presented in four sections relative to the four objectives of the study.

5.4.1 Influence of task characteristics of antimicrobial stewardship and conservancy module on the performance of healthcare professionals.

The first objective of the study was to understand the influence of the tasks carried out by HCPs who took the ASC e-module on their performance. To achieve this, the four constructs from Kirkpatrick's model were used to measure participants' Reaction (which is their perception of, and satisfaction with the e-learning module task), Learning (how the task they engaged in, helped HCPs to acquire Knowledge and skills), Behavior (how the skills acquired from learning tasks reflected in their clinical practices and were utilized in their work places), and Results (whether the skills acquired and utilized in their workplace had an impact on their work organizations). The reaction and learning constructs helped to understand the influence of the e-module on the individual performance of HCPs while the behavior and result constructs helped to understand the influence of the e-module on the organizational performance of HCPs.

5.4.1.1 Reaction

To understand the influence of task characteristics of the e-module on the individual performance of HCPs, the first construct of the Kirkpatrick Model was used to ask questions about their satisfaction with the e-module tasks, weekly study materials, the discussion forum and if the module met their expectation.

Satisfaction with ASC e-module task

Participants were asked to describe their perception of the task (study activities) they carried out for the ASC Module. They were asked to state if they were satisfied with the module, one participant stated that:

“Yes, I was satisfied with the module!” (Interview 1, 2017).

The participant when asked to describe her level of satisfaction with the module stated that:

“I was very satisfied. I had limitations with the language, but the module was very clear, so I was very satisfied with the module” (interview 1, 2017).

In agreement, another participant stated that she had challenges with the language of Instruction:

“Yes, I was satisfied with the module, but it could be much better. If they improve on administrative issues. They didn’t tell us the whole course will be in English, we thought we will have all materials translated” (Interview 3, 2017).

Although all the participants were satisfied with the module and felt that the module was useful for them, data shows that their level of satisfaction differ. When asked to state their level of satisfaction, one participant had this to say:

“You can say I am 50 percent satisfied with the module, my lack of satisfaction did not have to do with the module, it is related to the fact that conflicting work interest. I had a heavy workload at work and I still needed to merge that with my studies and deadlines for assignments and quizzes” (Interview 5, 2017).

Another participant had the same view and explained how work-study pressure affected his satisfaction. He stated that:

“I am satisfied with the tasks that I carried out while taking the antimicrobial stewardship and conservancy module; the weekly materials were not too much but I had limited timeframe to work with them due to the demands of my job” (Interview 4, 2017).

Weekly study materials

Participants had study materials which they were tasked to read every week. When asked to discuss their opinion of the weekly study materials and weekly assignment data shows that most HCPs who took the ASC e-module felt that the materials were too much. This is especially since they were all working full-time, while also studying full-time.

One participant stated that:

“The weekly materials and assignments were too much! The biggest challenge was the time-frame for submission. We would get the assignment on a Sunday evening and we had to submit on Monday, meanwhile, we had to meet with the translator, so she could explain what is being required of us in Portuguese to us and help us with reading the material. The language barrier made doing assignments very tedious” (Interview 1, 2017).

Another participant shared the same opinion and stated that:

“The weekly materials were a little bit too much because we just had a week to read all the materials and do the assignment. It sometimes affected my performance but not all the time” (Interview 2, 2017).

Another participant shared this view:

“The only challenge I had with the study material was that sometimes you are given a lot of stuff to read. Considering that you have a lot of work to be done at work, it becomes a challenge. The only time I had to do it was over the weekend, and some of the courses are due on Sundays, and the others due on Mondays” (Interview 7, 2017).

Even though HCPs perceived that the learning materials were too much, data shows that they found quality in the study materials.

One participant explained the relevance of the weekly study materials:

“The weekly materials and assignments were relevant to my workplace and the workload was manageable” (Interview 5, 2017).

Discussion forum

The discussion forum on UZKN Moodle was used by HCPs to share their ideas about various subject matters relating to the e-module. This was a form of assessment in which all of them had to participate and contribute. When participants were asked about their opinion of the discussion forum.

One participant stated that:

“The discussion forum helped us to develop our communication skills and learn from the knowledge of others, so we know more” (interview 1, 2017).

This resonates well with what another participant said:

“I used the discussion board to enable interaction with other students and learnt things happening across different countries with respect to antibiotic resistance” (Interview 5, 2017).

In agreement with the facts above, one participant also state that:

“The discussion board helped, even though when questions are posted, people might not comment until two or three days afterwards, it helped me to interact with other students. It helped me to inform my colleagues about developments

regarding antibiotic resistance and the One health approach in my country”
(Interview 7, 2017).

One participant stated the advantage of using UKZN discussion forum within her group members:

“The discussion forum helped me to see how others were doing things. We will call and tell ourselves in my group and say: I see you were the first person to post the last time, next time, I will be the first. So, it fostered healthy competition among HCPs in my group” (Interview 3, 2017).

Data shows that all HCPs echoed the fact that the discussion forum helped them to interact with their colleagues across borders while learning in the process.

Expectation versus reality

Participants were asked if they felt that the e-module met their expectation. All the participants agreed that they e-module met their expectations. One participant stated that:

“Even though I had challenges with work-study balance, the module met my expectation, and even more and I was still very satisfied with the e-module. The facilitators were great too!” (Interview 5, 2017).

In agreement with the response above, another participant had this to say:

“My expectations were high! I expected that the module enlightens me on antimicrobial stewardship and conservancy on local and International levels. I can say that the module met my expectation. Although I would have loved if the lab-based aspect of Antimicrobial stewardship and conservancy was included”
(Interview 7, 2017).

This agrees with what another participant said:

“My expectation was to understand the mechanism of action of antibiotic resistant organisms. I can say that the module met my expectation 50 percent!”
(Interview 4, 2017).

Data shows that HCPs had varied but significantly related expectations for the e-module. However, they all agreed that the module met their expectations.

5.4.1.2 Learning

This section uses the second construct of the Kirkpatrick's model in asking questions which helps to understand the influence of the ASC Module task on the individual performance of HCPs in terms of the knowledge gained from the e-module. HCPs were asked questions relating to the effect of the task (learning activities) they carried out while taking the e-module. Data shows that all the HCPs who took the ASC e-module acquired varied Knowledge and skills which are relevant and valuable to their personal development.

Online Quizzes

Participants were asked to explain the impact of the e-module quizzes on their individual performance and the following responses ensued:

“The first time, the quiz was very difficult for me, but I later improved myself. I found out that it was necessary to read more to attempt the quiz, it needed more concentration and attention because the answers looked similar, eventually, I did well” (Interview 1, 2017).

Another participant in agreement stated that:

“The quizzes were like what I learnt so I was very much okay with them” (Interview 2, 2017).

This resonates well with another participant who stated that:

“The online quizzes were a good method of self-assessment. It helped me to assess my knowledge and correct myself” (Interview 5, 2017).

In alignment to this fact, another participant stated that:

“The quizzes helped to cement the knowledge which I gained from the module because the quiz was coming randomly, so it helped me conceptualize and understand the application of the thing I learnt” (Interview 7, 2017).

After reading their weekly study materials, HCPs had to attempt their online quiz which was a form of assessment. Data gathered shows that HCPs had a positive attitude towards the quizzes and found it as a solid method of acquiring knowledge and skills while also self-assessing the level of knowledge acquired and correcting their mistakes.

Feedback from Lecturers/ Facilitators

For every assessment done by HCPs while taking the ASC e-module, feedbacks were provided from their lecturers in terms of marks awarded to them. Participants were asked if they felt that the feedbacks were true reflections of their abilities and the following responses ensued:

“The feedbacks were corresponding to my effort and ability” (Interview 1, 2017).

Another participant also stated in support of the above view that:

“The feedbacks provided by the lecturers a true reflection of my abilities” (Interview 7, 2017).

Another participant who also supports this view stated that:

“I would say that the feedbacks truly reflected my efforts and abilities” (Interview 5, 2017).

On the contrary, a participant felt that the feedbacks were not always a reflection of her effort and ability. She stated that:

“Not always! The feedbacks sometimes did, but not every time. For example, once I answered my assignment in my language and used Google Translator, but the content lost its meaning and I scored way below what I expected. I am sure of this because I was confident of my work” (Interview 3, 2017).

5.4.1.3 Behavior

This section uses the third construct of the Kirkpatrick’s model in asking questions which helped to understand the influence of the ASC Module task on the organizational performance of HCPs in terms of the knowledge gained from the e-module and how the knowledge and skills were utilized in their daily clinical practices as healthcare professionals.

Knowledge and skills acquired from the ASC e-module

The study found that all the HCPs who took the ASC e-module acquired varied Knowledge and skills which are relevant and valuable to their personal development. Even though the study intended to measure learning in terms of knowledge and skills gained from the e-module which HCPs could utilize in their daily clinical practices, data shows that although all the HCPs who took the module were clinically inclined, some of

them were not currently practicing physicians. The table 5.1. show the demographic characteristics of participants regarding their work position.

Work Position	Number
Pharmacist	4
Clinical Psychologist	1
Personal Assistant to the Vice Minister of Health	1
Deputy Head of Research Ministry of Health	1

Table 5.1: Demographic data of work position of study participants

Interestingly, the study found that while all the participants acquired both clinical and research knowledge and skills, they also acquired life skills which has helped them in various ways in their working organizations.

For instance, participants had this to say about one core knowledge and skills acquired by taking the e-module:

“Taking the ASC module as a pure online module made me gain new experiences, it made me able to organize my time learn and work independently” (Interview 1, 2017).

Another participant also stated that:

“I learnt how to conduct research and the right methodology to use” (interview 4, 2017).

In agreement another participant emphasized that:

“Because the module was a pure e-learning module, I could plan my time and I had no time restriction to study, the most important skills I acquired taking the module is time management” (Interview 7).

Relevance and transfer to practice of knowledge and skills at HCPs’ workplace

The researcher asked questions to assess if the knowledge and skills acquired from the e-module tasks and learning activities were relevant, applicable and useful in their workplace.

One participant put it this way:

“I presently do not work as a pharmacist, so there has been no opportunity to demonstrate my knowledge of the task I gained from the e-module, however, because I studied and learnt on my own, I am now better self-organized and able to manage my workload at work” (Interview 1, 2017).

Another participant related a scenario where her Knowledge and skills reflected in her clinical practices:

“A doctor at my workplace wrote a prescription for a patient. He prescribed two kinds of antibiotics from the same group to the patient. From the knowledge, I gained taking the ASC e-module, I confidently contacted the doctor and told him that he had prescribed a set of antibiotics from the same group whereas he should have prescribed antibiotics from two different groups. I therefore advised him accordingly” (Interview 2, 2017).

Another participant also narrated the relevance of the knowledge and skills acquired from the ASC e-module to her work practices:

“My job is mainly administrative and not clinical. Because of the topic of my research when documents come to me, documents like to buy medicine, to make budget, I analyze the differences, I know how to prioritize, I usually give input when they are talking about antimicrobial policies” (Interview 3, 2017).

One participant stated how his knowledge and skills has reflected in his clinical practices:

“As a pharmacist, I have critically analyzed antibiotics at my place of work by looking at the antibiotics and recognize old and obsolete antibiotics which need to be phased out. I read more publications, analyzed guidelines and made recommendations on new antibiotics. Before I took the module, I did not even notice that some of the medications used in my country were obsolete” (Interview 4, 2017).

One participant narrated how he has put his knowledge and skills to use at his work organization on a national scale:

“I am in the National steering committee for antimicrobial stewardship and conservancy, I used the knowledge which I gained from the e-module for the development of National Strategic plan for Antibiotic Resistant Infections” (Interview 7, 2017).

5.4.1.4 Result

This section uses the fourth construct of the Kirkpatrick's model to ask questions which helped to understand the influence of the ASC module tasks on the organizational performance of HCPs in terms of the knowledge and skills gained from the e-module which was transferred to clinical practices and how their knowledge transfer have been of benefit in HCPs' work organizations.

Benefits of knowledge transfer to practice in HCPs' work organizations

Since participants could narrate instances where they have demonstrated the knowledge of the ASC e-module task at work, they were asked to reflect on and discuss how the change in their clinical or official practices has resulted in positive impacts to their organization. Some participants felt there has not been direct impacts but indirect impact while others felt there has been direct positive impact in their work organizations.

For instance, one participant had this to say:

“From the knowledge I gained, we are working towards the One Health approach where we organize a taskforce of people and important stakeholders who will work together for the containment of antimicrobial resistant infections. We have been having antibiotic resistant infections for so long, but it's just recently are now vigilant about it. We are now incorporating Antimicrobial stewardship conservancy in our National health research agenda as a priority area where researchers are supposed to do more research on and fill the research gaps that exist regarding antibiotic resistance in our country” (Interview 7, 2017).

Another participant also used his knowledge and skills in similar way to impact his organization. He stated that:

“With my knowledge, I organize meetings with other physicians at my workplace where I discuss the result of my research in the ASC module and its impacts on the empirical treatment so that we can formulate a plan on how to contain antibiotic resistant infections” (Interview 6, 2017).

Similarly, another participant stated that:

“I have more knowledge of bacterial containment and treatment of antibiotic resistant infections. I have made several recommendations of new antibiotics to patients in my workplace because micro-organisms have become resistant to the old antibiotics. Even though not all these recommendations were taken because

the old antibiotics sell better, I have been able to contribute my own quota” (Interview 4, 2017).

Another participant also shared similar opinion:

“Now I understand the reason for resistance and I advise patients not to stop taking their antibiotics midway just because they feel better, but to complete the course as half dose could lead to antibiotic resistance” (Interview 5 ,2017).

One participant gave context to her explanation when she stated that:

“The minister of Health spends a lot of money to try to deal with the issue of epidemics. When I started to visit the hospital for my research, I found that there is a large gap and need for the hospital to revise their policies to deal with certain situations for example the research and expenditure needed to curb epidemics and medications such as antibiotics. Also, that there is a serious problem with the list of essential medicine that has been included in the budget to fight these epidemics” (Interview 3, 2017).

5.4.2 Influence of technology characteristics of antimicrobial stewardship and conservancy module on the performance of healthcare professionals.

The second objective of the study was to understand how the technology characteristics of the ASC e-module influenced the performance of HCPs. HCPs used UKZN LMS; Moodle to enable their learning since ASC was a full online module. To achieve this objective, the four constructs from Kirkpatrick’s model were used to measure participants’ Reaction (their perception of or satisfaction with UKZN Moodle), Learning (how UKZN Moodle helped them acquire technological Knowledge and skills), Behavior (How the technological skills acquired from using UKZN Moodle to learn were utilized in their workplace), Results (whether or not the technological skills acquired by using UKZN Moodle for learning has had positive impact on their work organizations).

The reaction and learning constructs helped to understand the influence of UKZN Moodle on the individual performance of HCPs, while the behavior and result constructs helped to understand the influence of UKZN Moodle on the organizational performance of HCPs.

5.4.2.1 Reaction

To understand how UKZN Moodle technology features influenced the individual performance of HCPs, questions were asked from participants to assess their perception of, and level of satisfaction with UKZN Moodle being the Learning Management System which facilitated their ASC e-module tasks. These questions were related to participants' perception of user interface of UKZN Moodle, their access to personal computers for study, the technological issues they experienced, how they were resolved and if the technological issues affected their individual performance.

User Interface

Participants were asked to express their opinion of the user interface to assess their perception of the ease of use of Moodle. Most participants found the UKZN Moodle user interface to be user friendly.

One participant stated that:

"I think the user interface was okay. The first time I logged on, I could find my way around. Although I wouldn't say that I was an expert, but I didn't struggle that much. The facilitators sent us steps that guided us on how to log in to the module" (Interview 7,2017).

This view was supported by another participant who had this to say:

"Honestly speaking, it wasn't that difficult, I don't know maybe it's because I was oriented to use it before" (Interview 4, 2017).

However, the study found that one participant struggled initially, but settled in with time. He stated that:

"I found it tricky at the beginning, but it took two-three months to be able to master Moodle" (Interview 6,2017).

Data shows that UKZN Moodle user interface is perceived as User friendly.

Access to Personal Computer

When asked if participants had access to personal computer which they used to study. The study shows that while some HCPs had access to personal computers, some did not. A few participants said they relied on their work computers most of the time which made studying more hectic.

In precise words, one participant had this to say:

“I had a computer that time, but it wasn’t working properly, so I didn’t always have access to a personal computer” (Interview 7, 2017).

Another participant had similar opinion and stated that:

“We started the course, first they said that they will buy computers for us, but nothing happened until now! My laptop was stolen, and I used the computer of my work. It was very stressful because I had to stay in the office for hours to use the computer” (Interview 3, 2017).

Moodle-related Technical issues

Participants were asked to narrate the technical difficulties which they experience using UKZN Moodle, most participants stated that they did not have any Moodle-related technical issues. They agreed that they had a very consistent and reliable e-learning technical specialist who was always on call to assist should they require assistance. They stated that the e-learning technical specialist was “too good” and would even inform them ahead of time should there be a systems maintenance schedule in the loop which will make the system unavailable. Therefore, they had a smooth ride technically with the module.

However, one participant stated that:

“I think the only Issue I had was with the internet, it sometimes takes too long to attach a file, the internet is an international problem, NORHED tried to address the issue but it is an international problem” (Interview 7, 2017).

When asked if participants had issues while using learning facilitation media such as YouTube, most of the participants state that they had no issues.

However, one participant stated that:

“It was difficult for me to watch videos on YouTube due to slow internet connection. Downloading materials was also very difficult due to internet connection, however, Kathy was great! In fact, I have no words to describe her!” (Interview 2, 2017).

The shows that even though there were no UKZN Moodle related technical issue, participants had technical issues that were related to internet connection.

Technology-Enabled Time Management

Participant's satisfaction of the functionalities of UKZN Moodle was assessed from the viewpoint of how the ASC e-module helped them to self-manage their time.

One participant particularly stated:

“It was helpful, very helpful! Because I learnt the time to work, the time to read, I had to use my initiative” (Interview 2, 2017).

Another participant supported this fact and stated that:

“Okay, we were given the stuff to read, and given time to write the assignment and submit, most of the time I submitted the assignments, so I will say yeah, I was able to learn to manage my time” (Interview 4,2017).

5.4.2.2 Learning

To further understand the influence of UKZN Moodle on the individual performance of HCPs, it was expedient to correlate the features and functionalities provided by UKZN LMS to the features and demands of the ASC module tasks, and establish the alignment between the technology features and the task demands.

Questions were asked from participants to assess if UKZN Moodle facilitated their learning well enough. These questions were related to participants' perception of task-technology fit of UKZN Moodle, if the use of UKZN Moodle helped them to perform well in the module, the role of learning facilitation media in their performance, if and how using UKZN Moodle enhanced student-to-student interaction and if participants experience the feeling of isolation while taking the e-module.

Whereas participants' answers to all the questions asked previously were indirect pointers to the goodness or otherwise, of UKZN Moodle as a LMS suitable to enable and enhance HCPs' individual performance efficiently and effectively, the researcher asked participants directly if they felt UKZN Moodle was “good enough”.

Task-Technology Fit of UKZN Moodle

When participants were asked if they felt that Moodle was good enough to facilitate their learning, most of the participants stated that UKZN Moodle was good enough to facilitate their learning of the ASC e-module task.

One participant stated that:

“It was! Honestly speaking it was, it was!!” (interview 4, 2017).

This view was supported by another participant:

“Yes, it was, it was Okay! Even though it would have been good to have some form of exposure to the lab, it still wasn’t bad” (interview 5, 2017).

Technology-enabled individual performance

Using technology to learn, participants were asked if they performed well according to their expectations and if they could attribute their performance to the “goodness” or the functionalities of UKZN Moodle.

One participant stated that:

“Yes, I performed well! I would attribute my success to the organization of the module and to the functionalities of UKZN Moodle. I had to organize my own time well to do my assignments well” (Interview 2, 2017).

Another participant attributed his performance to the course content and stated that:

“Yes! I performed well!! I didn’t perform well because it was e-learning, it’s more because of the content of the course” (Interview 1, 2017).

However, one participant stated clearly that his performance was technology related:

“Yes, I think that I did well. Even though I was limited with time based on work schedule but I did well. My performance I can say is technology-related. You know that the materials we get them online, sometimes they go extra mile and give additional materials on YouTube, so it is technology related” (interview 7, 2017).

One participant presented a more in-depth opinion:

“Yes, I performed very well! Majorly, I will attribute my performance to the facilitators, they knew the materials and that made everything easy because the other things were just mediums of learning, but if they brought in materials that were not well researched, then performing well will be impossible. So, I will attribute it to the organization of the module. But not only that, you know there is this officer who coordinated the module, ...Kathy, that one was very excellent, you will send an email, in few minutes she will respond. You’ve got a problem, Kathy is going to respond and make sure that she is there when she is needed. So,

it's not only those that are teaching the materials but also those that are facilitating it, Kathy being one of them" (interview 5, 2017).

The study shows that even though technology enabled and facilitated HCPs' learning, they could not totally attribute their Individual performance to the task-technology fit of UKZN Moodle. While some attributed their performance to the functionality of UKZN Moodle, some attributed theirs to the course content and other to the excellence of the facilitators and support staff.

YouTube as Learning Facilitation Media

HCPs who participated in the ASC Module had to see YouTube videos as additional study materials. Questions were asked to find out the role that learning facilitation media played in their performance. The following responses ensued:

"The videos I watched on YouTube did help. Most of the time, I went to check the videos and it helped me understand the materials more" (Interview 4, 2014).

Another participant supported this stance but also stated the challenges encountered using YouTube:

"It was additional materials but relevant. One challenge I noted with us was I was supposed to watch it over again, so the cost of being online on YouTube. In the initial place, they used to compress everything and sent it in a flash that was easier. But going to research it online was not easy for me" (Interview 5, 2017).

Another participant likened watching YouTube videos to having a personal tutor and stated that:

"I remember even during the bio-statistics, there were some YouTube Videos which were sent and they made things to be easier understood. It was like now you are doing the calculation with somebody else demonstrating like you're in class, like the feel of a personal tutor. We didn't have a proper statistical package though" (Interview 7, 2017).

The study demonstrates that learning facilitation played an important role in facilitating HCPs' learning and understanding of their learning content.

Technology-enabled Student-to-student interaction

Participants were asked if they felt that UKZN Moodle enhanced student-to-student interaction. All participants stated that it did. However, while some groups had cross-cultural interaction, some groups interacted more with HCPs from their home country. Students interacted through the discussion forum on UKZN Moodle.

One participant had this to say:

“Yes, we Interacted very well, with both country colleagues and people from other countries. And it was very helpful, the information we shared were very helpful” (Interview 5, 2017).

Participants stated that they created a WhatsApp group for participating HCPs in their home country where they interacted outside of UKZN Moodle. They even initiated physical contact occasionally.

One of the participants stated that:

“I mainly interacted with the Malawian group. We could meet occasionally, we had a WhatsApp group where we update each other. The only time I Interacted with people from Mozambique was when we had our discussion forum, that’s when we can see what they are writing and then comment on their post” (Interview 7, 2017).

This study found that HCPs interacted through the discussion forum of UKZN Moodle. There were intra-cultural and inter-cultural interaction also cross-platform interaction.

Feeling of Isolation

Although HCPs interacted on the discussion forum, on WhatsApp and even meet physically occasionally with group from their home country, most of them still reported a feeling of isolation with the module being a pure online module. When asked “Did you feel isolated at any time?” One participant stated that:

“Of course! Usually, what everybody will expect is a class experience, you know that feeling of someone who has graduated from a classroom experience where the whole class sits there, you know that fun that goes in the classroom is what I missed. I missed that component of being in the classroom with friend, jokes and all that. I don’t think I will joke on the online platform” (Interview 5, 2017).

This opinion was closely shared by another participant who stated that:

“Yeah, I think sometimes yes, you don’t feel like you belong to a university that much, when you don’t know your friend, like when you don’t have face-to-face interaction with your classmates. I think that is a natural feeling where you feel isolated at some point in time. But I feel like the WhatsApp group and the discussion forum helped to bond us together” (Interview 7, 2017).

While some participants expressed Isolation in terms of not being able to physically relate, socialize and joke with their colleagues, another participant expressed isolation in terms of not being able to physically relate with their lecturers and facilitators. The participant stated that:

“Yes, it was not so much about having other students around, but having your supervisor right in front of you so that you are able to get information directly. In my group, we were all female, and in the same department so we had team spirit. We get nervous when we were given assignments because we don’t physically have our lecturer to explain to us” (Interview 1, 2017).

Participants were asked if they thought that this feeling of Isolation affected their performance, one participant had this to say:

“I think it’s just a feeling, it might be have affected my performance but I can’t really say. Because if it was face-to-face, it would be easy to ask your friends for what the lecturer has given them if you miss anything but it is difficult now that it is online. But I don’t think that it affected our learning” (Interview 7, 2017).

NEW THEMES

Weekly Skype Group Chat

The researcher took it forward to ask participants, “If you had a weekly thirty minutes group interaction on Skype where everyone registered for the module could do group video chatting, do you think that could have had influenced your learning? And this influence, is it going to be social or educational influence?” The participant responded that:

“I think that would have an effect. And it can help you to make sure that you are able to open to each other and share learning issues”. (Interview 7, 2017).

Lecturer-Student Interaction (Video Conferencing with Facilitators)

This statement introduced a new theme: Lecturer-to-student Interaction. Most of the participants stated that they would have benefitted from a group video chat with their facilitators from time to time. This they felt could create a face-to-face contact with their lecturers and reduce the nervousness and anxiety they felt each time they had an assignment.

Another participant experienced lecturer-related isolation and stated that:

“They introduced us to supervisors, they said that they will work with us, but I didn’t feel it personally, I’m telling you, I didn’t feel that they were committed with my work. However, we sat with Prof and asked her to find a supervisor here in my Country, she said OK, but in my degree, it is difficult because I couldn’t find someone to help me. Only last year I got someone to Supervise me, and things start to happen. It is very difficult and I can’t hide how difficult it was” (Interview 3, 2017).

The study found that although most HCPs experienced the feeling of isolation, some associated this feeling with the physical absence of their colleagues while some associated the feeling with the physical absence of their lecturer.

5.4.2.3 Behavior

To understand the influence of UKZN Moodle on the organizational performance of HCPs, questions were asked to assess if HCPs’ exposure to e-learning or technology-enabled learning had any influence on their organizational performance as reflected in their daily clinical practices. The questions were related to if they had the opportunity to utilize their technological skills at work and the influence of technology-enabled learning on their daily clinical practices

Opportunity to utilize technological skills at work

Participants were asked if they had the opportunity to utilize their technological skills at their place of work. One participant stated that:

“Yes, we have the Health Information system at my place of work, whereby we have DHIS (Demographic Health Information Systems). I use my technological

know-how when I'm using our HIS from time to time at work whenever I want to see the burden of a certain disease in some certain areas" (Interview 7, 2017).

Another participant closely supported this view and stated that:

"We have HIS at work, I use it because we have a site for people who do research and sometimes I comment. We have a website which gives us information about the health situation of the country. I can see what is happening in the hospitals" (Interview 3, 2017).

Another participant also stated that:

"Yes, there has been opportunities to display my technological skills at work! I am being invited to talk about my research and experience for scientific journals. It is very beneficial for me professionally because I am getting a lot of feedbacks and attentions" (Interview 2, 2017).

Influence of Technology-enabled learning on HCPs' Daily Clinical Practices

Participants were asked to reflect on how their exposure to technology on UKZN Moodle has influenced their daily clinical practices or official duties. All the participants were positive that their use of technology for learning has influenced the way they carry out their daily routines in their various working environments.

One participant had this to say:

"It helped to improve my research to search the right way, it improved my confidence. I know how to access information that is trustworthy, that is correct and that I can depend on" (Interview 2, 2017).

This resonates well with the view of another participant:

"It has helped me even in the clinicals. Sometimes I search to know more about how to treat patients, how to do Psychotherapy, I improved" (Interview 1, 2017).

In agreement, another participant stated that:

"With the module, since it was like two years of working online, it has helped me to become more conversant with technology. For example, going on the internet to search for information, interacting with people using technology, it has helped me at my work place" (Interview 7, 2017).

Another participant gave a very thorough insight into the importance and workplace relevance of technological skills acquired:

“You see, from that module and how we navigated through the system and everything, you see that even in the country, resources are limited, now we are living in a technology world where things in other settings are equally relevant, it has helped me to look at other sites and fish for relevant information, distil it and make it become relevant by adapting it into our local setting. Going through the module was very exciting and thereafter clinical wise I have learnt a lot and I’m using most of the concepts, not only about the materials but about the skills and tools I have acquired going through the system, you will see that the web-based learning tools whether in the USA or UK are all the same, so using these tools, it becomes a bonus” (interview 5, 2017).

5.4.2.4 Result

To further understand the influence of UKZN Moodle on the organizational performance of HCPs, they were asked if their exposure to e-learning or technology-enabled learning as reflected in their daily clinical practices has been of any benefit to their work organization. HCPs were probed to reflect on the way that their work organizations had benefitted from their exposure to learning technologies by learning via UKZN Moodle.

Benefits of Technological Knowledge and Skills to HCPs’ Work Organization/ Quality of work-life

When asked “In what way would you say your exposure to e-learning technology through participating in the ASC Module benefits your work organization?” One participant had this to say:

“My ability to research for content, distil and adapt it to local context has been very... very crucial and beneficial to my work organization. Things continue to change, we are not living in an isolated world, new things continue to evolve, if we are not able to research, we will use very old things to manage dynamic problems which in many cases is not the same, so that style of conceptualizing, looking at what is there and relating it to what is here, and making decisions based on that is something that has been very beneficial in my case and to other organizations where I have been asked to provide guidance for on relevant issues” (interview 5, 2017).

This resonates well with the view shared by another participant:

“Yes, I think the experience with technology has boosted my skills on how to use computer technology, it has helped me to improve my skills to get whatever I want whenever I want them by researching online like on PubMed and this has directly impacted my work organization” (Interview 7, 2017).

Another participant agrees with this stance and stated that:

“I have been able to improve my daily task at work and manage them better” (Interview 2, 2017).

Another participant in support of the findings stated that:

“My organization has benefitted from my technological skills. I have more knowledge. I have been able to use technology to research and improve my work practices. Now I can use technology to my advantage when need be in my place of work” (interview 1,2017).

However, one out of the seven participants had a different opinion and stated that:

“Taking the module as an e-learning module has no direct impact in my work. The only impact is my topic of research. It has really helped me in the way I work” (Interview 3, 2017).

The study found that taking the ASC module as a pure e-learning module has allowed HCPS to gain technological know-how and skills which has not only improved their individual performances but also their organizational performance, via change in their clinical practices and official duties and direct and indirect benefits to their work organizations.

5.4.3 Influence of individual characteristics of HCPs who took the antimicrobial stewardship and conservancy module on their performance

The third objective of this study was to determine to what extent the individual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module. Questions were asked using Kirkpatrick’s model to measure HCPs’ Reaction (perception of their personal abilities and proficiencies with the task and technology), Learning (how their personal abilities and proficiencies influenced their individual performance), Behavior (How their personal abilities and proficiencies has

impacted their organizational performance), Results (how their personal abilities and proficiencies has impacted on their work organizations).

5.4.3.1 Reaction

To determine the extent to which the individual characteristics of HCPs influenced their performance, questions were asked regarding their previous participation in pure e-learning courses, previous experience with the use of LMS, initial skills at searching and communicating online and the level of self-discipline to self-study.

Previous participation in pure e-learning courses

Data from the demographic section of the interview revealed that only two out of the nine participants had taken a pure e-learning short course before they participated in the ASC e-module.

Previous experience using LMS

To assess how skilled participants were at using LMS before taking the ASC E-module, they were asked to describe how good they were at using the LMS before they took the ASC e-module. Three (3) out of the nine participants stated that they had used LMS to learn before they registered for the ASC module. One (1) out of these participants used LMS in a blended learning situation during her first-degree years at the University. However, the remaining four participants had not use any LMS before taking the ASC e-module.

One participant stated that taking the ASC e-module improved her skills at learning online:

“Before taking the ASC e-module, I did not have any experience with e-learning courses or using LMS, but after the module my skills in using LMS improved” (Interview 1, 2017).

Searching online for Information

Only two out of the seven participants knew how to search online for information before taking the ASC e-module. The remaining five participants did not know how to use the internet to search for information. One participant stated in clear words that:

“Before, I couldn’t use the search engines to search for content that I needed” (Interview 1, 2017).

On the contrary, one of the participants stated that:

“Before I took this module, I knew how to search online for content but not as much as I do after I finished taking the ASC e-module” (Interview 5,2017).

This assertion highlights the role that the e-module played in improving the skills of HCPs in using learning facilitation media.

Self-discipline to study independently

All the participants stated that they had a level of self-discipline before taking the ASC e-module. Although they all agreed that they were self-disciplined, all of them stated that participating in the e-module has increased their level of self-discipline and their ability to work and study independently where need be. One participant particularly had this to say:

“Before the ASC, I couldn’t really organize my work and study time, but after taking the module, my ability to manage myself improved” (Interview 2, 2017).

Another participant simply stated that:

“I am a self- motivated person and I really wanted to do this” (Interview 5, 2017).

5.4.3.2 Learning

To further determine the extent to which the individual characteristics of HCPs influenced their individual performance, questions were asked to assess if participants’ previous experiences and individual proficiencies (or lack of it), had any impact on their individual performance.

Influence of Previous e-learning experience on individual performance

When participants were asked if they felt that their previous experience with pure e-learning module (or lack of it) affected their individual performance, the group that had no previous experience agreed that not having previous experience negatively affected their performance mildly. However, they affirmed that even though they struggled a little, they could eventually find their feet.

One participant stated that:

“My lack of experience affected my performance at the beginning of the course, but eventually, I picked up” (interview 1, 2017).

However, the group that had previous experience stated that their previous experience impacted their performance positively. One participant had this to say:

“Before then, I was familiar with e-learning module so because of that, it assisted me in using the UKZN Moodle and I didn’t struggle much” (Interview 4, 2017).

Influence of previous experience using LMS on Individual Performance of HCPs

Participants were asked if their previous experience using LMS or lack of it influenced their individual performance.

One participant expressed this view:

“My previous experience using LMSs helped me while studying for ASC because I didn’t have to start from the scratch learning to use the system” (Interview 2, 2017).

The researcher took the question forward by asking participants if they felt they would have performed better if the module was not an e-learning module. All the participants agreed that they would not have had a better individual performance even if the module was a traditional face-to-face module. One participant stated that:

“I don’t think I would have performed better if it was not a pure-online module” (Interview 1, 2017).

Data shows that both participants who were experienced at using LMSs and those who weren’t experienced performed well individually eventually. Even though the group with no previous experience struggled to adjust to the e-learning environment, they eventually picked up and stated that their performance would not have been better if it was in a traditional face-face setting.

Influence of HCPs’ self-discipline on their Individual performance

All the participants stated that their ability to be self-disciplined and self-motivated was of great impact to their study. One participant stated that:

“Even though before taking the module, I had a level of self-discipline, taking the module as an e-learning module helped me further to be self-disciplined. I was

able to meet the deadlines for all assessments even though there was also workplace pressure” (Interview 7, 2017).

In agreement, another participant stated that:

“You can succeed in e-learning if you are self-disciplined and focused. There are timelines for every activity and you need to meet up with them, you need a level of self-discipline to perform well. Even then, the little level of self-discipline that you have will grow when you take an e-learning module such as this, you will have to adapt and learn fast” (interview 5, 2017).

Data shows that participants perceive that self-discipline is an individual trait which is needed to enhance their individual performance in an e-learning setting.

Willingness to take another e-learning course

Participants were asked if they would like to take another e-learning course. All the participants emphatically stated that they are willing to take another e-learning course. The researcher probed further by asking the participants which aspect of the ASC e-module motivates them to want to take another e-learning module and several responses ensued:

“The aspect that motivates me to want to take another e-learning course is the ASC e-module materials, they were dynamically engaging!” (Interview 7, 2017).

Another participant stated that:

“I am self-motivated, I want to have the qualifications, e-learning makes it easier without requiring your physical presence” (Interview 4, 2017).

Another participant also said that:

“I am motivated to take another e-learning course because like I said earlier, things are changing every time, you need to keep abreast of changes in your profession and e-learning helps you to do that with ease” (Interview 5,2017).

5.4.3.3 Behavior

To determine the extent to which the individual characteristics of HCPs influenced their organizational performance, it was expedient to ask them to reflect on ways that the personality trait has impacted their practices at work.

Continuous professional development

Most participants had to take a few seconds to reflect, after asking the researcher to rephrase and paraphrase the question. All the participants could eventually state at least one way in which personality traits which they developed and used while taking the e-module has influenced their daily clinical or work practices in their work organizations.

For example, one participant had this to say:

“I now have the ability to read on my own, and not rely on anyone when I need information about anything at my work” (Interview 1, 2017).

This agrees with what another participant said:

“Now I can learn individually and independently and this has positively impacted by clinical practice because all the time I am able to improve myself individually and relate confidently with doctors concerning antibiotics” (Interview 2, 2017).

Career self-improvement, technically referred to as “Continuous Professional Development” is of vital importance in medical education. Data shows that participants now know how to continuously develop themselves using e-learning technologies.

Relationship with Superiors at work

Participants stated that taking the e-learning module has helped them to be self-managed. While taking the e-module, lecturers only facilitated learning and HCPs had to strike a work-study balance to meet up with deadlines for assessment for the module, this trait has also been beneficial in their work places.

One participant stated that:

“ Learning independently has helped me to be able to also work independently at my workplace. I am self-motivated, organized, and self-manage my time properly and can also work under pressure because I was able to manage the work-study pressure while taking the ASC e-module” (Interview 7, 2017).

This statement aligns with the view of another participant who stated that:

“Taking the e-learning module has made me to be less dependent on my superior at work. I know I can use computers to help me whenever I need assistance” (Interview 5, 2017).

Another participant with a different view said:

“No, my proficiencies have not influenced my work practices but after my research, there will be impacts” (interview 3, 2017).

5.4.3.4 Result

To determine the extent to which the individual characteristics of HCPs influenced their organizational performance participants were asked to reflect on the benefit of their individual proficiencies in their work organizations. One participant had this to say:

“My personal proficiency has reflected in my organization. I perform information search at work, I access papers and analyze papers. It has helped me not to prescribe antibiotics anyhow due to pressure from patients” (interview 7, 2017).

Another participant closely supports this view and stated that:

“It helped me to know the list of all the antibiotics, which ones we have and which ones we don’t have here in my country, which ones we can import from another country” (Interview 2, 2017).

Data gathered in this section shows that HCPs’ individual characteristics, such as their previous experience, self-efficacy and personality traits also influenced their individual and organizational performance.

5.4.4 Influence of contextual characteristics of HCP who took the antimicrobial stewardship and conservancy module on their performance

To ascertain how the contextual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module, questions were asked using Kirkpatrick’s model to measure HCPs’ Reaction (perspective of different geographical factors in their study location and other related factors which influenced their performance), Learning (how different geographical factors in their study location impacted their individual performance), Behavior (How their geographical factors impacted their ability to transfer the skills acquired to their clinical practices), Results (how their geographical location has influenced the benefit of e-learning to organizational performance).

5.4.4.1 Reaction

To assess the perspectives of participants of factors in the context of their environment which played important roles negatively or positively in their individual performance, their demographic details were taken relative to ethnicity, language, culture, education and personal lifestyle.

Nationality

Out of the 9 study participants, there were 7 HCPs who consented to be part of the study. 3 (43%) are Malawians, while 4 (57%) are Mozambicans. Even though this module is based at the University of Kwazulu-Natal, South Africa, HCPs from two different sub-Saharan countries participated in the module. This highlights one of the majorly stated advantage of e-learning's potential to ensure access to life-long learning across geographical boundaries.

Home Language

The home language for the Malawian participants is Chichewa, whereas the home language for the Mozambican participant is Portuguese.

Proficiency in Speaking English Language

Although Chichewa was the Home language of participants from Malawi, they stated that English is their official language and all of them had their formal education in English. However, the group from Mozambique stated that Portuguese is both their home language and official language, and they had all their formal education in Portuguese. They also had the expectation that the module was going to be completely translated into Portuguese and they did not perform up to their expectation until the facilitators engaged the service of a translator who sat with students and translated the course materials from English to Portuguese.

Proficiency in Writing English Language

With the ASC e-module being a pure e-learning module and with English being the language of instruction, HCPs related with the module content in writing more than they did in speaking. The Assessments were done in English language, likewise, they interacted on the discussion forum in English language.

While the group from Malawi (3) stated that they had no problem at all with the language of instruction being English, and that they would have really struggled should the content have been translated to their mother language, the group from Mozambique (4) did not share the same opinion. One participant when asked if he would have preferred if the course was presented in his local language; Chichewa stated affirmatively that:

“No! I wouldn’t have preferred if it was in my local language because in Malawi, we begin to learn English from the first day of primary school. I did my learning throughout my entire studies in English and it would have been difficult to do it in Chichewa. Why should we do you in Chichewa when we have used English throughout our formal education?” (Interview 5, 2017).

Another participant also shared the same opinion and stated that:

“No! No!! That will confuse me more!!!” (Interview 7, 2017).

All the participants from Mozambique stated that they had never taken a course where the language of instruction was fully English, therefore they struggled at the beginning of the module.

Despite this challenge, data shows that the Mozambique group were comfortable writing in English more than they were in speaking English language. One participant stated that:

“My proficiency in English language is satisfactory too because I prefer to write in English than to speak in English” (Interview 3, 2017).

Internet Connectivity

When participants were asked to explain the major challenge experienced while taking the e-learning module which had to do with the study environment, one participant stated that:

“The most challenge is internet access, sometimes, the network was not good, you’re watching a video on YouTube and they close it because the network is bad” (Interview 2,2017).

Another participant’s view also agreed with this and said:

“The major challenge that I had was internet connectivity” (Interview 4, 2017).

Evidently, all the participants had internet connectivity challenge. Interview with the fifth participant gave more details to the situation:

“Thank you so much, as I mentioned earlier, so many of the challenges that we went through taking the module were not UKZN technical problems but slow internet connection, especially when you are downloading or uploading materials. At a point, I was transferred on official assignment to a remote area because I was working on a project that required me to move across the country. When I got to some district, I couldn’t access the module” (Interview 5, 2017).

Electricity supply

The next prevalent challenge that participants had was power failure. Six out of the seven participants stated that power failure was a challenge while they were taking the e-module. This was especially so for participants from Malawi.

A participant expressed this view:

“After internet connectivity, the next major challenge I had was frequent light out” (Interview 4, 2017).

Another participant expressed the same opinion:

“I had problem with electricity. If I don’t have electricity during weekdays, I might not be bothered because those days I return from work tired. But on weekends, especially on Sundays when you are required to submit, and the due time is always 9pm, then it will pass. Once the time is past you cannot access the site until Kathy helps you after you have contacted her. There was a time that we had serious black-out and it really bothered me especially for the quiz” (Interview 5, 2017).

This view perfectly resonates with the view shared by another participant:

“Remember that I was telling you that when you wanted to take a test, you are given an hour to write the test, if anything happens, internet connectivity or lights out, the system automatically logs you out, and you start all over again. So, for power failure, I used to go to a nearby hotel to write the exams, yeah. So, we use to have black out so I use to go to the nearby hotel or anywhere where there will be no power failure” (Interview 7, 2017).

Even though participants experienced challenges with power failure, they could work around it in ways which ensured that the challenge did not inhibit their individual performance.

Other Challenges

Participant 7 stated that another challenge was limited access to online library. Participant stated that:

“One other challenge that I had was limited access to journals. You will find that you are not like prescribed to be able to use online library. We could only access those libraries because when we were students, we had access to those library by using our student log on details which sometimes were not working so that was one of the challenges” (Interview 7, 2017).

5.4.4.2 Learning

To ascertain how the contextual characteristics of HCPs influence their individual performance in the Antimicrobial Stewardship and Conservancy module, questions were asked regarding the influence of language barrier, data affordability and social norm on their individual performance.

Language Barrier

As presented in the earlier section, while the group from Malawi felt that they would have been more confused and possibly performed negatively should the module have been presented in their mother-tongue, the group from Mozambique had a totally opposite opinion.

When asked “would you have performed better if the module was presented in Portuguese, one participant responded:

“Hundred percent, if it was a Portuguese module, hundred percent!” (interview 1, 2017).

The view from another participant also conformed with this:

“The language of instruction affected my performance negatively, if it was in my language Portuguese, then I wouldn’t have had to read the materials two or three times over to understand them” (Interview 2, 2017).

The statement from another participant threw more light on the impact of language barrier on the individual performance of participants:

“My first assignment I answered in Portuguese. I understood the question, I knew the answers but I could only answer in Portuguese. Now I needed to translate to English, I copied the answer to Google and used Google translator to translate to English before submitting the assignment online. However, the assignment lost its meaning due to translation and this led to me scoring a mark below my expectation because I was sure of my answers. That is why we asked Professor Sabiya to give us a translator, we found a translator and she has been very helpful” (Interview 3, 2017).

These statements highlight the “no silver bullet” approach to e-learning, what worked in a certain geographical context might not work in another. If language barrier is not addressed in e-learning, the individual and consequently, organizational performance of participants could be hampered, leading to Learning Management System Failure; a case where LMS fails to achieve the objective for which it was designed.

Data affordability

Asked to share their opinion about another context-related factor which influenced their performance, all the participants stated that affordability of data was a major challenge.

One participant stated that:

“In my country, data bundle is expensive” (Interview 4, 2017).

This same view is shared by another participant:

“In the online module, although it required a lot of data to connect over the internet, but then data was not provided in the scholarship. If you don’t have money today, it means you cannot download your materials tomorrow. That might limit the amount of time you must work on the submission or you might not even be able to meet the deadline” (Interview 5, 2017).

Social Norm (Influence of support from lecturers, family, friends and colleagues on Individual Performance)

When asked if participants received support from family and friends, one participant stated:

“I enjoyed support from my colleagues, they were around me, they saw my frustration and they helped me. With my family, I didn’t tell them what I was going through so they didn’t know how to support me” (Interview 3, 2017).

Another participant agrees with this view and state that:

“My lecturers I think they gave me the required level of support that I needed, and my family also supported me. Their support also helped me to perform better. My friends did not really support me, they were skeptical about this type of instruction because e-learning is new in Malawi, face-to-face is the norm, so they did not really support me” (Interview 4, 2017).

Another participant explained further that:

“Yes, they did! My family supported me. Some provided data if I don’t have, sometimes I will tell them that now I have got exams, if don’t see me on Saturdays and Sundays. They knew and they gave me space when I needed space. They were very supportive and it helped my performance” (Interview 5, 2017).

This resonates well with the view shared by one other participant:

“Yes, I enjoyed the support of my family and friends, especially my husband and that helped me to perform better because my husband, know how to speak and write in English and has experience in how to do research, that really helped me. He guided me with technology when I had to do my assignments. My supervisors also supported me because they explained the terminologies used and that really helped me a lot” (Interview 6, 2017).

5.4.4.3 Behavior

To assess the influence of contextual factors on the organizational performance of HCPs, they were probed to reflect on the relevance of the ASC e-module to their work environment and to state the contextual factors which motivated them to transfer their knowledge to practice.

Workplace relevance or value of e-learning module

One participant stated that:

“The ASC module is very relevant to my work environment, very much relevant. There are several cases of antimicrobial resistant infection in my country so the

knowledge of how to choose antibiotics and clinical pathology is very crucial” (Interview 2, 2017).

Another participant stated that:

“The knowledge from the module is very relevant to my cultural setting. There are lots of antibiotic resistant infection in my country, since I gained knowledge through the module, I have exercised restraint in prescribing antibiotics just because of pressure from the patients or my colleagues. I now know organisms become resistant to antibiotics and this has helped my daily practices unlike before” (Interview 7, 2017).

One participant however has a different view and said:

“The module was not relevant in my working environment but my research was very... relevant” (Interview 1, 2017)”

Motivation to transfer knowledge to practice

Participants were asked to reflect on factors within their local environment which has motivated them to transfer their knowledge to practice. One participant stated that:

“My knowledge has motivated me to transfer. Before, I did not know what was accessible and what was not prescription-wise, but now, having a knowledge of what is accessible within my environment has inspired me to keep using my knowledge in my daily clinical practices” (interview 2, 2017).

Another participant shared a different view and stated that:

“The burden of diseases in my country motivates me to continue to use my knowledge of antibiotic stewardship and conservancy. If attention is not given to antibiotic resistance in my country, the worst could happen to much of the entire populace” (Interview 5, 2017).

Data gathered shows that motivation to transfer knowledge and skills into clinical practices could be either individual or organizational.

5.4.4.4 Result

This section assesses the overall organizational benefit of the ASC module as a purely online module to the contextual working environment of the participants.

Contextual relevance and benefit of ASC module to HCPs' work organization

Deep insights were shared by participants when asked to reflect on the benefits of the ASC module as a pure e-module to their organization.

One participant stated that:

“The advantages, one, it saves time because now you are doing two things at a time! You can work and study and not have to leave your work place. If I had to move from Malawi to UKZN to learn about this, it means other things would have suffered. So, time was one benefit. The other thing is that the program itself, the way it was organized, it allowed individual customization to say this is when I need to do this, so it gives space for other things. Another advantage of the online module over being face-to-face is that we saved money. Because although the data was an issue, but the cost of data bundle is far... far much lower than buying a ticket and booking for accommodation if we had to travel to take the module” (Interview 5, 2017).

Another participant also had this to say:

“It has helped me to study while I also work, it has boosted my confidence. This is my first time to do an online thing. I remember when I was in college as undergrads in medical school, we used to have a dashboard like the one we have on Moodle, but I wasn't that confident to use it. Lecturers used to give us PowerPoint and give us marks through that dashboard, but I didn't use to be confident, so I didn't have an interest using it. But at least now, I know that it is the way to go! We are also able to initiate relevant interactions with our colleagues without seeing them” (Interview 7, 2017).

Willingness to recommend and impacts of recommendation to other HCPs

Since participants affirmed that the module influenced their performance both at individual and organizational level, they were asked if they would recommend the module to their colleagues at work and why they would recommend the module. The responses that ensued were insightful:

“I will recommend this module to all my colleagues at work, this will help them to have good understanding on how to use and prescribe antibiotics” (Interview 2, 2017).

“If something changes with the human resource management in Mozambique, I will recommend the module to friends and colleagues” (Interview 3, 2017).

One participant gave a deeply insightful statement about the contextual benefit of ASC e-module to his colleagues, work organization, country and the Sub-Saharan African region at large:

“I will recommend it because that is one of the issues we are looking at. In sub-Saharan African countries, I think we have not implemented a lot of the policies recommended by WHO and other organizations, so I think it time that Malawi, other sub-Saharan African, and even other African countries took this issue of antimicrobial resistance very seriously. Because very soon we will have a problem in which people are going to die massively from treatable conditions. I don't want to go into details but the ease with which we treated gonorrhoea has become seriously under threat because previously we used to use single dose antibiotics but that is no longer working. Therefore, the future looks bleak in terms of antimicrobial resistant initiatives. The only available non-resistant antibiotics available has been identified I think by the US. So, for a low-income country like Malawi, we must always put in effort to ensure that we look at this issue of antimicrobial resistance with seriousness. I will always recommend it, not only to pharmacist but to all Healthcare Professionals; Doctors, Nurses, everybody should learn how this is affecting and is going to affect us soon, I will always recommend it to most of the HCPs. In other settings, there are no doctors. Most of the people available there are clinical officers, medical assistant. Those people are also relevant, we must tell them because if they don't know then there is going to be problems. If there are problems here, problems there, they send us the problems from those clinics at the central hospital. Then we that have learnt the programme, we have the knowledge, but we have got problems at hand. It is better to prevent the problem other than sweating in the central hospital to fight, treat or cure the problems that we could have prevented in the first place. I would highly recommend not only to those practicing but even those that oversee policies to make sure that they understand, at least as an elective module. Those people that are making decisions, they must know about this Antibiotic resistance” (Interview 5, 2017).

5.5 SUMMARY

This chapter presented data from the findings of this study from the semi-structured in-depth interview conducted with Healthcare Professionals who took the ASC e-module. The next chapter will present the data analysis and discussion.

CHAPTER SIX

DATA ANALYSIS AND DISCUSSION

6.1 INTRODUCTION

The previous section presented data on the influence of e-learning on the performance of HCPs who took the ASC e-module. This section discusses and interprets the findings of the study as presented above. Themes discussed include task characteristics and technology characteristics of the e-module, and the individual and contextual characteristics of HCPs and how these influenced their individual and organizational performance. The study set out to answer the questions below.

6.2 RESEARCH QUESTIONS

- What is the influence of task characteristics of the Antimicrobial Stewardship and Conservancy module on the performance of HCPs?
- How do the technology characteristics of the Antimicrobial Stewardship and Conservancy module influence the performance of HCPs?
- To what extent do individual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module?
- How do contextual characteristics of HCPs influence their performance in the Antimicrobial Stewardship and Conservancy module?

6.3 RESEARCH OBJECTIVE ONE: TO UNDERSTAND THE INFLUENCE OF TASK CHARACTERISTICS OF THE ANTIMICROBIAL STEWARDSHIP AND CONSERVANCY (ASC) ON THE PERFORMANCE OF HCPS.

This objective is subdivided into four subsections:

6.3.1 To understand HCPs' perception of the effect of the ASC module task characteristics on their reaction

The findings from this study revealed that HealthCare Professionals who took the ASC module were satisfied with the module. Some HCPs had challenges with the language

of instruction being English, however, that did not influence their level of satisfaction with the e-module. Some other HCPs who stated that they were not entirely satisfied with the e-module acknowledged that their lack of satisfaction did not have to do with the e-module but rather with the fact that they did not have enough time to concentrate on the module task and their personal work demands.

Given the work-study demand of the participants, most of them considered the weekly reading materials to be too much. Most of them stated that the only time they had to really work on the reading materials was during weekends. Despite this, the research data revealed that participants perceived the study materials as having high quality of information which is of relevance to their workplace. Participants had high expectations of the e-module and they stated that the module met their expectations. The discussion forum fostered interactivity, knowledge sharing and healthy competition among participants. Taking into consideration both positive and negative answers to the set of factors highlighted above, this study reveals that HCPs were satisfied with the e-module task and had positive perception of the task of the e-module.

In agreement, a study by Sears et al. (2008) found that HCPs who took an e-learning course liked the interactivity of e-learning and were satisfied on the overall. In agreement to this finding, previous researchers on learners' satisfaction such as Hassanzadeh et al. (2012), Ko and Ko (2012), Rubin et al. (2013) and Roh (2015) also found that the technical characteristics of LMS, educational content, and self-efficacy had a positive influence on learner's satisfaction. Also, a study by Ghasemaghaei and Hassanein (2015). Al-Samarraie, Teng, et al. (2017) support the findings in this study. The study suggests that information quality rated highest among the core factors which determine users' satisfaction with the e-learning system, the higher the level of information quality of an information system, the greater the level of satisfaction of the system users.

On the contrary, a study by Cook et al. (2008) showed that the statistical significance of HCPs' satisfaction with e-learning is low and that HCPs favor short, high quality studies and courses over on-going ones.

6.3.2 To understand HCPs' perception of the effect of the ASC module task characteristics on their learning

Findings from this study revealed that e-module task engaged in by HCPs improved their learning outcomes. The online quizzes were stated to be a good method of self-assessment and evaluation and helped HCPs to strengthen the knowledge and skills which they acquired from the e-module task while also helping them to conceptualize and understand the application of what they had learnt. The feedback from assignments and other assessments provided by course lecturers were perceived to be true reflections of HCPs performance. Factors such as language barrier which negative influenced the individual performance of HCPs were mitigated and this helped them to optimize their performance.

Data reveals that the task characteristics of the e-module positively influence their individual performance. The predefined sets of activities which HCPs had to carry out enabled them to acquire knowledge and skilled which helped them to perform up to their expectation in the module.

In agreement with the findings of this study, Boye et al. (2012) conducted a study on second year students of a Norwegian University of Science and Technology (NTNU) medical school and found that e-learning is used by most medical students and that e-learning that the use of e-learning in this medical course improved learning outcomes for intermediate range students. In agreement, Romanov and Nevgi (2007) and Botezatu et al. (2010) found in their study that e-learning intervention improves examination outcomes in students.

6.3.3 To understand HCPs' perception of the effect of the ASC module task characteristics on their behaviour

Findings from this study reveals that HCPs acquired knowledge and skills from the e-module tasks and could transfer the knowledge and skills acquired from theoretical perspectives to practical workplace perspectives.

Although this study initially focused on the influence of the knowledge and skills acquired by HCPs on their daily clinical practices, this study found that not all participating HCPs work in clinical environments. Some work as administrators while some work as health policy makers. Despite this, the research data revealed that HCPs did not only acquire clinical knowledge and skills from the module, they also acquired research skills and life skills.

They also learnt to manage their time, learn and work independently, and even work under pressure. HCPs who were practicing clinicians related incidences where they could transfer their clinical knowledge and skills into practice in their work organizations while non-clinicians related incidences where they have transferred their research and life skills knowledge into practice in their work organization.

This result of this study is similar to what Sear et al (2008) found in his study. In his study, he reported that almost 60 percent of his study participants reported that they could transfer their knowledge from an e-learning course into practice. This shows an improvement in the organizational performance of the participants.

6.3.4 To understand HCPs' perception of the effect of the ASC module task characteristics on their result

Findings from this study revealed that HCPs work organizations have realized benefits from the e-module tasks. HCPs have been able to transfer the various set of knowledge and skills acquired from the e-module into practice. Thus, they could relate how this has benefited their work organization. Some HCPs have organized taskforce of people and stakeholders who are working together for the containment of antimicrobial resistant infections, some have advised their colleagues on the classes and spectrums of antibiotics which should be phased out or recommended for patients, while some have been able to influence the national budget to focus on, prioritize and cater for antimicrobial resistant infections in their country.

Not so many literatures are available on the impact of e-learning on patients (Cook et al., 2008). Curran and Fleet (2005) found that most studies did not go to the level four evaluation of e-learning going through 86 studies which evaluated e-learning. One review

evaluated patient health outcome together with behavior (Cook et al., 2008). This study moves the scope of evaluation of e-learning outcomes from being learner-centered alone to being organization-centered by considering the benefits of the e-learning tasks on the participants, their work organizations and other stakeholders involved.

Although there are very few studies which assess the influence of e-learning on the organizational performance of the participants, a study by Curran & Fleet (2005) also agrees with the findings of this study. In the study, Curran & Fleet reported that the performance of HCPs improved because of a change in their behavior after participating in an e-learning course. E-learning also has the ability to increase employee's commitment to solve organizational challenges (Shamsul, 2016). Employee commitment is a term used by the human resource department of organizations to realize employee's performance and their commitment to the realization of the vision of the organization.

6.4 RESEARCH OBJECTIVE TWO: TO UNDERSTAND HOW THE TECHNOLOGY CHARACTERISTICS OF THE ANTIMICROBIAL STEWARDSHIP AND CONSERVANCY MODULE INFLUENCE THE PERFORMANCE OF HCPS.

This objective is also sectioned into four:

6.4.1 To investigate HCPs' perception of the effect of the ASC module technology characteristics on their reaction

HCPs used UKZN Moodle as the e-learning platform to enable their learning. Findings from this study revealed that most HCPs had positive perception of and attitude towards UKZN Moodle. They felt that UKZN Moodle has a user-friendly interface. HCPs' previous experience with e-learning and use of LMS either for blended-learning or full e-learning helped them to be familiar with the use of UKZN Moodle.

HCPs without previous experience initially struggled but eventually found their way around the system and got adapted to the system. NORHED provided training to HCPs on how to use technology for learning at the start of the program and this was stated to have helped those with experience to refresh, and those without experience to have an idea how to use the system. Access to personal computer is very key in effecting a hassle-

free e-learning program. This study found that most HCPs did not have access to personal computer and this they said introduced constraints to their study as they had to stay behind at work to use their work computers. However, they overcame this challenge, and this did not negatively impact their performance.

This study revealed that HCPs encountered no technical issue while using UKZN Moodle, they gave credit to their course technical support specialist and appraised that she was too good. They could call her at any time should they require her attention and they could be sure that she would be there. She would also always inform them ahead of technical maintenance schedule for the system. Using the UKZN Moodle LMS to learn, HCPs stated that they learnt the skills of time management, prioritizing and working under pressure due to tight assessment submission deadlines while trying to find their work-study balance.

Contrary to the findings of this study, Jafari et al. (2006) stated that participants reported that they had problem with their system's user interface. According to the study, participants stated that the interface was complicated, and the navigation system was confusing. The study by Gormley et al. (2009) also opposes the findings of this study. The study assessed undergraduate medical students' perception of the level of accessibility and attitudes towards e-learning in basic clinical skills education compared to other methods and reported that majority of students stated that they had good access to computers and internet both while on campus and while off campus. One of the challenges of the use of e-learning in medical education include high student: computer ratio, slow internet connection and digital divide between resource-constrained countries and developed countries (Williams et al., 2010).

Khasawneh et al. (2016) clarifies the opposing views of these findings and states that the benefit of each e-module might depend on the setting, subject matter, and delivery. Participants emphasized the technical stability of UKZN Moodle and the unflinching reliability of their module technical support staff and agreed that they could attribute their performance to the support of the technical support staff.

6.4.2 To investigate HCPs' perception of the effect of the ASC module technology characteristics on their learning

Findings from this study revealed that HCPs considered the features and functionalities of UKZN Moodle as “Fit” or good enough to support the tasks they had to carry out to learn the ASC module. This affirmed their satisfaction with the e-module as Task-Technology Fit has been stated as one of the major factor which affect student’s continued satisfaction with the e-learning system. Since UKZN Moodle was FIT for HCPs’ learning task, they affirmed that they performed up to their expectation in the module. Although they attributed their outstanding individual performance to factors such as excellent course organization, excellent and well-structured learning content, knowledgeable and well-grounded lecturers and facilitators, and reliable technical support structure. HCPs also acknowledged that all these would not have been possible if UKZN Moodle was not available as the medium of learning.

Consequently, the study found that LMS itself is perceived as an electronic medium of learning which can enable performance where there exists a FIT between such technology and the task for which it is intended. Technology created an enabling environment for HCPs to learn the course content, facilitated cross-cultural student-to-student interaction, collaboration and knowledge sharing, and helped HCPs acquire electronic research skills and technical skills and know-how.

This study further revealed that the technology-enabled interaction and collaboration that occurred on UKZN Moodle was not enough to alleviate the feeling of isolation among participants. Therefore, they created a WhatsApp forum where they interacted informally outside of Moodle. This HCPs stated brought them together even closer and made them interact on not too formal levels. Despite this, all HCPs stated that they still experienced the feeling of isolation and missed out on the fun, interaction and socialization that happen in the traditional face-to-face learning setting.

The feeling of isolation is not only associated with lack of physical contact with fellow students, but also lack of physical contact with the module lecturers. While some HCPs associated their feeling of isolation to the physical absence of their course mates, other associated theirs to the physical absence of their course lecturer and the inability to

consult them as needs demand. HCPs felt that a weekly video group chat with their course-mates and an occasional group or personal video chat with their course lecturers could alleviate that feeling of isolation. Nevertheless, HCPs avowed that the feeling of isolation was only a feeling and did not negatively impact their individual performance.

Al-Samarraie, Selim, et al. (2017) agrees with the findings of this study by stating that Task-Technology Fit is one of the major factor which affect students' continued satisfaction with e-learning systems. The lack of fit or alignment between the technology and individual's task would yield impaired performance. The findings of this study however are contrary to previous studies which found out that most students who use LMS limit its use more for transmitting files and lesser for collaboration and interaction online (Morgan, 2003; Black et al., 2008; Kember et al., 2010; Malikowski, 2010; Mott, 2010; Alhazmi & AbdulRahman, 2012).

6.4.3 To investigate HCPs' perception of the effect of the ASC module technology characteristics on their behaviour

Findings from this study reveals that the technology features and functionalities of UKZN Moodle assisted HCPs to acquire knowledge and skills which improved their individual and organizational performance. By learning online via UKZN Moodle, HCPs did not only acquire knowledge and skills which are related to the content of the module. They also acquired life skills such as ability to self-manage themselves and work under pressure while also acquiring technological knowledge and skills.

While most of the HCPs stated that they could not use learning technologies to search for information before taking the e-module, they affirmed that taking the e-module made them skilled in the knowledge of online research. They could search and distil information for relevance and trustworthiness online.

This study found that the technological knowledge and skills that HCPs acquired have been used in their daily clinical and work practices. Some stated that that it helped them to use the Health Information System at their work place better, some stated that they are now able to use technology to search for health-related information and update their knowledge while some stated that they are now more conversant with technology and

their confidence in using technology has been boosted. Importantly, by taking the ASC module as a pure e-learning module, HCPs have used their acquired technological skills to search for health-related information, distill and make it relevant to their local context when necessary.

Usually, the purpose of using technology in education is to search for solutions to current educational problems so that performance is improved (Alhazmi & Rahman, 2012). The study by Gruson et al. (2013) agrees with the findings of this study by stating that e-learning efficiently assist in the transfer of knowledge to daily practices while Feng et al. (2013) also supported this view by showing that e-learning has the potential to improve performance in all participants especially in medical education.

While there are very few studies which evaluates the organizational influence of e-learning in medical education, the researcher could not find any study which pay attention to the fact that using e-learning in medical education also leads to the acquisition of technological knowledge and skills which HCPs could also utilize in their daily clinical practices as much as clinical knowledge and skills. These technological skills could also assist the transfer and continuous update of clinical knowledge to practice of HCPs.

6.4.4 To investigate HCPs' perception of the effect of the ASC module technology characteristics on their result

Findings from this study reveals that HCPs' work organizations have benefited from the technological knowledge and skills which HCPs acquired by taking the ASC e-module. HCPs stated that their ability to achieve continuous professional development without necessarily being absent from their workplace is one major advance of the e-module. Also, HCPs stated that they use their technological knowledge and skills to research as new things continue to evolve in medicine. This has helped them not to manage dynamic problems with obsolete knowledge. Some also stated that they are now able to manage their daily work tasks better than they were before taking the e-module.

Evidently, e-learning helped HCPs to transfer their knowledge to clinical practices and other daily official practices while also improving their commitment to solve organizational challenges as employees.

The benefits of HCPs technological knowledge and skills to their work organization need to be explored in more details by researchers because of the non-existence of literatures in this subject. However, a study by Cook et al. (2008) supports the findings from this study. The study investigated the changes in patient care practices of HCPs because of change in their behavior and found that the results were more in favor of e-learning compare to other methods of learning. Attention needs to be paid to the quality of work-life benefits of e-learning in medical education. Tarhini et al. (2017) defines quality of work life as the perception of students about the fact that using technology will eventually be of benefit to their work by improving the quality of their work life.

6.5 RESEARCH OBJECTIVE THREE: TO DETERMINE TO WHAT EXTENT THE INDIVIDUAL CHARACTERISTICS OF HCPS INFLUENCE THEIR PERFORMANCE IN THE ANTIMICROBIAL STEWARDSHIP AND CONSERVANCY MODULE.

This section is subdivided into four:

6.5.1 To determine how the individual characteristics of HCPs' explain their reaction to the ASC module

Findings from this study shows that most HCPs who took the module had never taken a pure e-learning module neither did they use a LMS before they took the ASC e-module. Most HCPs also stated that they could not use the internet search engines to search for learning content. However, they appraised themselves as having the right level of self-discipline required to enhance their individual performance but also stated that the level of self-discipline they had initially had increased by the end of the program.

Notably, the study revealed that the course facilitators catered for HCPs' individual differences by training them on the use of LMSs for learning at the initiation of the program and this was stated to have gone a long way in creating an enabling environment for the e-module and eradicating anxiety felt by the first-timers.

The findings in this study are supported by Thompson et al. (2008) argument that an individual's technology experience explains an individual's acquaintance to technology and the skills and proficiencies acquired by using a technology. Al-Busaidi (2009) also found that Technology experience is significant on the usage of LMS in technology-associated learning, the more familiar they become to it, the more likely it is that they are going to continue using it use it for both blended learning and e-learning. A previous study also recognizes the importance of self-discipline in e-learning and affirms that lack of self-discipline towards self-directed learning from students has been identified as one of the challenges of e-learning (Nielsen 2003). Self-discipline has a cause-effect relationship with positive performance in e-learning. This study found that self-discipline is needed to perform effectively and could also grow because of taking an e-module.

6.5.2 To determine how the individual characteristics of HCPs' affect their learning in the ASC module

Findings from this study reveals that HCPs who had previous experience using LMSs felt that this helped them to get accustomed to UKZN Moodle faster and influenced their individual performance positively. Those with no previous experience felt that their lack of experience negatively influenced their individual performance initially. However, they felt that although they struggled at the beginning, they eventually got used to the system. HCPs' self-discipline and self-motivation was nevertheless found to positively influence HCPs' individual performance by helping them to achieve learning outcomes and passing the module in a way which was satisfactory relative to their initial expectations. All HCPs affirmed that they would be willing to take another e-learning course.

Interestingly, the variation in HCPs' previous technology experience did not negatively influence their perception of Task-Technology Fit of UKZN Moodle for their learning task requirements. HCPs felt that their individual performance would not have been better if the module was a traditional face-to-face module.

Wan et al. (2007) supports the findings of this study by stating that a learner's previous experience in the use of technology has an important effect on learning procedures and, subsequently, learning outcomes. Also, previous literatures agree with this study by

identifying computer self-efficacy and lack of technical know-how as one of the challenges, barriers and limitations of e-learning (Compeau & Higgins, 1995; Mishra & Koehler, 2006; Moore-Hayes, 2011). Data from this study shows that while computer self-efficacy is perceived as necessary to help LMS users acclimatize to the e-learning environment at the initial level, technical orientation and continued use of LMS help user to eventually settle to the use of the system. While some literatures stated large deficiencies in basic computer skills of students (Samuel et al., 2004; Ameh et al., 2008), some have shown that students were able to adapt quickly to technology usage irrespective of their previous knowledge and experience (Olatunji-Bello et al., 2002).

6.5.3 To determine how the individual characteristics of HCPs' affect their behaviour in the ASC module

The purpose of this section is to assess how HCPs individual trait acquired or used during the program has influenced their daily clinical practices. Findings reveal that HCPs ability to direct their own learning reflects in their work practices. Some HCPs reported that they are now capable of working independently because they learnt independently, and they can now improve themselves individually. Others stated that they can manage their time properly at work and work under pressure.

Notably, some HCPs stated that taking the ASC Moodle improved their relationship with their superiors at work because they are now less dependent on their superiors and more dependent on technology to help when the need arises.

A study by Tarhini et al. (2014) support the findings of this study by suggesting that individual digital literacy enables the use of e-learning and should be assessed when the impact of e-learning on performance is assessed. The study proposes that the level of digital literacy of an individual affects their performance. A study by Sayadi et al. (2017) supports the findings of this study. The study found individual factors was one of the six factors which affect the transfer of training into practice.

6.5.4 To determine how the individual characteristics of HCPs' affect their result in the ASC module

Findings from this study reveals that the personality skills developed from taking the e-module which has reflected in HCPs' clinical and work practices has also benefited their organizations. HCPs stated that they have brought forward their individual traits which were either developed or strengthen from taking the e-module at several times in their organization and they were confident that their organization has benefit on several occasions.

This study found that individual proficiencies of HCP also influences their perception of Task-Technology fit and consequently, their individual and organizational performance. However, this study established that individual characteristics has a weaker relationship with HCPs' perception of Task-Technology Fit compared to Task Characteristics and Technology Characteristics. This is evident as HCPs variation in previous experience and other personality factors did not reflect on their assessment of Task-Technology Fit of the e-learning system.

Sayadi et al. (2017) aligns perfectly with the findings of this study, he affirms that effective training has the potentials to compensate for deficiencies in education quality by boosting employee performance in their work organizations. A study by Blume et al. (2010) strongly supports this study. The study established positive relationships between transfer and predictors such as cognitive ability, conscientiousness, motivation, and a supportive work environment.

6.6 RESEARCH OBJECTIVE FOUR: TO ASCERTAIN HOW THE CONTEXTUAL CHARACTERISTICS OF HCPS INFLUENCE THEIR PERFORMANCE IN THE ANTIMICROBIAL STEWARDSHIP AND CONSERVANCY MODULE

This section is also divided into four:

6.6.1 To explore HCPs' perception of the effect of contextual characteristics on their reaction to the ASC module

The objective of this section is to examine factors within HCPs' cultural setting which influenced their individual performance. While HCPs who participated in the e-module are from Malawi and Mozambique, the module was Hosted on UKZN LMS Moodle.

The group from Malawi stated that their home language is Chichewa while the group from Mozambique stated that their home language is Portuguese. However, while English language is the official language in Malawi, Portuguese is the official language in Mozambique. This introduced diversity as HCPs felt that they would have been more confused if the language of instruction for the e-module was in their home language; Chichewa, since their formal education was in English language from their first grade through to their post-graduate level. Whereas, the group from Mozambique struggled with English language being the language of instruction, since Portuguese was both their home language and the formal language of instruction from first grade up until their university education. They all stated that this was their first time taking a full English program and they had expectations that the whole course material would have been translated into Portuguese to accommodate their individual diversity.

Another contextual factor which HCPs stated to have been a major challenge was internet connectivity. All HCPs stated that the internet speed was either very slow most times or not available at all depending on their location at the time of access. Electrical supply was also stated as the next major challenge. Electricity was erratic, and HCPs sometimes had to go to business locations with back-up power supply to ensure uninterrupted power supply especially when they had to attempt their quizzes. Access to digital library was also stated as one of the contextual limitations that HCPs encountered.

Ruiz et al. (2006) supports the findings from this study and states that e-learning has the potential of facilitating cross-border learning regardless of learners and instructors' location. Previous study defines social norm is the feeling that an individual has about whether the people who are important to him or her thinks he should perform a certain behavior or not (Ajzen & Fishbein, 1980). Previous research findings also align with findings from this study since they associated social norm as an antecedent to the

behavioral intention to use e-learning and perceived ease of use (Venkatesh & Davis, 2000; Venkatesh et al., 2003; Abbasi et al., 2015).

6.6.2 To explore HCPs' perception of the effect of contextual characteristics on their learning of the ASC module

Findings from this study reveals that language barrier was a major contextual limitation which negatively influenced the individual performance of Portuguese speaking HCPs. They all stated that they could not cope initially when they first started the program. One HCPs stated that she answered her first assignment in Portuguese and used Google translator to translate it to English language, the assignment lost its meaning and she scored a mark which was not representative of her ability and hard-work. This implies that for e-learning to enhance both individual and organizational performance, it must cater for, or be adapted to learners' contextual characteristics.

The ASC course facilitators however catered for this contextual diversity by paying for the Portuguese speaking students to take English courses. HCPs affirmed that this was truly helpful. After this, NORHED enlisted the service of a translator who worked with the Mozambique group on individual and group levels. This was affirmed to have totally eradicated the barrier created by the language of instruction.

Countries in sub-Saharan Africa suffer from erratic power supply, however, HCPs found their way around this challenge and it did not negatively impact their individual performance. Also, purchasing data bundle to access the internet was found to be expensive, even though most HCPs stated that they were on scholarship, the scholarship did not cover the cost of data. The financial challenge was stated to have slightly impacted their study process by sometimes causing delay to access study material until money was available to buy data bundle thereby limiting the amount of time to study and meet assessment deadlines.

Data from this study shows that social norm could be a determinant of individual performance in e-learning. A study by McGill and Klobas (2009) however opposes the findings of this study. The study found that social norm did not play a role in the performance impacts of LMs. Tapanes et al. (2009) supports the findings in this study by

suggesting that cultural differences do influence the perception of students about online learning. The perception of student on e-learning does predict their learning outcomes and eventually impacts their organizational performance.

6.6.3 To explore HCPs' perception of the effect of contextual characteristics on their behaviour in the ASC module

This objective of this section was to assess the influence of factors within HCPs' cultural setting which influenced the transfer of knowledge and skills acquired from the ASC e-module to their daily clinical practices and other work practices. Findings from this study reveals that most HCPs felt that the module was relevant to their cultural setting and their work environment due to rampant cases of antimicrobial resistant infections in their countries. Data gathered shows that HCPs had both internal and external factors which motivated them to transfer their knowledge. The major internal motivating factor was stated to be the knowledge and skills they had acquired while the major external motivating factor was the burden of diseases in HCPs' countries.

Data gathered from this study reveals that contextual factors influences the transfer of knowledge and skills acquired from e-learning. Contextual factors could dictate the suitability, acceptability and functionality of e-learning interventions. If contextual characteristics are not considered and embedded into the design of e-learning systems and programs, learners' satisfaction will not be guaranteed, learning objectives will not be achieved, neither will there ever be knowledge and skills that could be transferred to practice.

Sayadi et al. (2017) supports the findings of this study by stating that it is very unlikely that there are positive changes in job performance of participants if they do not transfer their newly learnt skills and knowledge to practices in the context of their work environments. The study identified contextual factors such as opportunity to utilize knowledge and skills, technological support, and support of superiors as factors which could impact knowledge transfer to practice. Lance et al. (2002) aligns well with the findings of this study and states that factors in a work environment are crucial for eliciting transfer to practice processes of trainings.

6.6.4 To explore HCPs' perception of the effect of contextual characteristics on their result of the ASC module.

The objective of this section is to assess the contextual benefit of the ASC module as a pure online module to HCPs' work organizations.

HCPs stated benefits such as ability to work and study at the same time, ability to make them present to attend to patients so patients don't suffer, customized and personalized learning, it saves money; even though data bundle is expensive, it is not comparable to the cost of tickets and accommodation if they had to travel to South Africa to learn, it boosts HCPs technical confidence (Improved self-efficacy).

The points raised by HCPs reflect the ability of e-learning to improve the knowledge and skills of medical practitioners in medical education without taking HCPs away from their work place and depleting the already burdened health workforce.

Since HCPs believed that taking the ASC module as a fully online module provided benefits which is relevant to their contextual settings, they were very keen to recommend the module as an e-learning module to their colleagues at work. According to them, more HCPs taking the e-module would mean more HCPs would be aware of antibiotic resistant infection and have their capacity strengthened to be able to combat the burden of diseases in sub-Saharan Africa. HCPs stated that they would even recommend the e-module to policy makers in their countries so that they could make informed decisions concerning antimicrobial resistance stewardship and conservancy in Africa, and in this case sub-Saharan Africa.

The study by Sayadi et al. (2017) aligns with the findings of this study. The study stresses that institutions should be aware of the need for alignment between the work context of students and the content of learning and training programmes to ensure the transfer of knowledge and skills into practices in their organizations. The study also highlights the role of superiors at work as a supportive factor which plays a pivotal role in the transfer of learning to practices for the enhancement of organizational performance of participants

6.7 SUMMARY

This chapter presented data generated in this study. The data presented is based on how task characteristics and technology characteristics of the e-module and how the individual and contextual characteristics of HCPs influence their individual and organizational performance. The second section presented the discussion and analysis of the findings of the study supported by literature review. The next chapter summarizes the study, make recommendations and suggest further areas of research in the future.

CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 INTRODUCTION

The aim of this study was to assess the influence of e-learning on the performance of Healthcare professionals (HCPs) in South Africa. The key terms and variables of the study were used to structure the literature which was thematically reviewed to build an underlying foundation for the study and review what previous researchers have achieved.

For instance, a study by Gormley et al. (2009) assessed undergraduate medical students' perception of the level of accessibility and attitudes towards e-learning in basic clinical skills education compared to other methods and reported that majority of students stated that they had good access to computers and internet both while on campus and while off campus. The students were also confident in their ability to use IT. These students believed e-learning positively impacted their learning of clinical skills in manners which are comparable to the traditional classroom setting. Also, they noted that students who portrayed deep learning traits when using e-learning performed better in their clinical skills. This study highlights that although undergraduate medical students are different in the way they utilize e-learning, they accept and appreciate the use of e-learning in clinical education.

Bagayoko et al. (2013) also evaluated the impact of distance learning as a way in which capacity can be built, satisfaction increased and performance of healthcare professionals in isolated health care facilities enhanced. This was achieved using an organizational framework and computer-based tools developed within RAFT: Réseau en Afrique Francophone pour la Télémédecine; a telemedicine network in French-speaking Africa. The study, carried out in Mali, found that preliminary results suggest that the accessibility of eHealth, particularly continuous education, increases retention and enables the recruitment of young health care professionals to isolated healthcare facilities.

A more recent study by Khasawneh et al. (2016) assessed the impact of e-learning on the medical knowledge, satisfaction, and perceived confidence of third year pediatric medical students using an e-module about infection control and congenital infections. It was found

that although the e-module was perceived as satisfactory by the students, it neither improved students' medical knowledge nor their performance on NBME or post-test. However, taking the e-module boosted the confidence among those who used them.

7.2 SUMMARY OF RESEARCH FINDINGS

This section summarizes the findings of this study according to the research objectives of the study.

7.2.1 Research objective one: To understand the influence of task characteristics of the antimicrobial stewardship and conservancy e-module on the performance of HCPs.

This study established that the task characteristics of the ASC e-module has a strong relationship with Task-Technology Fit perception of UKZN Moodle for the ASC e-module tasks, and a strong (and positive) influence on the individual and organizational performance of HCPs who took the module. Knowledge and skills were acquired from the ASC e-module tasks, transferred to clinical and practices and were stated to have benefited the work organizations of HCPs.

7.2.2 Research objective two: To understand how the technology characteristics of the antimicrobial stewardship and conservancy module influence the performance of HCPs.

This study found that technology Characteristics has a strong relationship with Task-Technology Fit perception of the ASC e-module. UKZN Moodle was said to be 'Fit' or good enough to support HCPs learning task and this was affirmed to have positively influenced their individual and organizational performance. Nevertheless, Technology characteristics was not considered as the biggest influence on HCPs performance but rather, factors which directly relates to the e-module task characteristics such as the quality, relevance and structure of the course content, the knowledge and experience of lecturers and facilitators, and the technical support provided by the module facilitators.

7.2.3 Research objective three: To determine to what extent the individual characteristics of HCPs influence their performance in the antimicrobial stewardship and conservancy module.

This study found that the individual proficiencies of HCPs influence their perception of Task-Technology Fit of UKZN Moodle for the ASC e-module task, and consequently, their individual and organizational performance. However, this study established that individual characteristics has a weaker relationship with HCPs' perception of Task-Technology Fit and individual and organizational performance compared to other constructs such as Task Characteristics and Technology Characteristics. This is evident because the variation in previous experience and other personality factors of HCPs did not influence their individual performance in terms of their perception of and satisfaction with the module and their ability to acquire knowledge and skills from the module content. Neither did it influence their organizational performance in terms of their ability to transfer their knowledge and skills into their clinical and work practices and provide value for their work organizations. All the HCPs who participated in the study also felt that the technology characteristics of the e-module influenced their individual characteristics as taking the module as a pure e-learning module helped them to develop certain personality traits such as self-discipline, scheduling and prioritizing and independence.

7.2.4 Research objective four: To ascertain how the contextual characteristics of HCPs influence their performance in the antimicrobial stewardship and conservancy module

This study found that the contextual characteristics of HCPs has a strong relationship with their perception of the Task-Technology fit of UKZN Moodle for the ASC e-module tasks and a strong (positively-mitigated negative) influence their individual and organizational performance. E-learning enabled cross-boundary interaction across three different sub-Saharan African (two English-speaking, and one Portuguese-speaking) Countries. This introduced several barriers such as language, economic and infrastructural barriers. All these barriers negatively influenced HCPs perception of the fitness of UKZN Moodle for the ASC tasks. ASC course facilitators however catered for the contextual diversity by paying for the Portuguese speaking students to take English courses. HCPs affirmed that this was truly helpful. NORHED also enlisted the service of

a translator who worked with the Mozambique group on individual and group levels. This was affirmed to have totally eradicated the barrier created by the language of instruction. HCPs were self-motivated to work around economic and infrastructural challenges they experience to enhance their own performance.

Contextual factors could dictate the suitability, acceptability and functionality of e-learning interventions. If contextual characteristics are not considered and catered for in the design of e-learning systems and programmes, learners' satisfaction will not be guaranteed, learning objectives will not be achieved, neither will there ever be knowledge and skills that could be transferred to practice, or value to organizations. This could lead to a case of Learning Management System failure; a situation where LMS fails to achieve the purpose for which it was designed.

7.3 RECOMMENDATIONS

In line with the findings and responses from sampled HCPs, the following recommendations are suggested;

7.3.1 For Learning Management Systems designers and stakeholders

- In South Africa and generally, sub-Saharan Africa, e-learning can strengthen the capacity of Healthcare Professionals so that the burden of diseases could be combated. However, e-learning programs or courses need to be delicately designed with focus on how to align the system to the learning objectives of the program.
- E-learning system designers need to consider the tasks for which the system is designed and ensure a "FIT" or alignment between such tasks and the functionalities that they system should provide. This will ensure learner satisfaction, achievement of learning outcomes, and consequently, knowledge transfer to practices, and both individual and organizational benefits to learners and their employers.
- E-learning system designers, learning facilitators and stakeholders should be warned against technology determinism; the belief that technological innovations and developments are the main agent of social change, rather than individuals and

social contexts informing the way technology is used. They need to realize that the appropriateness of e-learning is context-dependent. The fitness or appropriateness of LMS relies on the contextual environments of learners. Contextual factors such as language and internet access or affordability could pose as barriers to the achievement of learning outcomes and eventually, system failure, even in the best designed e-learning system if not well catered for.

- For an e-learning system to be successful, stakeholders need to realize that e-learning technology is not a silver bullet. The content of the system, the knowledge of the lecturers and facilitators, and the technical support system contribute majorly to the task-technology fit of LMS.
- Existing e-learning systems need to be audited to assess how stakeholders have taken into consideration the individual and contextual diversity of learners. A man cannot be separated from his culture. When the individual and contextual diversity of learners are catered for, there is a huge possibility that the benefits of e-learning will be realized. (Mecella et al., 2006; Zedan & Al-Ajlan, 2007).
- E-learning comprises the involvement and contribution of different group of people including content providers, instructional designers, teachers, technical support, trainers, database administrators and several other group of people who come together to provide learning platform and services to a community of learners. These stakeholders need to be oriented about the goal towards which they are working and made aware of factors that can pose as barriers to the accomplishment of these goals.
- To justify the investment made into e-learning, organizations need to involve in regular process and outcome assessment of e-learning programs. Process evaluation assesses the strength and weaknesses of e-learning interventions, while outcome evaluation assesses the changes in learners' acquisition of knowledge because of their participation in the e-learning course. Only then can the return on investment in e-learning be justified.

7.3.2 For South African Department of Health

- The burden of diseases in South Africa continues to rise with HIV/AIDS and TB being on top of the list. There is need to develop capacity and strengthen the existing health workforce capacity. However, the current burden of disease is such

that taking healthcare professionals away from their current place of work cannot be afforded. E-learning has been proven to offer continuous professional development to HCPs in such a manner that the knowledge and skills acquired lead to preferred changes in their clinical practices and improve their ability to solve institutional challenges. Therefore, the government should embrace e-learning for HCPs to alleviate the burden of diseases in the country.

- The South African government should form policies which will encourage HCPs continuous professional development through e-learning. This could be in form of rewards such as workplace promotion or formal recognition at work. This will serve as a form of external motivation for HCPs to strengthen their capacity through e-learning and mutually benefit both the individual, their work organization and the government of South Africa.
- The government should research into the establishment of medical institutions which will produce health workforce via full e-learning program or blended learning; where students have scheduled laboratory exposure physically to strengthen their clinical skills. This will ensure that health workforce is developed in a chain circle best described as “building capacity to build capacity”; this is a situation where the graduate produced from the e-learning program will also train another set of HCPs, in a cycle which will ensure that there is always healthcare workforce available to train and to practices in local hospitals.
- Technology is used in several organizations to enhance work practices, create sustainable advantage and enhance the performance of employees. The South African Department of Health should create an e-health department; which will function to utilize technology in diverse ways to enable healthcare processes in the country. This may include mobile health, Health Information System (HIS), e-learning, and other ways in which technology can be leveraged to enhance medical practices, improve health workforce performance, enhance the delivery of healthcare services and reduce the burden of diseases in the country.

7.3.3 Medical Education Institutions in sub-Saharan Africa

- Within the context of this study, a body of evidence has been established which validates that e-learning is beneficial in medical education. The burden of disease

in sub-Saharan Africa is high, therefore there is need to increase the health workforce capacity without taking existing medical practitioners away from their workplace either to train them, or have them train others as this could burden the already burdened system. Medical education institutions need to explore e-learning as means to develop and strengthen medical capacity.

- Medical journal dedicated exclusively to e-learning advances in medical education should be published to develop medical e-learning as a field of enquiry and practice in sub-Saharan Africa.
- The government in sub-Saharan Countries should make funds available to support research into the utilization of e-learning to strengthen capacity of HCPs in their respective countries.
- Community healthcare workers should be trained via e-learning to strengthen their capacity to combat and control tuberculosis, HIV and antibiotic resistant infections which has taken over sub-Saharan Africa and threatens the general populace.
- As institutions in resource constrained Countries, Medical Institutions in SSA need to be aware of their context and develop their e-learning systems in relation with the context of their environments, otherwise, contextual factors might pose as barrier and the system might fail.

7.3.4 Non-governmental Organizations (NGOs) in sub-Saharan Africa

- NGOs in SSA should join forces together to implement cross-border e-learning systems which utilizes existing medical human resources to develop and strengthen capacity for HCPs across the region. Projects like K4Health (Knowledge for Health) project based at Johns Hopkins Bloomberg School of Public Health's Center for Communication Programs (JHU-CCP), with support from the United States Agency for International development (USAIDS) has developed, implemented, and evaluated several asynchronous eLearning initiatives which uses e-learning to strengthen the capacity of public health practitioners and institutions by working with subject matter experts in a diversities of global health technical areas to develop their capacity to create asynchronous eLearning courses that are intended to improve the knowledge and comprehension skills of HCPs around the world.

- There exists a huge e-learning readiness among HCPs in SSA which needs to be explored. HCPs from sub-Saharan Africa are huge fans of e-learning for continuing professional development. The Global Health eLearning platform (GHeL) Center in April 2010 consulted Cekan Consulting to analyze their registration data from October 2005 to April 2010. The analysis showed that there were 50,197 registered learners from 184 countries. Of the top 30 countries earning certificates for successful completion of GHeL course, most of the learners were in sub-Saharan African countries, followed by Europe and North America and Asia.

7.4 FUTURE RESEARCH

The focus of this study was to assess the impact of e-learning on the individual and organizational performance of HCPs in South Africa. Further studies should be carried out using quantitative techniques to generate data with unbiased measurement of the statistical analysis of the influence of e-learning on the performance of HCPs in South Africa, and sub-Saharan Africa at large.

Medical e-learning initiatives in other institution needs to be assessed with focus on its impact on the individual and organizational performance of HCPs in South Africa.

Since this study found out that the appropriateness of e-learning in medical education is task-technology-fit based and context-dictated, a similar research should be carried out in other African countries to establish if this theory holds in multiple contexts. This will eventually contribute the existing body of knowledge concerning the influence of e-learning on the performance of HCPs in Africa, which is presently very limited.

7.5 SUMMARY

E-learning plays a major role in the 21st century education and has been acclaimed to be of benefits in medical education. Part of the benefits stated is the ability to provide life-long learning and continuous professional development to medical practitioners without taking them away from their physical place of work. Medical educational institutions across Africa continue to embrace e-learning. Some previous researchers have stated that

this is being done under the pressure to conform to the 21st century learning trend rather than for the pedagogical evidences of the influence of e-learning in medical education.

This study combined two frameworks to assess the process and outcome of e-learning in medical education in South Africa and shows that when an e-learning system is designed to align with the task requirements for which it was intended, the contextual factors of Healthcare professional are considered and catered for in the design and their individual differences are also accommodated, there are very high possibilities that the individual and organizational performance of Healthcare professionals will be enhanced.

Although e-learning is being embraced in medical education in Africa, there is still a high level of digital divide in sub-Saharan Africa compared to the developed countries. Designing LMSs in Africa relative to the task, the technology, contextual and individual characteristics of users would ensure that the region reaps the benefit of e-learning in medical education.

Capacity could be developed and strengthen to combat the burden of diseases that has plunged many countries in sub-Saharan Africa using e-learning. This chapter provided a summary of empirical and literature findings, presents recommendations for future research and the implication of this study.

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APPENDIX A : LETTER OF INFORMED CONSENT

Assessing the influence of e-learning on the performance of Healthcare Professionals: a case study of UKZN-NORHED collaboration

Supervisor: Dr. Given Mutinta College of Law and Management Studies, School of Management, Information Technology and Governance.

Email: mutinta@ukzn.ac.za

Office number: +27312608854

Greetings,

My name is Oluwadele Oluwaseun Deborah, a Master's of Commerce in Information Systems and Technology student from the College of Law and Management Studies, School of Management, Information Technology and Governance, cellphone number +27798950177 and email address; deborahajenifuja@gmail.com.

You are being invited to consider participating in a study that involves research in Assessing the influence of e-learning on the performance of Healthcare Professionals: a case study of UKZN-NORHED collaboration. The aim and purpose of this research is to assess the influence of e-learning on the performance of Healthcare professionals in South Africa. This study will use semi-structured interview to generate data. The sample for this study will be selected from all the participants (9) of the Antimicrobial Stewardship and Conservation module for the 2015 class. All the participants of the module are geographically located in Malawi and Mozambique. The procedures involved is to conduct semi-structured in-depth interviews to obtain an in-depth understanding of the subject matter. The duration of your participation if you choose to participate and remain in the study is expected to be one hour. The study is funded by NRF (National Research Foundation, South Africa).

The study involves no risks and/or discomforts and will provide no direct benefits to participants but will serve as a feedback to the NORHED organization as to the perceived

benefits of the Antimicrobial Stewardship and Conservancy course to the participants at both individual and organizational levels, to e-learning system developers to ensure alignment in the task requirements and system functionalities provided for e-learning and to the South African healthcare system, to establish the potentials of e-learning in building capacity of healthcare professionals in the country so that the burden of diseases facing the country can be combated.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number: HSS/0519/017M)

In the event of any problems or concerns/questions you may contact the researcher at deborahajenifuja@gmail.com or +27798950177 or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

**HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS
ADMINISTRATION**

Research Office, Westville Campus

Govan Mbeki Building

PrivateBagX54001

Durban 4000 KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Your participation in the study is voluntary and by participating, you are granting the researcher permission to use your responses. You may refuse to participate or withdraw from the study at any time with no negative consequence. Your anonymity will be maintained by the researcher and the School of Management, I.T. & Governance and your responses will not be used for any purposes outside of this study.

All data, both electronic and hard copy, will be securely stored during the study and archived for 5 years. After this time, all data will be destroyed.

If you have any questions or concerns about participating in the study, please contact me or my research supervisor at the numbers listed above.

Sincerely

Oluwadele Oluwaseun Deborah

CONSENT TO PARTICIPATE

I _____ have been informed about the study entitled Assessing the influence of e-learning on the performance of Healthcare Professionals: a case study of UKZN-NORHED collaboration by Oluwadele Oluwaseun Deborah.

I understand the purpose of this research is to assess the influence of e-learning on the performance of Healthcare professionals in South Africa

I have been given an opportunity to ask questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I usually am entitled to.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at deborahajenifuja@gmail.com or +27798950177.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557 - Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

I hereby provide consent to:

Use of my questionnaires for research purposes	YES / NO
Audio-record my interview discussion	YES / NO
Video-record my interview discussion	YES / NO
Use of my photographs for research purposes	YES / NO

Signature of Participant

Date

APPENDIX B: INDEPTH INTERVIEW GUIDE

INTERVIEW SCHEDULE FOR HEALTHCARE PROFESSIONALS

Semi structured In-depth Interview	
Date of In-depth Interview	
Time Allocation	30-60 minutes

SECTION 1 : DEMOGRAPHICS

1	Gender	Male <input type="checkbox"/> Female <input type="checkbox"/> Other (please specify) <input type="checkbox"/>
2	Nationality	Malawian <input type="checkbox"/> Mozambican <input type="checkbox"/> Other (please specify) <input style="width: 100px;" type="text"/>
3	Home Language	<input style="width: 150px;" type="text"/>
4	Student Number	<input style="width: 150px;" type="text"/>
5	Continuing Education taken	
6	Work Position	
7	Length of Service	
8	Have you done any other course which is a pure online module, with no classroom lectures before now?	Yes <input type="checkbox"/> No <input type="checkbox"/>
6	Proficiency in Speaking English Language	Above Average <input type="checkbox"/> Average <input type="checkbox"/> Satisfactory <input type="checkbox"/> Poor <input type="checkbox"/>
7	Proficiency in Writing English Language	Above Average <input type="checkbox"/> Average <input type="checkbox"/> Satisfactory <input type="checkbox"/> Poor <input type="checkbox"/>

INTRODUCTIONS

This interview is specifically focused on your experience in the Antimicrobial stewardship and conservancy module ; a pure e-learning module which ran on the UKZN Moodle in the second semester of 2015.

Facilitator

Introduction by the facilitator and thanking the participant for assenting to take part in the interview.

I appreciate your readiness to spare your time and undertake this interview. My name is Oluwadele Oluwaseun Deborah; a Master's Degree Student at the School of Information Technology, Governance and Management, Discipline of Information Systems and technology - University of KwaZulu-Natal (UKZN).

Participant introduction

Please introduce yourself, first name is okay. Please tell me which institution you work in, the location, your formal job title and your job description.

You are being invited to consider participating in a research titled “Assessing the influence of e-learning on the performance of Healthcare Professionals: a case study of UKZN-NORHED collaboration”. The aim and purpose of this research is to assess the influence of e-learning on the performance of Healthcare professionals in South Africa. In partial fulfilment of my programme, I am obligated to conduct interviews for my thesis. This interview is specifically focused on your experience in the Antimicrobial stewardship and conservancy module; a pure e-learning course which ran on the UKZN Moodle in the first semester of 2015.

I will clarify the semi structured in-depth interview guidelines and the duration.

We have this discussion scheduled for between 30 – 60 minutes per participant. This is basically to assess the influence of e-learning on the performance of Healthcare professionals in South Africa.

I am here to facilitate the session today. You will not upset or make me happy with whatever opinions you might offer. I am concerned with hearing your viewpoint. I will

try as much as possible to keep the interview focused and within our time frame. If too much time is being spent on one question, I may move the discussion along in order to cover all subjects.

Addressing the issue of confidentiality

I will ensure the voice recording of the discussion in order not to miss out on any comment. Please confirm that you are okay with this. Even though, first name will be used today, the final report will be devoid of any names. You are assured of thorough confidentiality.

Laying the ground rules

To facilitate the process, I will lay down a few semi-structured in-depth interviews rules;

- *We are going to ensure that only one person speaks at a time.*

- *Please feel free to express your views honestly. I want to learn from you. Your opinions, views, feelings, perceptions are important to me. Don't always just say "I agree"! There is no right or wrong answer and I encourage you to talk to me as this recording is confidential and will not be made available to the people running the course or the institution.*

- *If there is something you specifically would like to tell me, please feel free to introduce it in the discussion- even if I have not directly asked you about it. My role is as to be a facilitator not really interviewer so I facilitate the interview not to create it. I urge you to ask me questions to clarify issues.*

- *You have signed the initial form confirming your participation in this session as well as your agreement to ensure that everything that is discussed in this venue remains confidential and private. Can I confirm that you are satisfied with this arrangement?*

- *I formally request your permission to record our discussions.*

Discussion starter question

As mentioned earlier, the main topic of my theme is Assessing the influence of e-learning on the performance of Healthcare Professionals: a case study of UKZN-NORHED collaboration, focusing on your experience during your participation in the e-learning course “Antimicrobial Stewardship and conservancy in Africa”. In order to reach an agreement before proceeding with this exercise, it is pertinent that I spend few minutes to explain the themes of the interview.

THEMES

To start with, the facilitator will explain to the participants on what is meant by task characteristics and technology characteristics of Antimicrobial Stewardship and conservancy (ASC) module and the individual characteristics and contextual characteristics using practical Models.

Task characteristics imply the actions taken by HCPs to ensure that learning objective pre-determined by module facilitators are achieved. These are the activities you engaged in while studying the Antimicrobial Stewardship and Conservancy (ASC) module.

Technology characteristics are the features of the entire tools, e-learning applications, facilitating infrastructure and services that enable task execution by HCPs. This refers to the available computer systems (UKZN Moodle Learning Management System) which helped you carry out your task while studying the Antimicrobial Stewardship and Conservancy (ASC) module.

Individual characteristics describes the abilities, proficiencies, or competences of HCPs which affect how well they use the e-learning technologies to implement their tasks.

Contextual characteristics describe the cultural and social impacts, geographical variations and the enabling circumstance of HCP’s study environment which impacts HCWs’ perceptions on the suitability of e-learning in their study setting.

1. Healthcare Professionals' perception of the ASC module tasks and its influence on their performance

This section assesses the activities you engaged in while studying the Antimicrobial Stewardship and Conservancy (ASC) module (task characteristics) and their effects on your performance.

How did the tasks (activities) you engaged in while taking the ASC module influence your performance?

- I.** How satisfied were you with the module? Are you satisfied with the module? What is your opinion of the weekly materials and weekly assignments? How was the discussion board helpful to you? What is your opinion of the discussion forum? How did you use the discussion forum to your advantage during the course?
- II.** How did the online quizzes influence your learning? What is your opinion about the feedback provided by the module facilitators on your assessments? How do you feel about the module being a pure e-learning module? Could you please tell me two important knowledge you gained from the module? What was your expectation of the ASC module? Did the course meet your expectation? If it didn't, how should this module be improved?
- III.** Could you please describe a situation at work where you could demonstrate what you learned on the ASC module? Please list two more instances where you could apply the concept of antibiotic stewardship in your working environment?
- IV.** How has your knowledge of ASC benefitted your organization? In your opinion, how would it benefit your working environment if more HCPs take the ASC module?

2. Healthcare Professionals' perception of the UKZN Moodle Learning Management System (LMS) and its influence on their performance

This section assesses the available computer systems which helped you carry out your task (necessary activities) while studying the Antimicrobial Stewardship and Conservancy (ASC) module and how they influence your performance.

How did using UKZN Moodle platform to complete your tasks for ASC module influence your performance?

- I.** How did you find the ASC module online interface on UKZN Moodle? Did you have access to computers every time you needed to access the module? If no? Why? What technological issues did you experience while taking the ASC module? Were they resolved satisfactorily? What challenges did you face using learning facilitation media such as YouTube? How did you resolve them? How did the ASC module help you to manage your time?
- II.** Do you feel that Moodle was good enough to facilitate your studies? What role did further readings on YouTube play in your learning? In what way did the technical challenges you faced impacted your study? How were you able to find your way around the module page the first day you logged on? How would you describe your interaction with other students on Moodle? Did you feel isolated at any time? How did you get over this? What function of UKZN Moodle helped you the most in your study?
- III.** In what way has your exposure to technology on UKZN Moodle affected your daily clinical practices? Would you attribute your performance in the ASC module to the technological functionalities of UKZN Moodle LMS? Have you used computer technologies you used on UKZN Moodle for the ASC in your place of work? If yes, how? If no, why?
- IV.** In what way, would you say your exposure to e-learning technology through participating in the ASC module, benefitted your work Organization? How has your exposure to technology affected your relationship with your superiors at work? Does your work Organization make use of Health Information systems? Have you

applied your technological know-how for your Health information systems at work? How?

3. Healthcare Professionals individual abilities and its influence on their performance

This section assesses your individual abilities and how they affect your performance while studying the Antimicrobial Stewardship and Conservancy (ASC) module.

In what way do you think your personality influenced your performance in the ASC module?

- I.** How good were your skills at using LMS before you took the ASC module? How good were your skills at using internet search engine before you took the ASC module?
- II.** In what way has your previous experience in online learning (or lack of it) affected your performance in the ASC module? In what way has your ability to use computers (or lack of it) affected your performance in the ASC module? What is the level of your self-discipline at studying and doing your assignments on Moodle? What aspect of ASC module has motivated you to take another e-learning course?
- III.** What aspect of your experience in e-learning has influenced your clinical practices? How? In what way has your ability to learn independently reflected on your daily clinical practices at work?
- IV.** Are the skills you have in using technology relevant in your work place? How? If not, Why? How have these skills made you to impact your work Organization?

4. Healthcare professionals' cultural environment and its influence on their performance

This section assesses your cultural backgrounds and geographical variations and how they affect your performance while studying the Antimicrobial Stewardship and Conservancy (ASC) module.

In what way did your cultural setting and geographical location influence your performance in the ASC module?

- I. What challenges did you face while learning the ASC module which may be because of your location? Describe your experience with accessing the ASC module, internet connection and electricity availability in your country.
- II. What is your opinion about the language of Instruction (English)? Did it enhance or inhibit your performance? Does your country have policies which support bandwidth and data availabilities? How affordable is data in your country? In what way did your lecturer, family and friends' opinion or support on e-learning influence your performance?
- III. Is the ASC module relevant in your place of working environment and in your country? How? In your working environment, what has motivated you to use your knowledge of ASC in your daily practices?
- IV. In order of importance, list three benefits of the ASC module as a pure online course to you and to your working environment. Would you recommend that more HCPs in your country take the ASC module? Why?

APPENDIX C: GATEKEEPER'S APPROVAL LETTER



26 April 2017

Mrs Oluwaseun Deborah Oluwadele
School of Management and Information Technology and Governance
College of Law and Management Studies
Westville Campus
UKZN
Email: deborahajenifuja@gmail.com

Dear Mrs Oluwadele

RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at the University of KwaZulu-Natal (UKZN), towards your postgraduate studies, provided Ethical clearance has been obtained. We note the title of your research project is:

"Assessing the influence of e-learning on the performance of Healthcare Professionals: a case study of UKZN-NORHED collaboration".

It is noted that you will be constituting your sample by conducting interviews via Skype with students/foreign nationals from Malawi and Mozambique from the College of Health Sciences on the Westville campus.

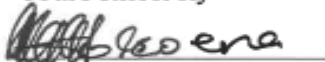
Please ensure that the following appears on your notice/questionnaire:

- Ethical clearance number;
- Research title and details of the research, the researcher and the supervisor;
- Consent form is attached to the notice/questionnaire and to be signed by user before he/she fills in questionnaire;
- gatekeepers approval by the Registrar.

You are not authorized to contact staff and students using 'Microsoft Outlook' address book.

Data collected must be treated with due confidentiality and anonymity.

Yours sincerely

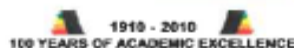

MR SS MOKOENA
REGISTRAR

Office of the Registrar

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APPENDIX D: ETHICAL CLEARANCE APPROVAL LETTER



08 June 2017

Mrs Oluwaseun Deborah Oluwadele (214584163)
School of Management, IT & Governance
Westville Campus

Dear Mrs Oluwadele,

Protocol reference number: HSS/0519/017M (Approved under HSS/1056/015)

Project title: Assessing the influence of e-learning on the performance of Healthcare Professionals: A case study of UKZN-NORHED collaboration

Approval Notification – Expedited Application

In response to your application received on 12 May 2017, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

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

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Dr Shamila Naidoo (Deputy Chair)

/ms

Cc Supervisor: Dr Given Mutinta
Cc Academic Leader Research: Professor Brian McArthur
Cc School Administrator: Ms Angela Pearce

Humanities & Social Sciences Research Ethics Committee

Dr Shenuka Singh (Chair)

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