Barriers and enablers in information communication technology adoption by students in a private nursing education institution

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PREFACE AND ACKNOWLEDGEMENTS

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DECLARATION

I declare that this research dissertation titled ***Barriers and enablers in information communication technology adoption by students in a private nursing education institution*** is my own work. It has not been submitted before at any university or tertiary institution.

Maryke de Beer

15 December 2015

Signed: 

ABSTRACT

The background and problem statement centre the role of information communication technology (ICT) integrated globally with health, to provide secure electronic health information to the right person at the right time and place, and to optimise healthcare delivery, research, education and knowledge. Although the World Health Organisation (WHO) positioned ICT within healthcare, international research shows that healthcare workers do not adopt ICT to a sufficient degree. ICT is as much applicable to student nurses as other training and business situations. Technology adoption research in healthcare is lacking. It is essential for students to have ICT access to assist with learning, and it should be incorporated into nursing and midwifery curricula. Although technology is available at a private nursing education institution, the researcher recognised barriers to the adoption of ICT by undergraduate student nurses. The literature review peruse what is known about ICT adoption in health systems internationally and nationally, to gain a deeper understanding of ICT adoption focussed on nurses. The aim of this research is to enhance ICT adoption by undergraduate student nurses at a private nursing education institution where students have to complete eLearning programmes supportive to their curriculum. The objectives are to explore and describe the barriers to and enablers for ICT adoption as part of eLearning by undergraduate student nurses at a private nursing education institution; and to formulate recommendations for nurse educators to enhance student nurses' adoption of ICT.

The study followed a qualitative, explorative interpretive, contextual design (Grove *et al*., 2013:66). An all-inclusive, purposive sampling method was applied to select participants from a small and well-defined population (Grove *et al*., 2013:351) of pupil enrolled nurses and bridging students (N=17). A mediator recruited participants and explained informed consent and the research topic to participants. Data was collected by means of semi-structured focus groups with 4-6 participants per group, and the writing of narratives after the focus groups. From the focus groups three main themes and seven sub-themes were formulated. Firstly, that student nurses hold positive, negative and contrasting perceptions regarding ICT; technology infiltrates the caring presence of nurses; and incremental steps to use technology within a technology-enhanced and blended-learning environment. From the narratives it concluded that although student nurses are aware of challenges access and connectivity, they perceive themselves to have the potential to become independent ICT users. The enablers for ICT adoption outweighed the barriers. Recommendations are formulated for nurse educators based on technology-enhanced learning within a blended-learning environment that is learner-centred and contextual.

Key terms: Adoption/adaption, barriers, enablers, eLearning ICT (Information Communication Technology), student nurses

(Abstract word count: 414)

OPSOMMING

Die agtergrond en probleemstelling sentreer rondom die integrasie van informasie kommunikasie tegnologie (IKT) met gesondheid in die globale arena om veilige elektroniese gesondheidsorginligting aan die regte persoon, op die regte tyd en plek te voorsien; en optimale gesondheid, navorsing, onderwys en kennis te verseker. Alhoewel die Wêreld Gesondheidsorganisasie (WGO) IKT posisioneer, toon internasionale navorsing dat gesondheidsorgwerkers nie IKT optimaal aanneem of aanwend nie. IKT is toepaslik op sowel verpleegstudente as ander opleidings- en besigheidsituasies. Tegnologie-aanwendingsnavorsing in gesondheidsorg is gebrekkig. Dit is noodsaaklik vir studente om toegang tot IKT te hê ter ondersteuning van leer, en dit moet in verpleegkundige en vroedvroue se kurrikula geïntegreer word. Alhoewel tegnologie beskikbaar is by ‘n privaat verpleegopleidingsinstelling (VOI), het die navorser hindernisse waargeneem wanneer verpleegstudente IKT moet aanwend. Die literatuurstudie ondersoek aspekte wat reeds bekend is oor IKT aanwending in gesondheidstelsels internasionaal en nasionaal om sodoende die aanwending van IKT beter te verstaan met die fokus op verpleegkundiges. Die doelwit van die studie is om IKT aanwending te verbeter by verpleegstudente by ‘n privaat VOI waar studente e-leerprogramme moet voltooi ter ondersteuning van hulle kurrikulum. Die doelwitte is om die hindernisse wat IKT verhinder asook faktore wat IKT verbruik verbeter in verpleegstudente se kurrikulum by ‘n privaat VOI te identifiseer en te beskryf; en om voorstelle te formuleer vir verpleegkundedosente om verpleegstudente se aanwending van IKT te bevorder.

‘n Kwalitatiewe, verkennende interpretiewe en kontekstuele ontwerp is gevolg (Grove *et al*., 2013:66). ‘n Omvattende, doelgerigte steekproef is gebruik om deelnemers te selekteer. uit ‘n klein en goed-gedefinieërde populasie van verpleegstudente (Grove *et al*., 2013:351) uit die leerling ingeskrewe verpleegkundige groep en oorbruggingsstudentegroepe (N=17). ‘n Tussenganger is aangestel om deelnemers te werf, om ingeligte toestemming aan deelnemers te verduidelik en om die navorsingsontwerp te verduidelik. Data-insameling is gedoen deur semi-gestruktureerde fokusgroepe, met tussen 4-6 deelnemers per groep, en die skryf van narratiewe. ‘n Onafhanklike onderhoudvoerder het die fokusgroepe gelei en die tussenganger het toegesien dat etiese beginsels nagekom word. Drie hoof- en sewe sub-temas is vanuit die fokusgroepe geformuleer. Eerstens het verpleegstudente positiewe, negatiewe en teenstrydige persepsies oor IKT; tegnologie filtreer in die omgee-teenwoordigheid van verpleegkundiges in; en opeenvolgende stappe om tegnologie te gebruik midde ‘n tegnologies-bevorderende en vervlegde leeromgewing. Vanuit die narratiewe bleik dit dat verpleegstudente ten spyte van uitdagings betrekkende toegang en

verbinding in IKT, hulself ervaar om oor die potentiaal te beskik om onafhanklike IKT-verbruikers te word. Fasiliterende faktore tot verhoogde IKT verbruik het hindernisse oorskry. Aanbevelings geformuleer is gebaseer op tegnologie bevorderende, vervlegde leeromgewing wat leerder-gefokus en kontekstueel van aard is.

Sleutelterme: Aanneem/aanwend, hindernisse, fasiliterende faktore, e-leer, Informasie Kommunikasie Tegnologie (IKT), verpleegstudente.

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LIST OF ABBREVIATIONS

CABLS	Complex adaptive blended-learning systems
CAMM	Clinical Adoption Meta-Model
CCA	Canonical Correlation Analysis
C-TAM-TBP	Combined Technology Adoption Model and Theory of planned Behaviour
ECG	Electrocardiogram
eHealth	Electronic health
EHRs	Electronic health records
eLearning	Electronic learning
EMR	Electronic medical records
HITAM	Health Information Technology Model
HREC	Health Research Ethics Committee
ICT	Information Communication Technology
IDT	Innovation Diffusion Theory
IT	Information Technology
ITU	International World Telecommunication Union
mHealth	Mobile Health
MCUR	Magister Curationis
MDG	Millennium development goal
MM	Motivational Model
MPCU	Model of Personal Computer Utilization
NEPAD	New Partnership for Africa's Development

NEI	Nursing Education Institution
NWU	North-West University
PEHF	Provincial e-health framework
PHRs	Personal health records
SAHIA	South African Health Informatics Association
SANC	South African Nursing Council
SCT	Social Cognitive Theory
TAM	Technology Acceptance Model
TEL	Technical enhanced learning
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UK	United Kingdom
USA	United States of America
USB	Universal serial bus
UTAUT	Unified Theory of Acceptance and Use of Technology
WHO	World Health Organisation
WWW	World Wide Web

SECTION 1: INTRODUCTION AND OVERVIEW

1.1 INTRODUCTION

Section 1 serves as the blueprint for this research aimed at obtaining better understanding of student nurses' adoption of information communication technology (ICT) with specific reference to eLearning. This section presents the background and problem statement, including international perspectives of ICT adoption and the current situation on the African continent, followed by a South African perspective. The research objectives are outlined, followed by an overview of the research methodology, rigour and ethics. Section 1 concludes with an outline of the dissertation.

1.2 BACKGROUND AND PROBLEM STATEMENT

The convergence of the fields of information technology (IT) and telecommunications has produced the term information communication technology (ICT) (Jordan, 2008:388). Lopez-Nicolas and Soto-Acosta (2010:523) have stated that ICT's are "*tools that allow information and knowledge exchange*" and also refers to "*work execution by integrating information, documents and employees*". ICT is a concept that is as much an integral part of healthcare as any other industry. The role of ICT is to integrate healthcare globally and is presented in the two National eHealth Strategy Toolkits compiled by the World Health Organization (WHO) (WHO, 2012a; WHO, 2012b). According to the WHO (2012a:1), eHealth is defined as "*the use of information and communication technologies (ICT's) for health*." WHO (2012a:2) further describes eHealth as a means to ensure that eHealth provides secure electronic health information to the right person at the right time and place; and to optimise health care delivery, research, education and knowledge. EHealth is important to improve information flow, to support healthcare delivery and to manage health systems. ICT provides significant benefits towards achieving health goals and demonstrating what health outcomes have been attained and at what cost (WHO, 2012a:1). The broad range of applications of ICT in healthcare is evident as the WHO (2012a:78) has adapted the following examples of eHealth from the *Global Observatory for eHealth*: (1) electronic medical records (EMRs), (2) electronic health records (EHRs), (3) personal health records (PHRs), (4) telemedicine (telehealth), (5) mobile health (mHealth), (6) decision support systems, (7) chronic disease

management systems, (8) practice, patient and clinical management systems, (9) electronic medication services, (10) health knowledge resources, (11) distance learning for health professionals (eLearning) and (12) health information services.

Although the WHO positioned ICT within healthcare, international research shows that healthcare workers do not adopt ICT to a sufficient degree. Coles *et al.* (2008:17) have found that the major deterrents of healthcare workers' adoption of electronic records are to accept and adjust to the changes in established workflow practices. Even though change is perceived as positive, it is also seemingly stressful (Coles *et al*., 2008:17). Technology adoption is by itself a concept that has enjoyed decades of focused research. The Technology Acceptance Model (TAM) developed by Davis (Davis *et al.*, 1989:982) aimed to understand the reasons why workers in general did not want to use IT, despite having the technology available. The TAM listed two important factors related to adopting technology, namely the perceived ease-of-use and perceived usefulness. Perceived ease-of-use refers to the degree to which a person believes that a specific system will be free from effort and implies factors extrinsic to ICT. Perceived usefulness implies the degree to which a person believes that the use of a specific system will enhance his/her performance and outcomes (Davis, 1989:319-340).

ICT adoption is as much applicable to student nurses as other training and business situations, although Chismar and Wiley-Patton (2003:1) have concluded that technology adoption research in healthcare is lacking. Albeit not focusing on technology adoption, but acknowledging the importance of ICT in nursing, the Nursing Summit of 2011 (strategic priority 5.3 of 2013/14 – 2016/17), has stated that it is essential for students to have ICT access to assist with learning (South Africa, 2011a:46). In addition, ICT's should be incorporated into nursing and midwifery curricula in order to improve competency levels (South Africa, 2011a:48). Despite the fact that the WHO is promoting eHealth internationally, the healthcare sectors remain one of the slowest to adapt to IT implementations (England *et al.*, 2000:176). Current literature and research are insufficient to address poor ICT adoption by nurses in their working lives (While & Dewsbury, 2011:1302). In fact, seven years after the 58th Assembly, the WHO concluded that ICT in healthcare has become a crisis in many countries (WHO, 2012a:1). Conjointly, Genson and Chun (2006:1) have claimed that ICT implementations will increase significantly in the coming years.

In 2009, 114 of the WHO member countries completed a global survey published in the Atlas of eHealth. This survey reported the various stages involved in achieving the Millennium Development Goal (MDG) number 8, namely global partnership for development. Target 8.F

of the MDGs aimed to avail the benefits of new technologies to healthcare in cooperation with the private sector. This includes specific reference to ICT and to increase the number of mobile cellular subscriptions worldwide to 6 billion users by the end of 2011 (United Nations, 2013). According to the International Telecommunication Union (ITU, 2013) [ITU refers to an agency of the United Nations that specialise in ICT's], high-speed access to the Internet in 2013 was the highest in Asian economies, followed by the European countries of Bulgaria, Iceland and Portugal, and thirdly the Americas. Although the United States of America (USA) is one of the leading countries to deliver ICT in healthcare, ICT is not yet available to all rural areas.

Singh *et al.* (2010:987) have explored how rural public health institutions in Georgia (USA) can sustainably adapt to tele-health innovations. They found that extensive internal and external collaboration and a combination of technology push and opportunistic exploitation can enable sustainable rural tele-health innovation. Effken and Abbott (2009:439) have discovered the roles nurses play in ICT, for improving healthcare delivery in rural USA, where ICT is fragmented. Challenges to provide care in rural areas, and the role that ICT play in the delivery thereof; included insufficient funding to educate and prepare nurses; severe shortages in healthcare workers; lack of training and education opportunities; lower remuneration and ICT incompetence of educators. ICT applications within the USA should be treated with caution because of their attractiveness to providers and recipients of intervention funding (Lucas, 2008:2122). Despite significant improvement in the healthcare industry in the USA, there are still inefficiency and limited accomplishment to understand innovation in healthcare (Thakur *et al.,* 2012:562). Failure to meet objectives, delayed implementation, and over expenditure are some of the problems involved in adopting ICT in healthcare (Lucas, 2008:2123). But amidst various challenges, ICT continues to grow in the healthcare sectors of the USA and the United Kingdom (UK) (Abbott & Coenen, 2008:238).

Canadian literature expounds similar challenges as in the USA. The use of ICT in Canada is most popular when applied to mobile ICT, as users resist the adoption of ICT in general (Herbert, 2007:6). Cocosila and Archer (2010:248) have identified that intrinsic motivation played a key role in ICT adoption in the Canadian healthcare context. ICT should be appealing and there are target user doubts about its necessity. In Spain, ICT infrastructure is the biggest challenge in ICT adoption, followed by the scarcity of healthcare workers (Bebea-González *et al.,* 2011:157) which complicates the launch and maintenance of ICTs over time. Furthermore, Heeks (2002:101) has indicated that ICT initiatives in developing countries such as India, experienced total failure and in South Africa; partial failure was due

to unattained goals. An example in South Africa is the touch-screen kiosks in rural communities. This was accepted well in the rural community, but was not adequately updated, and was removed within a year later. Initiatives can be categorized as either failing totally or partially. A new dimension of ICT have risen in 2015 when the ITU was able to highlighted how ICT can impact on the Sustainable Developmental Goals (United Nations, 2015) although ICT's were not a specific goal in itself.

Research focussing on Africa indicates that a lack of local expertise and non-sustainable ICT projects in the developing world left a legacy of scepticism (Abbott & Coenen, 2008:240). Woreta *et al.* (2013:1) have explored the knowledge and utilisation of ICT among health sciences students in North-western Ethiopia and have concluded that students from urban areas used ICT more than students from rural areas. It was clear that students from educated families were more likely to utilize ICT compared to non-educated families. Despite the fact that ICT was introduced into the curricula of preparatory schools and universities in North-western Ethiopia, the level of computer literacy remained low (Woreta *et al*., 2013:4). Woreta *et al.* (2013:4) have reasoned that poor access to computers and inadequate ICT courses cause low computer literacy. In Ghana, urban students in general showed positive attitudes towards ICT compared to students in rural areas (Woreta *et al.*, 2013:3-4). Rural-based students' knowledge was inadequate and their ICT utilization was poor and it was suggested that computer laboratories should be established to develop students' ICT utilization. Idowu *et al.* (2008:17) compared the ICT utilization of Nigeria and the UK, finding very low computer use in Nigeria due to costs and low income. Only multinational companies could afford computer systems. Less than 5% of Nigerian citizens used computers in 2006 compared to approximately 70% of the UK population (Idowu *et al*., 2008:17). Idowu *et al*. (2008:17) also estimates that it can take 20 years to breach the Nigeria-UK gap (Idowu *et al*., 2008:17). According to Idowu *et al*. (2008:17), some of the obstacles to health informatics in Nigeria included unstable electricity supply with interruptions within a time frame of 10 consecutive hours (Idowu *et al.*, 2008:20). By 2008, Nigeria's health facilities' only access to communication was by means of an intercom system in the wards and no nurses or doctors had access to fax lines, landlines or e-mail facilities (Idowu *et al.*, 2008:20).

The New Partnership for Africa's Development (NEPAD, 2007:7) has stated that African countries should have a fully functional health system to deliver basic healthcare to the citizens and this health system should include transport, ICT facilities and supplies (NEPAD, 2007:6), improved training and existing institutions should be increased and upgraded with

Internet connectivity (NEPAD, 2007:12). Despite the fact that NEPAD progressed to the establishment of master degrees in three African states, statistics by the ITU indicated that in 2013 high-speed access to the Internet was the lowest in Africa, although the growth of mobile broadband subscriptions in African countries more than doubled (ITU, 2013). Only 7% of households in Africa have access to the Internet, compared to the highest access in Europe, which is 77% (ITU, 2013).

In 2011 all nursing stakeholders in South Africa were called together at the National Nursing Summit, aimed to "reconstruct and revitalise the nursing profession" for a longer and healthier life for all South Africans citizens (South Africa, 2011a); especially since some of the major challenges nursing faces are nursing education and training, resources in nursing, and nursing human resources for health (South Africa, 2011a:2). ICT in nursing in South Africa presents a unique challenge. Threats identified at the Summit were insufficient numbers of nurse educators; high workloads for nurse educators with increasing numbers of student nurses, and a lack of sufficient skills in new technologies (South Africa, 2011a:21). Strategic objective number 5.4 of the Summit (South Africa, 2011a) aimed at improving the use of ICT in nursing and midwifery on an on-going basis. In education and training, ICT access to students is essential. ICT assists students with their learning and in the clinical setting it is important to enhance nursing practice needs (South Africa, 2011a:48). The inclusion of ICT into the curricula of medical professionals and nurses is vital according to the South African National Infrastructure Plan (South Africa, 2012a). ICT competencies should be incorporated in curricula and the competency levels with ICT as well as access and provision of ICT systems should improve to include all employees (South Africa, 2011a:48).

Ravjee (2007:27) has stated that eLearning was introduced to higher education in South Africa from the 1990's onwards, and was influenced by issues of accessibility and resource contribution. Castells (2010:73) has warned that increased reliance on ICT would be strongly intertwined with a rising inequality and exclusion throughout the world and this digital divide has since been realised. Social exclusion is a process and concerns people and societies across territories (Castells, 2010:73). As an integral part of higher education, nursing education has been recommended for repositioning during the Nursing Summit (South Africa, 2011a:8).

Nkosi *et al.* (2011:876) has done a descriptive study to measure the attitudes of post-basic nursing management students toward the use of ICT in practice. The results indicated that the students demonstrated a positive attitude towards the use of a computer; yet their

access to and use of ICT was limited as nurses in clinics had no access. All the students agreed to the fact that ICT should be introduced into nursing programmes and the authors recommended that all nurses should have access to ICT training in order to empower them and make them aware of ICT. Although the study was insightful, it only reflected the attitudes of nurses as post-basic students towards ICT. Coleman *et al.* (2011:6) have researched eHealth readiness of hospitals in South Africa and indicated that despite the availability of ICT infrastructure in rural and urban hospitals, there is no integration of ICT systems across hospitals. Healthcare professionals can thus not benefit from eHealth applications.

Although numerous WHO articles have been published regarding eHealth, limited information is available on eHealth in the public sector in South Africa due to the fact that it has only recently become part of strategic planning and implementation in nursing education (South Africa, 2012b:9). Some countries progressed more, but developing countries such as South Africa still have to incorporate ICT into nursing education (South Africa, 2011a:46). The WHO publications (South Africa, 2011b, South Africa 2012b) have described the need for and the advantages of ICT in healthcare; confirming that there is limited capacity and capabilities regarding implementing eHealth in the public health sector in South Africa (South Africa, 2012b:9). It is therefore evident that South Africa is in the early stages of implementing ICT in the health sector. In the District Health Management Information System Policy (South Africa, 2011b), one of the key challenges for ICT implementation is inadequate ICT infrastructure development and management. Funding for eHealth implementation is available only from the provincial and municipal budgets, which vary in the different provinces. The Free State, Northern Cape and North West provinces were reported to have the lowest budgets (South Africa, 2012b:13). In the eHealth strategy (South Africa, 2012b:13), South Africa was categorised at stage 3 of eHealth maturity, with some provinces at stage 1 or 2. Stage 3 implies that the migration of traditional district health information systems to electronic storage and reporting was in place. EHealth relates to several ICT terms. Jahangirian and Taylor (2013:2) have classified eHealth projects into four categories, namely: (1) telemedicine, (2) health information systems, (3) health-related research, and (4) health education. Jahangirian and Taylor (2013:15) have concluded that communities take time to adopt eHealth and those technologies should be introduced gradually to consider both infrastructural and cultural perspectives. Schreurs *et al.* (2008:268) have suggested that eLearning readiness should be determined before organisations introduce eLearning programmes. According to Bowles (2004:4), eLearning depends on effective communication of knowledge; the communication between teachers and learners as well as amongst

learners themselves. ELearning readiness requires readiness from the organization, the trainer and the learner.

Even when ICT is available in healthcare and healthcare education institutions, there are still barriers to adopting it (Borycki *et al.*, 2011:51). In a baseline review published by the WHO and the ITU, one of the main barriers to implementing eHealth was a lack of qualified professionals to implement eHealth projects (WHO, 2013a). This problem affects students in the sense that there is limited ICT training in their curricula and educators lack the skills to provide such training. Borycki *et al.* (2011:54) have noted three main barriers to the adoption of e-records, although, ICT involves more than e-records. These barriers included the shortage of health professionals familiar with these records, health informatics specialists who can implement it, and poor access to different types of software. In addition, Nkosi *et al.* (2011:879) have identified possible barriers to ICT adoption by post-basic nursing students in practice as a lack of computer skills and access to computers, lack of time and support, as well as budgetary constraints. Abbott and Coenen (2008:240) have identified similar barriers for ICT adoption by professional nurses and listed these barriers as a global problem that is not restricted to developing countries only. These barriers included high cost drivers, misalignment of incentives, and an unskilled workforce. Although literature identified post-basic nursing students' and professional nurses' barriers to ICT adoption in practice, there is a lack of evidence of the barriers to ICT adoption by undergraduate student nurses during their education. ICT adoption by undergraduate student nurses, also in private nursing education institutions, is necessary because the higher education institutions in South Africa are directed by the National Plan for Higher Education and the Draft Paper on e-Education 2003, which supports the role of ICT to enhance education (Ravjee, 2007:29).

Undergraduate nursing education is also conducted at private nursing education institutions in South Africa, such as Company A (pseudonym used to ensure confidentiality). Company A is one of the three largest private hospital groups in South Africa (i) employs over 13 800 workers at 52 private and multidisciplinary hospitals throughout Southern Africa (Anon, 2014:1), (ii) is a registered private higher education institution (Anon, 2014), and (iii) is a private nursing education institution (South African Nursing Council, 2014b). Company A offers the following programmes: (1) accredited undergraduate nursing programmes (enrolled nurse auxiliary; enrolled nurse and bridging to a registered nurse); (2) various university-affiliated short courses; (3) fundamental nursing programmes, and (4) programmes presented as eLearning, self-study and/or workshops (Ströh, 2007). Olajide (2013:8) has stated that a 2011 international report from Company A revealed this

company's focus on continued development when considering that 641 learners completed undergraduate programmes and 83 learners completed postgraduate programmes during 2011; 911 learners completed in-house structured programmes and up-skilling of 703 learners at 27 education institutions. Student nurses enrolled with Company A have compulsory eLearning activities to do during the course of their training. These activities are available on Company A's intranet and include topics such as medical terminology, fluid balance, neurological assessment, scientific nursing process and electrocardiogram (ECG). Company A provides the ICT infrastructure to student nurses who are assisted to do eLearning activities in a fully equipped computer room. Yet, the researcher, who is a registered nurse educator, experienced that student nurses are reluctant to complete the eLearning programmes, impacting negatively on their academic progress.

The background provided above clearly shows that there is a global need to adopt to ICT utilisation in healthcare and in healthcare education. Countries on other continents have progressed more than African countries regarding ICT infrastructure and policy in healthcare. In South Africa and other developing countries, ICT is predominantly available at higher education institutions whilst a large part of the rural population does not have any access to ICT. Furthermore, the implementation of ICT in nursing education to promote healthcare is a challenge not limited to South Africa alone, but is also evident in other developing countries in general. Yet, limited information is available regarding the adoption of ICT in nursing education as previous research was conducted mainly on post-basic nursing students who are professional nurses. Although literature has identified barriers to ICT adoption at large, insufficient literature was found on national and international databases (EbscoHost, Sabinet, Emerald Scopus, Science direct and Google Scholar) regarding barriers to ICT adoption by undergraduate student nurses in basic nursing programmes in both public and private nursing education institutions in South Africa. As confirmed by Asah (2013:499), computer literacy courses were not part of nursing curricula in the past two decades. Within the challenged South African background of lack of access and poor connectivity, student nurses are exposed to ICT through eLearning programmes in a private hospital group. eLearning programmes are compulsory in the completion of courses. The researcher, who is also a nurse educator at the participating nurse education institution observed barriers when student nurses' access the eLearning programmes. In return, these barriers were then also aligned with national and international events. This lead the researcher to explore how ICT adoption can be enhanced by student nurses using eLearning programmes. Yet, before knowing how to improve ICT adoption, the researcher needed to first understand what might cause poor ICT adoption.

1.3 RESEARCH QUESTION

The following research question has been formulated based on the background and the problem statement: *What are the barriers to and enablers for ICT adoption by undergraduate student nurses at a private nursing education institution*?

1.4 AIM AND OBJECTIVES OF THE RESEARCH

The aim of this research is to enhance ICT adoption by undergraduate student nurses at a private nursing education institution where students have to complete eLearning programmes that support their curriculum.

The objectives were:

- to explore and describe the barriers to and enablers for ICT adoption as part of eLearning by undergraduate student nurses at a private nursing education institution; and
- to formulate recommendations for nurse educators to enhance student nurses' adoption of ICT.

1.5 CENTRAL THEORETICAL STATEMENT

Insight into the barriers to and enablers for ICT adoption of undergraduate student nurses at a private nursing education institution will assist the researcher to formulate recommendations for the nursing education institution to enhance ICT adoption by these students. Increased ICT adoption might imply enhanced utilisation of established eLearning programmes and enhanced competency amongst student nurses, which may in return improve healthcare outcomes.

1.6 DEFINITION OF KEY CONCEPTS

The concepts defined below are central to this research.

Information communication technology (ICT)

ICT refers to the tools that allow the exchange of information and knowledge and the execution of work by means of integrating information, documents and employees (Lopez-Nicolas & Soto-Acosta, 2010:523). It includes eHealth, eLearning, internet, intranet, computers and devices and any other form of information technology (ITU, 2013; WHO, 2012a; WHO, 2012b; WHO, 2013a). ICT in this research refers to all the forms of information technology (IT) and all applicable devices used supplementary to the student nurses' learning programme.

Information technology (IT)

ICT is closely linked with information technology (IT); therefore IT is also defined. The Oxford Advanced Learner's Dictionary (2010:770) refers to IT as the use of electronic equipment to store and analyse information, predominantly in reference to computers. In this research ICT is used as the umbrella term and includes IT as well.

ICT adoption

ICT adoption refers to the intention to use a specific technology or service (Pederson, 2005:205). ICT adoption is synonymous with ICT adaption. In this research ICT adoption also refers to student nurses' adoption of ICT, with specific reference to eLearning.

eHealth

The WHO defines eHealth as the use of ICT for health and includes the use of ICT to support treatment of patients, to educate students, to do research and to track diseases and monitor public health (WHO, 2012a:1). In this research, eHealth is used in the context of educating students and using eLearning.

eLearning

ELearning is described by the WHO in the Atlas of eHealth country profiles (WHO, 2011:vii) as the use of ICT for learning. elearning is an aspect supplementary to student nurses' curriculum that are presented online, accessible only through computer technology and

access to the internet or intranet, to increase accessibility to education (for geographically isolated, or inadequate learning facilities).

Blended learning

Blended learning is described by the Oxford Advanced Learners' Dictionary (2010:142) as a way of studying a subject, combining class content with different technologies, including learning over the internet.

Barriers

Barriers refer to situations, rules or problems that prevent something, or that makes it impossible for individuals to do something (Oxford, 2010:106). In this research barriers refer to all the aspects that prevent student nurses' optimal adoption of ICT as part of their learning programme.

Enablers

Enablers refer to that which assists a person to achieve a goal or outcome (Merriam-Webster, 2014) and in this research enablers are the aspects that help student nurses adapt to ICT in the eLearning programme that is compulsory to all students.

Student nurses

Student nurses (also referred to as pupil enrolled nurses, R2175); are described in Regulation 2175 in terms of Section 16 of the Act (Act No. 50 of 1978). A person shall be enrolled as a nurse if:

- she (also referred to as he) has received the education and training referred to in these regulations at an approved nursing school;
- she (also referred to as he) was enrolled as a pupil nurse; for the duration of the course referred to in these regulations;
- she (also referred to as he) has attained the course objectives referred to in regulation 6;
- she (also referred to as he) has passed the examinations referred to in regulation 8 or has been exempted therefrom in terms of regulation 7;
- the nursing school where the course was followed has submitted a satisfactory record to the council (South African Nursing Council, 2014a).

Student nurses (also referred to as enrolled nurses, R683) are described in Regulation 683 in terms of Section 16 of the Act (Act No. 50 of 1978). A person shall be registered as a general or psychiatric nurse, as the case may be if she (also referred to as he):

- has received the education and training referred to in these regulations at an approved nursing school;
- was registered as a student in terms of the regulations regarding registers for students;
- has successfully completed the course prescribed by regulation 7(2), and has complied with the programme objectives set out in regulation 7(1).

In this research the focus is on student nurses' (enrolled in the R2175 programme; or registered as a student in the R683 programme) adoption of ICT within their learning programme at a private nursing education institution.

Private nursing education institution

A private nursing education institution (NEI) is a nursing education institution funded by a private company and accredited with the South African Nursing Council (SANC) under the Nursing Act 33 of 2005, Section 42 (South African Nursing Council [SANC], 2014b).

1.7 RESEARCH METHODOLOGY

The research methodology is described as the research design and research method.

1.7.1 Research design

A qualitative, explorative, interpretive descriptive, contextual design (Grove *et al*., 2013:66) was followed to identify the barriers to and enablers for ICT adoption of student nurses at a private nursing education institution in the Free State, South Africa. An explorative design was appropriate to this research because there is insufficient research (Creswell, 2007:37-39) conducted within the South African context regarding the barriers to and enablers for ICT adoption by student nurses; and student nurses that need to complete compulsory eLearning programmes will be explored within their natural setting. An interpretive descriptive approach was followed because it acknowledges the constructed and contextual nature of human experience, and simultaneously allow for shared realities (Thorne *et al*., 2004:5). The interviewer was the key instrument for data collection. Within this focused field, the research was contextual because the researcher was only interested in undergraduate

student nurses enrolled in a private nursing education institution exposed to the realities of eLearning supportive to their curriculum.

An interpretive descriptive approach was further conducted through multiple sources of data used in writing format (narratives) and through words (focus groups). Data analysis was interactively, recursively and inductively whereby the interviewer and the researcher worked with the student nurses in a bottom-up approach to get structure and meaning into themes. As the researcher became engaged with data collection and investigating the research problem, the research design was emergent, as the researcher learned more of the research problem. This in return influenced the research design and data collection methods. The researcher strived to provide a holistic perspective of the complexities surrounding the barriers to and the enablers for ICT adoption by student nurses rather than a superficial cause-and-effect account. This research is focused only within a nursing education institution's undergraduate student nurses within a learning centre that is adjacent to a private hospital in the Free State Gold Fields, central South Africa.

1.7.2 Research methods

Research methods are divided into research setting, data collection, data analysis and the role of the researcher.

1.7.2.1 Research setting

The setting refers to the physical, social and cultural location where the research was conducted. Data was collected at the private nursing education institution adjacent to an exclusive private hospital in the Free State Gold Fields. Students enrolled at this private nursing education institution were full-time employed by Company A. Students applied through a national application process and were selected and allocated to specific hospitals and nursing education institutions. The nursing programmes presented included training to sub-category nurses. One year training led to enrolment as an auxiliary nurse and two year training to enrolment as an enrolled nurse (SANC, 2014a). Students had the opportunity to do a further two year bridging course, leading to registration as a general registered nurse (SANC, 2014a). The private nursing education institution presented with one full time lecturer, registered as Nurse Educator with the SANC. The facility is completed with a lecture room and a computer room with three computers. All the computers were connected to Company A's Intranet, accessible to students during office hours. The students' academic

calendar consisted of theory and practical hours according to the specific qualification they were registered for at SANC.

1.7.2.2 Data collection

Population, sampling, sample and sample size

The population (Grove *et al*., 2013:351) included pupil enrolled nurses and bridging nurses (on their way to registering as general nurses), practicing under Regulation R2175 and R683 of the South African Nursing Act (Act nr 33 of 2005) at a private nursing education institution in the Free State (N=17). The reason why this population was the focus in this research was because it included students that had first-hand exposure to eLearning in their nursing programmes. This sample was used because the unique characteristics of the students in this particular environment could provide rich information (Rossouw, 2012:113). The sample presented 17 predominantly female student nurses aged 19 to 46 years and represented different indigenous cultures and language groups. The researcher had access to the population (Grove *et al*., 2013:351) as the researcher was familiar with the eLearning programmes available to students enrolled at the private nursing education institution. The sampling method included making use of an all-inclusive sample. This sampling method was selected in order to get rich information from the specific group (Grove *et al.*, 2013:365) of student nurses according to the inclusion criteria (Botma *et al*., 2010:124), to prevent sampling errors, and to avoid biases in the selection of the participants.

The population was small and well-defined (Grove *et al*., 2013:352) and the sample selected according to the following inclusion criteria, namely students:

- registered as pupil enrolled and bridging students at a private nursing education institution during the period of January 2015 to December 2015;
- willing to participate voluntary;
- who provided written and informed consent; and
- who were proficient in business English.

The exclusion criterion was if students withdrew at any stage of the data gathering process (focus groups or narratives). Only the students who signed informed consent and were willing to participate were included.

Recruitment and informed consent

The *researcher* applied for ethical approval for the research, compiled an advertisement, arranged the logistical aspects and identified a mediator. The researcher was not part of the recruitment process or the signing of informed consent (**see** annexure A) as this would have posed conflict of interest. However, the researcher provided the informed consent documents to the mediator and discussed it thoroughly. The prospective participants were recruited by the mediator (enrolled nurse who trained at Company A within the past two years). Information regarding the research was discussed with them. Prospective participants who indicated their willingness to participate were provided with the informed consent document at least 24 hours before the focus groups were conducted, by the mediator. If the prospective candidates needed more information about the research or about the process, they could contact the researcher to clarify their questions. The researcher's details were visible on the advertisement (**see** annexure B). The mediator made field notes during, before and after the data collection process, and ensured that participants' ethical rights were attended to.

The researcher identified in collaboration with her study leader, a competent interviewer. The researcher arranged a meeting with the interviewer to discuss the proposed research and focus group schedule. Confidentiality agreements were signed by the mediator (**see** annexure C) and interviewer (**see** annexure D). The interviewer received extensive training to conduct the focus groups (according to her experience and curriculum vitae) and facilitated the completion of the narratives.

Informed consent documents were in English on a level that the participants would find easy to understand, as the medium of instruction at Company A is English. The focus groups and narratives were therefore conducted in English. The informed consent document was explained in detail by the mediator, as well as what the participants could expect and the advantages and disadvantages of the research. Prospective participants were allowed to take the informed consent document home (**see** annexure A) to discuss it with their families and friends so that they could make an informed decision before giving their consent. Prospective participants were ensured by the mediator that participation was entirely voluntary, and that if they wished not to participate, it would not influence their marks negatively. Prospective participants were informed that they may withdraw from the study at any stage, even after signing informed consent without being discriminated against. Continuous voluntary consent was ensured by the mediator.

Method of data collection

Two methods of data collection were used. These included focus groups and written narratives. Field notes included written observational and reflective notes throughout the data collection process.

Phase 1: Focus groups

The first method of data collection was semi-structured focus groups (Polit & Beck, 2006:291) conducted by an independent and trained interviewer to gain a detailed picture of the participants' viewpoints and responses. A focus group entailed the interaction between specific participants to share their views and perceptions. Focus groups were used to facilitate interaction among participants in a nonthreatening environment, helping them to express their views openly (Grove *et al*., 2013:274). From the 3 focus groups, participants discussed and added information and life experiences to statements made by other group members. Focus groups were used instead of one-on-one interviews as interviews in this particular area might pose more discomfort to participants, for example "stage fright" and be experienced as invasive (Grove *et al*., 2013:273). The research setting was the learning centre at Company A. This setting was familiar and non-threatening to the student nurses and they could access this centre with ease. Rich data could be collected over a short period of time (Botma *et al.*, 2010:210). Participants were informed of the process of data collection to ensure a facilitating environment.

The focus groups' composition was student nurses (enrolled under R2175 and R683 at SANC) registered for the same programmes through the private nursing education institution in 2015, despite being from different age groups, language and cultural groups. The mediator accommodated 5 to 6 members per focus group. The mediator conveyed the following information prior to data collection and granted participants at least 24 hours to consider their participation: (i) the research aim, (ii) the inclusion criteria for participation and the methods of data collection, (iii) the provision of refreshments but no incentives, (iv) the date, time and venue, (v) withdrawal allowed at any time without discrimination, and (vi) the availability of support after each focus group.

Focus groups were conducted in the lecture room at the private nursing education institution. The facility ensured comfortable seating and was sufficiently ventilated. The date and time of the focus groups were 25 September 2015 at 09:00, 10:30 and 12:00. On the day of the focus groups, privacy and confidentiality were ensured by restricting entry to only

participants, the mediator and the interviewer. A notice was placed on the door to prevent interruptions. The researcher was not present on the day of the focus groups, and participants were informed of this fact. Chairs were placed in a circle-like structure and a digital voice recorder was positioned central to the circle on the table. Participants were informed in advanced and before the focus groups of the use of a digital voice recorder. Voice recordings were transcribed by a transcriber identified by the study leader. The transcriber signed a confidentiality agreement (**see** annexure E).

The focus group questions were developed by the researcher, identifying four main challenges from previous student groups in this specific setting, and consulting literature regarding the topic. In addition the Technology Acceptance Model (TAM) developed by Davis (Davis *et al.*, 1989:982) guided the researcher to compile the following questions:

- What do you see as information communication technology (ICT)?
- How do you view the use of ICT in your studies?
- What prevents you from using ICT in your studies?
- What can help you to use more ICT in your studies?

The questions were typed and handed to the interviewer with sufficient spacing allowed for field notes. A venue used had a round table to allow eye contact between participants. The independent interviewer conducted the focus groups on behalf of the researcher. The interviewer was knowledgeable of this research theme as she completed a Magister Curationis (MCur) degree titled “Enhanced use of information and communication technology by professional nurses in distance education”, and conducted focus groups herself during the above degree in 2014-2015. Therefore the interviewer was able to facilitate discussions and the direction of the focus groups. The interviewer was also selected because she has more than 20 years teaching-learning experience in nursing education, had a warm personality and communicated easily. The interviewer was selected based on her experience with data collection during qualitative research about a similar topic (with post-basic students) and her curriculum vitae. She listened and talked during the focus groups and was able to pick up perspectives central to this research. The interviewer and researcher met at a time convenient to the interviewer. The researcher discussed the research proposal with the interviewer. The study leader evaluated if the interviewer was competent to conduct the focus groups.

The interviewer familiarised herself with the question guide (sent to her by e-mail from the researcher) prior to the research as it was her responsibility to ensure continuous conversation and to direct the focus groups. The focus group process was as follow:

- Upon arrival at the venue, the interviewer set the atmosphere by being friendly and confident and making small talk prior to the focus group discussions.
- After informed consent was signed by the participants and mediator, the interviewer let the group sit in a circle where they were formally greeted.
- The interviewer explained basic ground rules: all said in the focus group is confidential (although due to the nature of focus groups only partial confidentiality can be assured); no participant will be pressured to talk but everyone will get an opportunity to participate, the participants' contributions are valued and the focus group is a discussion where there are no wrong answers. Numbers were allocated to participants, ensuring that they will not be identifiable. If they participate and discussed the questions, they will be addressed on their allocated number.
- The group was again made attentive of the use of the digital voice recorder.
- The interviewer shared the question guide with the participants by reading the questions.
- The interviewer used communication skills such as summarising, paraphrasing, minimal verbal response and probing. In addition, the interviewer will be aware of and actively address group dynamics.
- The focus group concluded by summarising and verifying the main points, by asking if all the points were covered in the summary and to ask if anything else was missed.
- The interviewer expressed her gratitude for the participation and concluded each group.

Phase 2: Written narratives

The second type of data collection was writing narratives. It was anticipated that the use of narratives might tap into individual (Creswell, 2003:21) barriers to and enablers for ICT adoption by student nurses. Narratives are known to give more insight into the racial and ethnic diversity of the participants (Creswell, 2003:77). Research by Geiler (2015) revealed the factors of gender, poverty, age, growing up in rural communities and previous disadvantaged groups as factors inhibiting ICT adoption by professional nurses. The narratives provided an opportunity for participants to write down their own experiences from their point of view, and enabled them to share information which they did not want to share

during focus groups. The narratives provided the participants with two areas to write their stories, namely:

- Who I am and where I come from make it difficult/easy to use ICT because….
- If I had all the ICT available to me in the world, it will influence my studies more/less difficult because.....

Narratives were written in the lecture room, also facilitated by the interviewer. Participants were given the option to decide whether they wanted to continue with the narratives or not without discriminating against them. Participants' names were not written on narratives, to protect their identity. The participants completed the narratives within 30 minutes after the focus group; which has proven to be enough time. A total of 17 narratives were written.

Field notes

The interviewer and the mediator had the opportunity to make field notes (space provided on questionnaire) during each focus group (Botma *et al*., 2010:191). Written reflective field notes following each focus group described the empirical observations and a list of occurrences. Observational notes described events and conversations. The time, place and participants were described to portray the session (Polit & Beck, 2006:306) and reflective notes were recorded after each focus group. Polit and Beck (2008:406-407) suggested reflective notes to include methodological notes, which are reflections about the strategies and methods followed during the focus groups and narratives. Theoretical notes were documented to describe the thoughts of the researcher.

1.7.2.3 Roles were defined as follow

The *researcher* received ethical clearance from the North-West University's Health Research Ethics Committee (NWU–00094-15-51) (**see** annexure F) and consent from Company A (**see** annexure G). A mediator was identified by the researcher and provided with the informed consent documents after a thorough discussion. The researcher and mediator scheduled the date, time and venue for the focus groups for data collection in collaboration with the mediator. The researcher compiled an advertisement and the mediator pinned it to the student notice boards, inviting student nurses to participate in the research. The researcher identified a competent interviewer in collaboration with her study leader and

arranged a meeting with the interviewer at a time convenient for the interviewer to discuss the proposed research and focus group schedule. Confidentiality agreements (**see** annexure C & D) were signed by the mediator and the interviewer. The researcher made it clear that she could not be part of the recruitment or data collection process, but would be available to discuss and clarify the research to prospective participants who requested more information. The researcher and interviewer prepared the venue where the focus groups were conducted; prepared the writing materials for the narratives after the focus groups; which were handed out by the interviewer after the focus group. The focus group recordings were transcribed by a transcriber identified by the study leader. The data analysis of the transcriptions were done by the researcher and study leader. The results will be communicated by the researcher to the participants and to company A on completion of the research. The researcher, study leader and co-leader worked together to finalise the manuscript.

The *interviewer* was identified by the study leader (based on her experience and curriculum vitae) and received extensive training to conduct the focus groups and facilitate the narratives. The interviewer also had the opportunity to make notes (space provided on the questionnaire) during each focus group, but did not make any. The interviewer explained the purpose of the study and explained the practicalities of the focus groups and narratives to the participants. The focus groups would consist of four to six participants; that it would be audio-recorded to enable the transcription and analysis of the information; and that the transcriber, interviewer, mediator and co-coder signed a confidentiality agreement. Codes were used instead of participants' names to protect their privacy (external anonymity). Internal anonymity was not possible because the participants discussed their views in the focus groups. In collaboration with the mediator, the interviewer confirmed that informed consent was signed by all participants, and that they understand that participation is entirely voluntary, and that they may withdraw from the study at any time without any consequences. The interviewer guided the structure of the focus groups and the discussions of the topics (Polit & Beck, 2006:292). Probing questions were asked to clarify and enhance participation. Individual narratives were coded to protect the participants' identities.

The *mediator* was identified by the researcher based on ethical principles. The mediator was an enrolled nurse who completed her studies at company A within the last two years. The mediator was therefore able to relate to the research topic. She was familiar to the participants, but was not in an authority position. The prospective participants were recruited by the mediator. Logistical arrangements were communicated. The date, time, venue and

duration (approximately 30-60 minutes per focus group and 30 minutes to complete narratives after the focus group) were announced to those participants who indicated that they wanted to be part of the study. Participants received the informed consent documents at least 24 hours before the focus group to discuss with their friends and families to make an informed decision. Participants received copies of the informed consent documents. Block periods and off duty times were taken into consideration to accommodate all participants and to cause as little inconvenience as possible. Student nurses were ensured by the mediator that participation is entirely voluntary (Polit & Beck, 2006:93) and that they may withdraw from the study at any stage without any consequences. The mediator ensured that all the demographic information of the participants were completed before the focus group discussions began. She made field notes during, before and after the data collection process, and ensured that participants' ethical rights were acknowledged.

1.7.2.4 Data analysis plan

Creswell's 6-steps method of data analysis was used (Creswell, 2009:184). This analysis involved multiple levels of analysis by following a linear, hierarchical, interactive approach, building from the bottom to the top. The steps followed in this data analysis are listed below:

Step 1: Organisation and preparation of data for analysis by transcribing the focus group discussion. The field notes made by the mediator and interviewer were also considered. A transcriber transcribed the digital audio recordings. A confidentiality agreement (**see** annexure E) was electronically signed by the transcriber before the researcher handed the audio recordings (via external hard drive) to the transcriber. The researcher explained the process to the transcriber. The raw data were kept on a password-protected computer by the transcriber and the transcriptions were sent to the researcher. The transcriber then destroyed all the digital footprints and information from her computer. The researcher kept the original recordings in mp3 format on a password protected computer in her study at home. Codes were used to replace participants' names so that the participants will never be identifiable to the readers. Transcriptions received from the transcriber will also be stored on the researcher's computer for at least seven years. The research supervisor will also keep the data on a password-protected computer in her office at the Potchefstroom Campus of the North-West University for seven years. The researcher and research supervisor will destroy all digital footprints after seven years.

Step 2: Developing a general sense of the data by reading through it and reflecting on the overall meaning. The researcher made notes during this phase. The research supervisor

acted as the co-coder. The transcriptions and the method of data analysis are described in Section 3.

Step 3: The coding of the data involved organising material into segments. Creswell incorporated the coding process of Tesch (1990) into this step (Botma *et al.*, 2010:224), namely:

- A preliminary analysis framework was developed and used during and after the data collection process.
- To get a sense of the whole, all transcriptions were read and ideas were written down.
- One document was picked and read to look for the underlying meaning. Notes were recorded.
- The rest of the data were read and the same process was followed. A list of topics was made; columns were created for each topic.
- The researcher took the list of topics back to the data. Topics were abbreviated and coded. Codes were written next to the appropriate segments of the text, observing for emerging categories and codes.
- Descriptive wording for topics were turned into categories, group categories, and interrelationships.
- Each category was abbreviated and the codes were arranged alphabetically.
- The data were sorted into categories and a preliminary analysis was performed.
- In cases where it was necessary, existing data were recoded.

Step 4: Description and identification of themes. The coding process was used to generate a description of the people and themes. The major findings are arranged according to the themes.

Step 5: A representation of findings was conveyed by the narrative passages.

Step 6: Interpretation of data. The researcher's findings, supported by literature were explained (Botma *et al*., 2010:225) in the manuscript (section three) as part of the final research report.

These six steps were also followed for the analysis of the narratives.

1.8 MEASURES TO ENSURE RIGOUR

Botma *et al*. (2010:232) have combined methods from different authors to ensure rigour in qualitative research, referred to as trustworthiness. This combination of methods was applied to this research and the epistemological standards of trustworthiness were ensured by:

1.8.1 Truth value

> *"Truth value asks whether the researcher has established confidence in the truth of the findings for the subjects or informants and the context in which the study was undertaken"* (Lincoln & Guba, 1985:218).

Credibility was obtained from prolonged engagement with literature on the research problem. As such the researcher conducted a literature study to engage with the literature and to spend prolonged time with the identified research problem. Method triangulation was achieved by using both focus groups and narratives for data collection. Peer review was done by engaging an independent interviewer that completed a Masters-degree in a similar field and regular feedback was given by the research supervisor and co-supervisor to facilitate accuracy. The perceptions of the participants were explored during the focus group discussions and narratives. The focus groups enhanced the interaction between the group members and allowed for different viewpoints to be discussed, while the narratives gave participants an opportunity to give individual feedback. The researcher included all information (negative and positive) in the findings, attempted to stay neutral, knowing that subjectivity is also integral to qualitative research.

1.8.2 Applicability

> "*Applicability refers to the degree to which the findings can be applied to other contexts and settings or with other groups; it is the ability to generalize from the findings to larger populations"* (Krefting, 1991:216).

Transferability was enhanced through a rich description of the realised research methodology. A detailed description of the findings with additional information such as field notes is declared. It is anticipated that this results will only be applicable to homogenise contexts such as similar private nursing education institutions in semi-rural settings where student nurses have access to eLearning programmes. Data collection continued until saturation of data was reached in the focus group interviews and narratives. The final research report serves as an audit trail.

1.8.3 Consistency

"....whether the findings would be consistent if the inquiry be replicated with the same subjects or in a similar context." (Krefting, 1991:216).

Dependability was ensured by reviewing national and international identifiable sources in the literature. A literature review was concluded over a two year period to ensure that the most recent publications are included. The researcher declared the research process followed. The process of recruitment and sampling were described in great length. The interviewer had the competency to clarify participants' responses in the research and has insight into private nursing education institutions and nursing education within semi-rural areas. Data were coded and co-coded and a consensus discussion was conducted to ensure the most accurate reflection of participants' actual responses.

1.8.4 Neutrality

".... freedom from bias during the research process and results description" (Botma et al., 2010:225).

A confirmability audit was conducted to ensure bias-free research. Triangulation of data collection methods and reflexivity through field notes confirmed neutrality. There were ample opportunity to clarify participants' responses during focus groups. After the researcher structured the research process, the researcher had no contact with participants during the recruitment, data collection or data analysis phase to prevent coercion and bias. The researcher declared her position as an educator at the participating private nursing education institution and implemented specific ethical guidelines.

1.8.5 Authenticity

"Authenticity is demonstrated if researchers can show a range of different realities (fairness), with depictions of their associated concerns, issues and underlying values" (Tobin & Begley, 2004:392).

Similar to a piece of art, participants' own views were skilfully explored and clarified by the interviewer during focus groups. The narratives enabled a next level of variety as participants came from different backgrounds and social statuses. Although the focus groups and narratives provided a basic structure with specific questions, participants' responses exceeded these pre-planned structural boundaries and all the responses were considered (Botma *et al*., 2010:234).

1.9 ETHICAL CONSIDERATIONS

Mouton (2012:239) has declared that the researcher might have the right to search for the truth, but not at the expense of the rights of other individuals. In this research the Declaration of Helsinki, adapted by the WHO (*in* Brink, 2009:30-32) was supported as an international guideline for ethical considerations. The fundamental ethical principles *in* Brink (2009:32) were applied in the research, namely:

1.9.1 The principle of respect for persons

Respect for persons was demonstrated by maintaining confidentiality and anonymity. *Anonymity* was only partial due to the nature of focus group discussions, but before onset of the focus group discussions, ground rules were set to protect the participants. Although the researcher knew the participants, their identities were protected and the information was kept *confidential*, with only the researcher, transcriber and the study supervisor having access to the direct responses (Botma *et al.,* 2010:17). All digital recordings on the recording device of the interviewer were destroyed after transferring the recordings to the researcher.

Participants had the right to *self-determination* by having given a choice of participating. Written informed consent was obtained from all participants (**see** Annexure A) before participation in the focus group discussions and narratives. It was explained to the participants by the mediator before the data collection process. The interviewer was independent, therefore non-threatening to the participants. The Learning Centre where informed consent was explained and signed was private, confidential and safe. Participants were all legally competent to sign consent (above 18 years and with the mental capacity to consent). The informed consent document was again discussed in detail by the interviewer and enough time was set aside for participants to ask questions about the research. The benefits and risks were explained in detail. Before the signing of the informed consent, the interviewer made sure that the participants clearly understand what they are signing. The mediator oversaw the process. Comprehensive consent was ensured throughout the focus groups and narratives. The interviewer made sure that participants who felt threatened or who wanted to leave the study at any time, felt free to do so and that they knew that there will not be any negative consequences if they decided to leave. No participants left during the focus groups or narratives. External anonymity was ensured by the external parties signing a confidentiality agreement (**see** Annexure C, D & E).

1.9.2 The principle of beneficence

According to Botma *et al.* (2010:3), beneficence means to do no harm, or to minimise harm and also to do good. The well-being of the participants was secured. The research was non-invasive, but the participants were protected from distress by a mediator. The mediator was known by the participants, but not involved with their training. Participants had the opportunity to ask questions and leave the research at any time. The benefits outweighed the risks. The benefit is that the research community has gained a better understanding of the topic, and has a better understanding of the barriers and enablers students experience with ICT adoption to support their studies. The risks were minimal. Narratives gave the participants the opportunity to add additional information that they did not feel comfortable to share during the focus group interview. No students indicated that they were distressed or uncomfortable. Observations made by the mediator indicated that all participants were emotionally and physically comfortable during the data collection process. Participants could withdraw at any time and support through counselling services was available, free of charge, if needed.

1.9.3 The principle of justice

According to Botma *et al*. (2010:19), the principle of justice is to treat participants fairly and to adhere to the research protocol by giving information to the participants. Only interventions described in the informed consent were conducted. Information was kept strictly anonymous and confidential, and is only identifiable to the researcher, transcriber, study leader and the mediator. An all-inclusive convenient sample excluded unfair selection of participants. The mediator explained the participants' rights, ensured that informed consent was discussed with participants before the data collection. The focus group discussions were done by a trained external interviewer not involved with the participants' training and education. Information was kept strictly anonymous and confidential.

As this research approached enrolled students from the perspective of a vulnerable population, the researcher applied for ethical approval in written format from the Health Research Ethics Committee of the North-West University and it was granted (**see** annexure F). Ethical and goodwill permission was granted by the Ethics Committee of Company A (**see** annexure G), where the research was conducted. Once approval was granted, the research proceeded.

1.10 DISSERTATION OUTLINE

The format example from Mouton (2012:123) determined the outline of the dissertation, namely:

Section 1: Overview and introduction to the research.

Section 2: Literature review titled *Information communication technology adoption in health systems.*

Section 3: Results, presentation and discussions by means of a manuscript. The manuscript titled "*When eLearning becomes compulsory: ICT adoption by student nurses*" was formulated to be published in the Medical Teacher Journal and is at present presented for peer review.

Section 4: Evaluations, limitations and recommendations.

1.11 SUMMARY

The adoption of ICT by student nurses is crucial to the future of learning, and addressing the use of ICT by nurses in healthcare settings in rural and semi-rural areas. The research aimed to identify barriers to the adoption to ICT and to offer recommendations to enhance ICT adoption by student nurses required to do eLearning within a private nursing education institution. Section One presented an introduction to the research problem and an overview of the research methodology. In the following section the reader is accompanied through literature to review ICT adoption in nursing education institutions, globally and in South Africa.

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SECTION 2: LITERATURE REVIEW

INFORMATION COMMUNICATION TECHNOLOGY (ICT) ADOPTION IN HEALTH SYSTEMS

2.1 INTRODUCTION

To contextualise the research problem, researchers have to familiarise themselves with current knowledge. An in-depth critical review of existing literature was undertaken to enable the researcher to understand the area of interest. A range of research products were analysed to find the most appropriate findings in the research field, to explore various past research methods to support current research, to identify valid and reliable instrumentation, and to identify key concepts in the field of study (Mouton, 2012:87).

Adebesin *et al.* (2013) conducted a study in African countries to explore factors that restrict the adoption of eHealth standards and to suggest ways to overcome the barriers. The major barrier to eHealth adoption was identified by the International World Telecommunication Union (ITU, 2013:11) as health information systems' inability to inter-operate and share information. Although a huge number of standards are available, competing and contradicting factors hamper eHealth standardisation. Therefore, the key to achieving inter-operability of healthcare systems is to agree on standards.

2.2 PURPOSE OF THE LITERATURE REVIEW

The purpose of the literature review was to explore national and international literature to gain a deeper understanding of ICT adoption focussed on nurses. The themes investigated in this literature review include: concept descriptions, international perspectives on ICT adoption, ICT models and theories, ICT adoption by nurses and ICT in South African nursing education with the focus on the private sector. The section concludes with conclusions from the literature reviewed.

2.3 CONCEPT DESCRIPTION

Research regarding ICT and ICT adoption entails the use of acronyms and abbreviations that are central to the literature review. Concept descriptions declared in Section One is also applicable in this section and will not be repeated; only extra acronyms are defined below to ensure ease of reading and comprehension.

Canonical Correlation Analysis (CCA)

CCA was developed by Billon *et al.* (2009) to differentiate between the ICT adoption of developed and developing countries.

Clinical Adoption Meta-model (CAMM)

CAMM was developed by Price and Lau (2014) to describe the clinical adoption of health information systems.

Technology Acceptance Model (TAM).

The model developed by Davis (1989) to determine perceived usefulness and perceived ease of use of information technology adoption.

Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour by Ajzen (1991:179-211), was refined from the TRA by Ajzen and Fishbein (1980) (PB or Planned Behaviour refers to the model that results from adding perceived behaviour control to the TRA).

Theory of Reasoned Action (TRA)

The Theory of Reasoned Action or RA by Ajzen and Fishbein (1980), Fishbein and Ajzen (1975) refer to a model from social psychology concerned with determinants of consciously intended behaviours.

Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology or UTAUT, as developed by Venkatesh *et al.* (2003), focuses on explaining individual acceptance of information technology.

Unified Theory of Acceptance and use of Technology 2 (UTAUT 2)

UUTAUT 2 is an extension of UTAUT, including three more constructs (hedonic motivation, price value and experience and habit) (Venkatesh *et al.*, 2012).

2.4 ICT MODELS AND THEORIES

Different models were developed over decades to enhance user acceptance of ICT. Although models such as the TAM (Technology Acceptance Model) (Davis, 1989) were developed for technology in general, it has been used in a number of studies and applied to the healthcare context. The following paragraphs discuss the different ICT models and theories applied to healthcare. The purpose of adoption models is to provide a simplified explanation of the complex adoption process over time (Price & Lau, 2014).

Davis (1989) has developed the TAM to predict and explain system use by participants by focussing on perceived usefulness and ease of use. These variables were the fundamental determinants of user acceptance. Davis (1989) developed 6 scale items for the 2 variables that were pretested for content validity and tested for reliability in 2 separate studies. Perceived usefulness was found to be a higher variable than ease of use in the studies. Ease of use may be a causal antecedent to usefulness and not parallel to perceived usefulness. Davis (1989) has stated that people will use applications to the extent they believe it will help them in their job. With ease of use people will use systems they believe is free of effort. Users are more likely to accept easier systems. The 2 scales were prepared in reference to electronic mail systems (Davis, 1989:324). Davis (1989:334) has suggested that future research is needed to evaluate intrinsic motivation. The study findings indicated that people act according to their beliefs about performance. Although the early studies were conducted to improve white collar performance (Curley, 1984; Edelman, 1981; Sharda *et al.*1988*, in* Davis, 1989:319), many ICT theories and models were developed according to the TAM.

In addition to the TAM, Davis *et al*. (1989) have compared 2 theoretical models for user acceptance of computer technology. Intention models from social psychology were suggested as theoretical foundation for research on human behaviour. Ajzen and Fishbein (1980), Fishbein and Ajzen (1975) have developed the Theory of Reasoned Action (TRA). TRA was designed to explain human behaviour. The TAM used TRA as theoretical basis. TAM is less general than TRA, and a combination of the elements of TAM and TRA allows

one to gain a more comprehensive view of determinants of user acceptance. TRA states that the attitude towards behaviour is determined by a person's salient beliefs (Davis *et al.*, 1989:984). The conclusion of the study was that 3 main insights determine computer use, namely i) computer use can be predicted from users' intentions, ii) perceived usefulness as the main determinant, iii) the perceived ease of use (Davis *et al.*, 1989:997). Both TRA and TAM found that behaviour intention is the major determinant of usage behaviour, and other factors indirectly influence behaviour intention. Both models indicated that perceived usefulness is a major determinant of behaviour intention (Davis *et al.,* 1989:998). This specifies causal linkages between perceived usefulness and perceived ease of use. Yet, the TAM was designed to apply only to computer usage behaviour.

Venkatesh and Davis (2000:187) have indicated that the TAM became a powerful model to predict user acceptance over the 10 years. Although there had been impressive advances, underutilisation of systems continued. TAM explained 40% of user behaviour, and also compared favourably with models such as TRA and TPB (Venkatesh *et al.,* 2003:429). Perceived usefulness was the most powerful tool to predict usage intention. The TPB added perceived behavioural control to the TRA. The TPB included subjective norms, attitude, and perceived behavioural control towards behavioural intention (Venkatesh *et al.,* 2003:429). With advancements and progress, as well as change over a period of time, it became necessary to re-visit the other determinant of TAM, namely perceived ease of use, which has been overlooked (Venkatesh & Davis, 2000:187).

TAM 2 was developed as an extension of the TAM. Four longitudinal field studies were conducted to test TAM 2 and it included theoretical constructs of social influence processes. TAM 2 (Venkatesh & Davis, 2000:187) reflects the impact of the following 3 interrelated social forces on adoption:

Subjective norm: This factor is consistent with the TRA, which was the theoretical underpinning for the original TAM. People choose behaviour to perform a task, whether they favour performing it or not. Staff members are more motivated to perform a task if they know more important referents accepted the task. However, the research results in this area had mixed results (Venkatesh & Davis, 2000:188).

Voluntariness and compliance with social influence: In this study participants were divided into voluntary and mandatory groups. The finding was that the subjective norm had a significant effect on the intention of the participants from the mandatory group, but not the voluntary groups. Voluntariness posits as a moderating variable where potential adopters

perceive adoption to be non-mandatory (Venkatesh & Davis, 2000:188). Participants believe that if a superior or co-worker suggests the usefulness of a system, they believe that it is useful and they intend to use the system.

Image and social influence: Participants respond positively if they believe a system will enhance their image, and more so if important members of the social group believe they should use the system (Venkatesh & Davis, 2000:189). Individuals perceive the usage of a system as something that will increase their status in the group, and that will grant them power and more influence. TAM 2 captures this effect with the subjective norm on image, coupled with perceived usefulness.

Venkatesh and Davis (2000:190) have stated that the direct effect of the subjective norm on intentions for mandatory use will be stronger before implementation and in early use. It will weaken over time as systems develop and individuals' experience increase. The authors have stated that the influence of images on perceived usefulness is not expected to decrease over time. Furthermore, Venkatesh *et al.* (2003:425) have compared 8 different models and subsequently compiled UTAUT. Venkatesh *et al*. (2003:426) have agreed that researchers are confronted by many models and have to choose from a wide variety of models and ignore alternative models. Some models test individual acceptance, while others test organisational acceptance of information technology. The UTAUT focuses on explaining individual acceptance of information technology (Venkatesh *et al.,* 2003:427). Models and theories of individual acceptance were tested, including the TRA, TAM, MM (Motivational Model), TPB, C-TAM-TPB (combined TAM and TPB), MPCU (Model of PC Utilization), IDT (Innovation Diffusion Theory) and SCT (Social Cognitive Theory).

UTAUT has 4 constructs that measure behavioural intention to use technology, namely performance expectancy, effort expectancy, social influence and facilitating conditions (Venkatesh *et al.,* 2012:159). This model was tested and outperformed the individual models from which it was formulated. The findings were that performance expectancy is a determinant of intention in most situations. Gender and age are stronger for men and younger workers (Venkatesh *et al.,* 2003:467), whereas the effect of effort expectancy on intention is moderated by gender and age, and is more significant in older workers and women. These effects decrease with experience. Social influence on intention is contingent on all four moderators. The facilitation of conditions on usage was significant when it was examined in combination with moderating effects of age and experience. However, Gupta *et al*. (2008:146) did not consider the moderating effect of age, because they believed that younger employees do not have a better understanding and exposure to information

systems than older employees. Gupta *et al.* (2008) have used UTAUT to examine adoption behaviour to enhance government-to-employee interactions in a developing country. Venkatesh *et al.* (2003:471) have stated that it mattered for older workers in later stages of experience. The authors have concluded that the scales used to measure the core constructs was a limitation to the study and they focus on identifying constructs that can add to prediction and intention of behaviour above what is already known (Venkatesh *et al.,* 2003:471). UTAUT explained more or less 70% of the behavioural intention to use technology, and 50% in the use of technology (Venkatesh *et al.,* 2012:157). UTAUT was used in many research studies in different contexts, and 3 broad extensions were used in different contexts. The need for systematic investigation and theorising led to the extension of the UTAUT (Venkatesh *et al.,* 2012:158). Gupta *et al.* (2008:152) have concluded that UTAUT is a valid model to understand ICT adoption in governmental organisations in developing countries. Venkatesh *et al.* (2012) have extended the UTAUT and proposed UTAUT 2, which included 3 more constructs, namely:

Hedonic motivation: the fun or pleasure an individual experiences when using a technology is seen as an important role in determining technology acceptance and use;

Price value: consumers bear the price of technology, whereas employees do not. Consumers will use low-cost technology such as SMS's due to lower pricing;

Experience and habit: experience is necessary, but not sufficient to form a habit.

These constructs were a substantial improvement on the items measuring behavioural intention. Age, gender and experience were moderating effects of behavioural intention and technology use (Venkatesh *et al.,* 2012:157). Hedonic motivation and price value were important determinants of acceptance. The authors have stated that hedonic motivation was stronger in younger men with limited experience of technology, while price value was more important to older woman (Venkatesh *et al.,* 2012:171). This study confirmed the importance of the 3 constructs included in the original UTUAT. UTAUT 2 was tested in Hong Kong, where technology is more readily available.

Price and Lau (2014) have developed the CAMM (clinical adoption meta-model), describing the clinical adoption of health information systems. The study was conducted in Canada, which is more developed in terms of ICT infrastructure and adoption than Africa is currently. The authors compared different models for healthcare. Adoption of health information systems is still a concern, even in the developed countries (Price & Lau, 2014). It is evident

that health information systems transform healthcare in societies. Lahrmann and Marx (2010:522) have indicated that adoption models should have certain dimensions to be considered as an adoption model. These factors are that a model should describe a number of dimensions related to adoption, it should be designed for a specific audience and it should allow for variability in assessment. Adoption models were also developed for specific domains in healthcare and differ between countries (Price & Lau, 2014). The CAMM was specifically developed for Canadian health information systems, and is still in the implementation phase. The CAMM model consists of 4 dimensions related to post-deployment adoption. These dimensions are dependent on each other. A health information system is required before use can occur. Within the South African context, this is still problematic. The South African Health Informatics Association (SAHIA, 2013) confirmed that although some universities in South Africa offer eHealth and Telemedicine for post-graduates, there is no under-graduate training available in health informatics. The CAMM is designed to be generic and applied to various hospital information systems, office-based systems, personal health records and health applications on smart phones. The 4 dimensions are:

Availability: End users should be able to interact with health information systems. User access, system availability and availability of the content in the health information system are aspects that should be addressed.

System use: The intended interactions of the end-users are determined by use of the system and user experience of the system, including the time it takes to use the system and the features used.

Clinical/health behaviour: Meaningful adaptation of clinical health behaviours are facilitated by the health information system. This can align with clinical or business goals. The users incorporate information provided by the system into activities not directly related to the system.

Clinical outcomes: Refers to the impacts attributable to the adoption of the health information system.

The 4 domains are summarised with example indicators (Price & Lau, 2014) in Table 2-1 (next page).

Indicators can be developed based on the aspects for each dimension, as relevant to the particular Health Information System and the context of the adoption. Price and Lau (2014)

compared the CAMM to other adoption models, such as TAM and UTAUT. Although TAM and UTAUT are applicable to a range of Health Information Systems, the applicability and benefits of CAMM were higher. The CAMM is found to be generic and can be applied to more clinical adoption contexts and clinical practice in healthcare. Evaluators, researchers, learners and implementers were considered when CAMM was developed.

Table 2-1: Domains and aspects with example indicators (Price & Lau, 2014)

DOMAIN	ASPECTS	EXAMPLE INDICATORS
Availability	System availability, user access, content availability.	• Percentage of uptime of an electronic medical record (EMR). • Number of users with accounts for a Personal Health Record (PHR). • Months of dispensing data for a dispensing record.
System use	Use, user experience.	• Number of log-ins/user/month. • Survey of user experience.
Clinical behaviour	General capacity, specific behaviours.	• Number of patients seen per day in office. • Rates of blood pressure screening.
Clinical outcomes	Patient outcomes, provider outcomes, organizational outcomes, population outcomes, cost outcomes.	• Change in blood pressure. • Nosocomial infection rates. • Rates of obesity. • Changes in relative cost curves for an organization.

Although various models were researched, it is clear from the literature that adoption of ICT is different when comparing developed and developing countries. Billon *et al*. (2009) conducted cross-country research. The researchers recognise that differences between groups of countries exist in terms of ICT adoption patterns. The CCA (Canonical correlation analysis) was used to differentiate between adoption of developed and developing countries' ICT adoption (Billon *et al.,* 2009:596). Factors such as broadband connectivity are the main divide between developed and developing countries. The most important technologies for developing countries are mobile phones, because it is less dependent on ICT structure.

Mobile phones overtake fixed line phones (Billon *et al.,* 2009:597) in developing (low-income) countries, while the use of mobile phones in developed countries are moving to a point of saturation. ICT diffusion are also influenced by public regulation and policies. Local competition and market diffusion impacts the cost of ICT, and therefore access and service cost is one of the key factors that determine the number of ICT users (Billon *et al*., 2009:600). Cultural differences such as language may influence ICT adoption, although not significantly. Most technologies require English language proficiency. The authors have suggested private-public partnerships to provide funding in developing countries, and focussing on the urban population between the ages of 16–65 years. Non-expensive activities such as telecommunication infrastructures in community centres, schools and libraries will promote low-cost ICT use (Billon *et al.,* 2009:608).

Although there are many models to choose, most literature related to the ICT adoption in the African context refers to the TAM by Davis (1989). Jimoh *et al.* (2012) used TAM to determine the adoption of ICT by health workers in Nigeria. The authors suggested that an expanded TAM should be mandatory during the pre-implementation study among all health workers in low-resource settings in sub-Saharan Africa (Jimoh *et al.,* 2012:773). According to Sackett (2014), the best models are believed to be the TAM 2, HITAM (Health Information Technology Model) and UTAUT 2.

2.5 ICT ADOPTION BY NURSES

Globalisation brought the world closer through information and knowledge and this has a direct and an indirect impact on people's health (Alexandru *et al.,* 2007:287). ICT's are powerful tools to improve health information dissemination (Alexandru *et al.,* 2007:288). It is possible to bring educational opportunities to more people of all ages, including rural populations, previously excluded groups and woman facing social barriers (Alexandru *et al.,* 2007:289). While and Dewsbury (2011:1302) have confirmed that the impact of ICT on nurses' working lives are not adequate, and that nurses should engage more with ICT to shape the care system on nurses' ICT and communication skills (While & Dewsbury, 2011:1304). ICT's are part of the solution to the health care challenges. Patients should not be the only beneficiaries of ICT, it should also provide nurses with increased accessibility to evidence, as the demand on nursing practice increases.

Billon *et al.* (2009:608) have compared the cross-country digital divide by using the CCA model to explain differences in ICT adoption. The authors distinguished between different patterns of ICT adoption between different groups of countries. Different studies were reviewed to indicate some of the unique situations experienced in developed and developing countries. Singh and Muthuswamy (2013:1531) have conducted a study in India. Research was conducted in medium-sized private hospitals. Electronic health records were used by only 33% of the nurses. The lack of training was the main barrier to adopting electronic health record keeping. Factors for successful adoption are financial support, incentives, quality of care and ICT's for basic administrative tasks. The author has stated that contributing factors to adoption are firstly lack of training. Healthcare workers should be well trained to use electronic records, because it can create frustration. Lack of time was a concern (Singh & Muthuswamy, 2013:1532). Heavy workload was one of the concerns that physicians had. They also showed a fear of electronic media with regard to the transition from paper-based to electronic records, and was worried about the fact that there is no direct patient care while using electronic medical records. Privacy is one of the primary concerns in hospitals. The security of information should be guaranteed and unauthorised access should not be possible (Singh & Muthuswamy, 2013:1533). The American Recovery and Reinvestment Act of 2009 provided incentives for physicians to adopt electronic health records (EHR) (Singh & Muthuswamy, 2013:1532). Furthermore, Rajagopal (2013:79-96) has identified that of the different stakeholders in healthcare in India, patients are the major beneficiaries of health care technologies. Patients benefit from faster access to health care and better quality health services (Rajagopal, 2013:81). South Africa, Germany and Sweden are among the countries with insufficient funding for EHR implementation. Yet, South Africa has already moved towards a government-funded national system (Singh & Muthuswamy, 2013:1532). The authors have concluded that training programmes should be provided for nurses so that they can also realise the benefits of EHR's. This is vital for successful implementation of EHR's.

Onu and Agbo (2013:63-69) have identified several factors that affect adoption of ICT by nurses in the state of Ebonyi in Nigeria. Two major factors were nurses' resistance to new technology and a lack of support from the government. Nurses feel that new technology will have a negative impact on their job. The general belief is that with technology, downsizing will lead to unemployment (Onu & Agbo, 2013:68). According to Onu and Agbo (2013:67), the Nigerian government is not supportive when it comes to the use of ICT in health care systems. Idowu *et al.* (2008:21) have also indicated that the Nigerian government's attitude towards the use of ICT is not supportive. Onu and Agbo (2013:68) have suggested that the

Ebonyi state government should establish an independent agency and empower them financially to expose nurses to ICT to improve better healthcare delivery in Nigeria.

Isabalija *et al.* (2011) have studied the factors affecting adoption, implementation and sustainability of telemedicine information systems in Uganda. Two case studies were done in Ugandan hospitals. The findings were that the key factors affecting telemedicine in Uganda was lack of telemedicine policy, knowledge and skills, and resistance to change by members of staff in hospitals. In developed countries IT is used by doctors to send live video, sound and images between distant locations and for examining patients in clinics, which reduces the costs considerably (Isabalija *et al.,* 2011:300). These applications improve patient care by giving local health workers access to remote specialists' skills and knowledge. The implementation of these frameworks in Uganda failed or stopped during the early stages of implementation. The reason was a lack of implementation frameworks. The authors found that respondents were not knowledgeable on and skilled with telemedicine. Policy and availability is crucial for sustainable telemedicine (Isabalija *et al.,* 2011:312).

In Ghana, Sarfo and Asiedu (2013) have interviewed registered nurses from all health service levels. Senior and junior nurses had a fair knowledge of computers. The nurses acknowledged the need for incorporation of computers into nursing care, but felt that the lack of organisational support is problematic. Rank, age and gender had an immense role in the nurses' perception of the importance of computer skills acquisition and the lack of programmed nursing software worsened the situation (Sarfo & Asiedu, 2013:209). Although nursing informatics has emerged as a global speciality, it is clear that in some developing countries ICT's are still lagging behind in scope. The WHO drafted the eHealth project in 2005, which improves this matter. In contrast to the situation in Nigeria, where the government does not support ICT in nursing and nurses resists technology (Onu & Agbo, 2013), the ministry of health in Ghana and the Investment Fund for Electronic Communication support the up-scaling of computers, internet and training of healthcare personnel and nursing training institutions (Sarfo & Asiedu, 2013:210). Nurses in Ghana agree that the use of computers in healthcare is important. Respondents see online distance education and in-service training through eHealth as a vital source for nurses in developing countries, and feel that eHealth should be included in the curricula of student nurses. Once nurses received the training, they saw the need for informatics in their departments (Sarfo & Asiedu, 2013:214). Past training in informatics influenced their interest in acquiring further computer skills. Older age was a barrier to learning new technological trends and some of the older nurses did not show any interest in acquiring computer skills. Female adoption was

less, although some females saw the importance of learning to use computers. They perceived males as being more interested in computers. Juniors saw the use of computers as something that brings status or prestige, while the senior nurses believed that the juniors will mismanage the few computers in the hospital because they have little use for them (Sarfo & Asiedu, 2013:215). Although the ministry of health supported ICT by the Ghana Investment Fund for Electronic Communication, lack of funding and lack of institutional acceptance were also problematic. The high cost of computers meant that fewer nurses own a computer, leading to less competency in ICT use. The authors have concluded that ICT training and the importance of computers in nursing should be emphasised. This should be regulated by international nursing informatics standards. Government should make computers accessible to all units in the hospital, and should be nursing-friendly. Nursing informatics should be encouraged by nursing educators and professional regulatory bodies. Informatics should be included in the curriculum of nurses (Sarfo & Asiedu, 2013:218).

Similar to Ghana, Woreta *et al*. (2013:4) have confirmed that Ethiopian students in rural areas have a less positive attitude towards ICT than their counterparts in urban areas. The availability of ICT facilities such as internet connectivity, electricity and telephones were some of the reasons for the less positive attitudes in rural areas. Woreta *et al.* (2013:4) have indicated that people will respond positively after increased exposure to ICT tools. Developing countries are in contrast with developed countries. ICT usage in education in developing countries is limited (Woreta *et al.;* 2013:1) in contrast to developed countries such as the United Kingdom and the United States of America, where numerous advanced initiatives are aimed at assimilating computer literacy into nursing curricula and clinical practice (Sarfo & Asiedu, 2013:210).

Fetter (2008) has emphasised the importance of IT competence in baccalaureate nursing programmes in the United States of America. The author has recommended more advanced faculty knowledge and skills. Performance expectations should be documented for students and faculty and the effect of IT on students should be evaluated. Leaders in nursing colleges, accrediting bodies and agencies should work together to adopt standardised IT literacy outcomes for nursing students (Fetter, 2008:10). Christensen and Remler (2009:1013) have indicated that despite greater investment in ICT by politicians to decrease medical costs in the United States of America, adoption is still low and not fully understood. Legal issues and financial barriers are some of the reasons for slow adoption. New technologies require training, which increases the cost considerably, whilst interlinked markets in healthcare complicate it further. Health care services, health insurance and the

labour market are interlinked, with government also playing a role as insurer (Christensen & Remler, 2009:1017). Technical compatibility and interoperability standards are critical (Christensen & Remler, 2009:1029). Incentives to providers influence the use of ICT in health care. Policies to facilitate and accelerate adoption should be implemented by government through setting technical standards and a common operating platform to accommodate diversity. However, slow adoption might be better for society to avoid adopting the wrong type of ICT (Christensen & Remler, 2009:1030). The cost of technical errors is higher in health care than in other industries and can result in permanent disability or death (Christensen & Remler, 2009:1024).

The absence of research on ICT adoption among nurses in their working lives was identified and the conclusion was that nurses should engage more with ICT to shape the healthcare system (While & Dewsbury, 2011:1302). Petit dit Dariel *et al.* (2013) have explored the underlying factors influencing eLearning adoption in nurse education in the United Kingdom. eLearning in the United Kingdom has a high profile, but is not readily integrated with teaching practice in nurse education. There is a wide variety of views regarding eLearning in nursing education among academics (Petit dit Dariel *et al.,* 2013:1289) and the adoption rate by individual academics to eLearning is limited. Bartholomew (2011:564) has indicated that academics in the UK acknowledge these limitations. External factors influencing eLearning adoption was lack of time, lack of training and lack of infrastructure (Petit dit Dariel *et al.*, 2013:1290). These factors should be addressed by the institutions. Various studies were conducted by researchers, using the TAM (Davis, 1989) to measure the academics' intention to engage with eLearning. Perceived usefulness and perceived effectiveness are the factors identified to predict eLearning adoption by academics. Academics identified common factors such as technology that does not work, no time, no training, and limited access as barriers (Petit dit Dariel *et al.,* 2013:1290). Underlying factors was the unwillingness of academics to move outside their comfort zones. Other influencing factors were identified as academic culture, nursing culture and social networks. The potential and possibilities of technology in the classroom is held by the educators' vision of teaching and learning (Petit dit Dariel *et al.,* 2013:1297). eLearning strategies and development of staff should inform policy makers to promote eLearning. A possible solution to healthcare challenges in the UK is the use of ICT (While & Dewsbury, 2011:1302-1310).

2.6 ICT IN SOUTH AFRICAN NURSING EDUCATION WITH A FOCUS ON THE PRIVATE SECTOR

The importance of ICT to the future education domain in healthcare is tremendous (Alexandru *et al.,* 2007:287). ICT changes the way people can access knowledge in healthcare. Undergraduate nursing education in South Africa is conducted at amongst others private nursing education institutions, such as Company A (pseudonym used to ensure confidentiality). Company A employs over 13 800 workers at 52 private and multidisciplinary hospitals throughout Southern Africa (Anon, 2014:1), is a registered private higher education institution (Anon, 2014) and a private nursing education institution (South African Nursing Council [SANC], 2014b). Student nurses enrolled with Company A have compulsory eLearning activities to supplement their training. These activities are available on Company A's intranet and include topics such as medical terminology, fluid balance, neurological assessment, the scientific nursing process, electro-cardiograph (ECG) and Waterlow scales. Company A provides the ICT infrastructure to student nurses, who are assisted to do eLearning activities in a computer room. The researcher has identified that students are still reluctant to complete the eLearning programmes. Limited resources are available regarding the use of ICT in the private sector. Most previous studies had been conducted at tertiary institutions such as universities, and the focus was mainly on post-graduate level. A literature search on national and international databases (EbscoHost, Sabinet, Emerald Scopus, Science direct, GoogleScholar) revealed insufficient literature regarding barriers to ICT adoption by undergraduate student nurses in basic nursing programmes in both public and private nursing education institutions in South Africa.

The SAHIA (South African Health Informatics Association) (2013) is a National Health Informatics Association established in 1982, scoping for opportunities to collaborate with higher education institutions for capacity building. In the capacity building statement it is indicated that there is currently no training available in health informatics for undergraduates. Several universities offer training in eHealth and Telemedicine for postgraduates. A literature review done by Frehywot *et al.* (2013) in low income countries found that instructors rated eLearning as a good teaching tool. The challenges are access to computers for regular use, bandwidth availability and the cost (Frehywot *et al.,* 2013:15). The different types of eLearning used were videoconferencing, journal clubs and research meetings to communicate with students at distant hospitals. These studies were conducted at the University of KwaZulu-Natal. Frehywot *et al.* (2013:11) have stated that institutional support is critical to sustain eLearning programmes. Investments are substantial and to be

successful, eLearning should be integrated with the curriculum. As confirmed by Asah (2013:499), computer literacy courses have not been part of nursing curricula in the past two decades.

2.7 CONCLUSION

In a study by Mapi *et al.* (2008), different trends of adoption of ICT's in a marginalised Africa country was examined and tested in schools in rural Transkei. Adoption of ICT's in rural areas is problematic because these communities lived for years without ICT's, therefore the introduction and adoption of ICT's is problematic and complex (Mapi *et al.,* 2008:72). Issues to be considered are the perceived need of the community to adopt new innovation, and the possible adopters of these technologies (Mapi *et al.,* 2008:75). The researchers identified education, gender and age as variables influencing the adoption of ICT's. The information provided by their research is included here because it represents many rural realities of South Africa. Illiteracy, poverty, lack of infrastructure; for example poor roads and electricity, are some of the major challenges facing rural South Africa. Motivational factors influencing ICT adoption refer to what the community or individuals think they will benefit by using ICT. Language is one of the challenges to adapt to ICT's and is perceived as tools for educated individuals (Osborn, 2010). Poor comprehension of English generates fear of using ICT's. ICT adoption was influenced by 3 major factors, namely education, age and gender. Uneducated people felt inferior towards teachers. Nurses showed interest in being trained, but did not have access to computers due to differences in working hours. The authors concluded that training programmes should be introduced, that schools should use a permanent trainer and ICT's should be included in the curriculum to make adoption successful (Mapi *et al.,* 2008:85).

Rowe (2008), a lecturer at the University of the Western Cape in Physiotherapy, has confirmed that the use of ICT in healthcare is an increasingly important aspect of clinicians' professional practice and can improve the delivery of health services and communication between healthcare workers. It can also enhance decision making through better flow of information. ICT in education is generally known as eLearning and it can take several formats. eLearning has a positive role to play in higher education, but should be seen as enhancing the learning process, and not as the only way of instruction. Eksteen reported in a conference presentation (*as cited by* Rowe, 2008:70) that eLearning provides a well-structured method to solve problems and to reason, but it does not provide interaction and

face-to-face contact. Rowe (2008:71) agreed that although eLearning decreases the opportunities for face-to-face contact, educators must realise that the present student generation views the world through ICT, and that it should be incorporated in their studies. A challenge of ICT in health education and practice is that it can widen the gap between rich and poor, and usually the people who need the internet the most, have the least access (Rowe 2008:73). In addition, educators should be aware of potential new ways to cheat. The incidence of academic dishonesty increases among students who are ICT literate (Stephens *as cited by* Rowe, 2008:74).

Ruxwana *et al*. (2010:17) have researched the uptake of ICT in rural Eastern Cape healthcare centres. ICT's is seen as something to bridge the digital divide between urban and rural health care facilities. This should resolve shortcomings in the rural health sector. The use of ICT's in rural facilities as part of eHealth initiatives is possible, but shortcomings must be addressed. Better access and more e-facilities, health-related information made possible via ICT's and ICT skills training are some of the structural variables that should be addressed. Psychological factors also impact the effective use of ICT applications in e-health solutions (Ruxwana *et al*., 2010:25). The perceived usefulness and ease of use (according to TAM model) decreased the effectiveness of e-health solutions in rural areas. A vital step is to address the shortcomings. The authors have recommended that basic infrastructure (hardware, software and telecommunications) should be improved, as well as the development of ICT skills and knowledge by providing training programmes and policies.

ICT's should be used more effectively. It was evident from this research that limited user participation and lack of information were the major factors that caused ICT projects to fail in rural South Africa. A quality assurance model will aid successful implementation and sustainability of e-health in developing countries (Ruxwana *et al*., 2010:25). Coleman *et al.* (2011) have assessed the eHealth readiness of rural and urban hospitals in the North West Province of South Africa. The authors indicated that computers were not used for clinical duties such as patient consultation, prescription of medication, referral of patients and training of healthcare professionals, but mainly to search for information and to send emails (Coleman *et al.,* 2011). No eHealth solutions were found. The eHealth maturity level was at a zero-level. The authors have recommended the formulation of a provincial e-health framework (PEHF) to integrate systems between hospitals and to enable health care professionals to benefit from eHealth solutions. eHealth is one of the supportive systems that can have a positive impact on addressing some of the challenges in the healthcare system. Substantial sums of money were invested in the North West Province Health Departments'

district and provincial health services. This includes ICT efforts to improve the work processes of healthcare professionals so that they can deliver better health care. Despite the investment, a high number of healthcare professionals still do not receive the benefit of ICT's to improve their work. The authors have recommended the TAM for developing countries, especially rural areas (Coleman *et al.,* 2011). This is seen as vital to introducing any form of technology in rural hospitals. Coleman *et al.* (2011) have compiled an e-health framework to improve work processes, including the effective use of ICT in patient record systems, consultation processes, referral of patients, prescriptions and training. The results of this study clearly show that rural hospitals have less ICT access and equipment. Internet access in rural areas is frequently affected by interruption in electricity supply and poor telephone lines.

Mafenya (2013:59) has concluded that online learning depends on infrastructure, computers and internet penetration and costs. The successful implementation of eLearning often depends on the readiness of the student. Institutions should therefore determine the readiness of the student to accept such technologies prior to implementation. Asah (2013:508) has confirmed that sending nurses on computer courses would not guarantee the adoption of ICT to enhance the profession. At present computers are under-utilised by the nursing profession, particularly in rural health facilities. Lucas (2008:2122) has indicated that chaotic and corrupt health systems in many countries often deliver far less than promised. ICT systems should therefore be treated with caution. Dust free, temperature-controlled environments with a stable power supply are some of the factors that will influence ICT applications. Disruption of one component will have widespread implications in developing countries. Cline and Luiz (2013) have concluded that successful and sustainable ICT initiatives are equally functions of the technology and the change management system accompanying the system implementation. Similarities were found between the South African context and other countries (Nigeria, Kenya and India), such as a lack of basic infrastructure.

2.8 SUMMARY

The adoption of ICT by student nurses is crucial to the future trend of learning and for addressing the use of ICT by nurses in healthcare settings in rural areas. The proposed research can help to identify barriers to the adoption to ICT and can offer possible recommendations to enhance ICT adoption by student nurses required to do eLearning.

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SECTION 3: MANUSCRIPT

WHEN eLEARNING BECOMES COMPULSORY: ICT ADOPTION BY STUDENT NURSES

3.1 DECLARATION BY AUTHORS

The authors hereby declare each contribution as follows:

Maryke de Beer	Outline of the manuscript according to the journal's (Medical Teacher) author guidelines. Wrote the methodology, analysed the data and completed the data, discussion and practical points.
Petra Bester	Conceptualized the manuscript, assisted in formulating the background and problem statement, co-analysed the data and assisted with writing the research results and discussion.
Karlien Smit	Reviewed the manuscript from a trans disciplinary perspective.

By the time of examination, this manuscript has been submitted for peer review and presented to the journal **Medical Teacher.**

Please note that by the time of submission, the authors awaited feedback from the editor regarding conflicting information in the author guidelines regarding the use of the reference style.

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The first page of the manuscript should contain the following information:

i) the title of the paper.

ii) a short title not exceeding 45 characters for use as a running head.

iii) names of authors.

iv) names of the institutions at which the research was conducted.

v) name, address, telephone and fax number, and email address of corresponding author.

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All papers should be accompanied by an abstract of up to 200 words. The abstract should reflect the content of the paper including methods used, results, and conclusions drawn.

Text

This should in general, but not necessarily, be divided into sections with the headings: ‘Introduction’, ‘Methods’, ‘Results’, ‘Discussion’ and ‘Conclusion’.

Practice Points

Up to 5 short bullet points which summarises the key messages of the article should be included (not required for short communications). ‘Practice Points’ will be included in a box at the end of the article.

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Papers submitted as articles should include 'Glossary terms', a definition of at least one term or concept that is a key feature of your paper. Please have a look at the glossary available in MedEdWorld and if you feel there are terms or concepts central to your paper which are not already defined in the glossary please let us know, giving if possible the reference it was taken from. Your definitions will then be added in a box at the end of your paper and added to the MedEdWorld glossary.

References

References should be in APA 6th format, with names and dates in brackets in the text, and the full reference listed at the end of the paper, in alphabetical order by first author, as follows:

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Illustrations and tables should not be inserted in the appropriate place in the text but should be included at the end of the paper, each on a separate page. Tables should be given Arabic numbers (e.g. Table 3), and their desired position in the text should be indicated. Tables should be used only when they can present information more efficiently than running text. Care should be taken to avoid any arrangement that unduly increases the depth of a table, and the column heads should be made as brief as possible, using abbreviations liberally. Lines of data should not be numbered nor run numbers given unless those numbers are needed for reference in the text. Columns should not contain only one or two entries, nor should the same entry be repeated numerous times consecutively. Units should appear in parentheses in the column heading but not in the body of the table. Words or numerals should be repeated on successive lines; 'ditto' or 'do' should not be used. Tables should be typed using single-spacing. All photographs, graphs and diagrams should be referred to as Figures and should be numbered consecutively in the text in Arabic numerals (e.g. Figure 3). A list of captions for the figures should be submitted on a separate sheet (or where figures are uploaded as separate files, captions can be entered during the electronic submission process) and should make interpretation possible without reference to the text. Captions should include keys to symbols. Avoid the use of colour and tints for purely aesthetic reasons. Figures should be produced as near to the finished size as possible. All files must be 300 dpi or higher. Please note that it is in the author's interest to provide the highest

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TITLE PAGE

WHEN eLEARNING BECOMES COMPULSORY: ICT ADOPTION BY STUDENT NURSES

(Word count: 4 717)

Short title as running head: ICT adoption in compulsory eLearning nursing programmes (43 characters)

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Abstract

When student nurses in a private nursing education institution struggle to complete compulsory online eLearning modules, nurse educators search for solutions to address this challenge. There is a lack of in-depth understanding of ICT adoption in private hospitals and nursing education institutions in South Africa. ICT goes hand-in-hand with unreliable and expensive connectivity and poor access. The research objectives were to explore and describe barriers to and enablers for ICT adoption by undergraduate student nurses by means of focus groups and narratives. A qualitative, explorative, interpretive descriptive, contextual design was followed. An all-inclusive, purposive sampling method was used (N=17). Three main and seven sub-themes were identified, namely positive, negative and contrasting realities; technology as a new dimension of the caring presence of nurses and incremental steps to use technology within a technology-enhanced approach within a blended-learning environment. The enablers for technology adoption outweigh the risks to ICT adoption. Against the backdrop of a developing country, South Africa remains underdeveloped in providing affordable and stable connectivity the moment a student nurse leaves the IT infrastructure of a training institution. Yet, context-specific recommendations are possible.

Word count: 183 (maximum allowed: 200).

Key words: Information communication technology, ICT adoption, eHealth, eLearning, barriers, enablers, student nurses, private nursing education institution.

Introduction

The convergence of information technology (IT) and telecommunications gave rise to the term information communication technology (ICT) (Jordan, 2008:388). According to Lopez-Nicolas and Soto-Acosta (2010:523), "ICT's allow information and knowledge exchange as well as work execution by integrating information, documents and employees". ICT provides significant benefits towards achieving health goals and demonstrating what health outcomes have been attained and at what cost (World Health Organization [WHO], 2012a:1). In health, ICT can be applied in the following areas: electronic health records, routine health (e.g. web-based surveillance systems), vital registration such as births and mortality, consumer health informatics, mHealth (mobile devices e.g. cellular phones), telemedicine (use of ICT's to provide care or education at a distance), virtual health care (professionals working together via ICT's) and health research (WHO, 2012a:2). Nonetheless, research has shown that health care workers do not adopt ICT to a sufficient degree. According to Jones and Donelle (2011:2), the major deterrents to health care workers' adoption of ICT are acceptance and adjusting to the changes in established workflow practices. This study explores and describes the barriers to and enablers for ICT adoption as part of eLearning by undergraduate student nurses at a private nursing education institution in South Africa and offers recommendations for nurse educators to enhance student nurses' adoption of ICT will be formulated. The Technology Acceptance Model (TAM) developed by Davis in 1989 helps to understand the reasons why workers in general do not want to use IT, despite having the technology available (Davis *et al.*, 1989:982).

ICT adoption is as much applicable to student nurses as other training and business situations, although Chismar and Wiley-Patton (2003:1) have concluded that technology adoption research in health care is lacking. Albeit not focusing on technology adoption, but acknowledging the importance of ICT in nursing, the Nursing Summit of 2011 (strategic priority 5.3 of 2013/14 – 2016/17), has stated that it is essential for students to have ICT access to assist with learning (South Africa, 2011a:46). In addition, ICT's should be incorporated into nursing and midwifery curricula to improve competency levels (South Africa, 2011a:48). Despite the fact that the WHO is promoting ICT internationally, the health care sector remains one of the slowest to adapt to IT implementations (England *et al.*, 2000:176). Current literature and research are insufficient to address poor ICT adoption by nurses in their working lives (While & Dewsbury, 2011:1302). In fact, 7 years after the 58th Assembly, the WHO concluded that ICT in health care has become a crisis in many countries (WHO, 2012a:1).

Although the United States of America (USA) is one of the leading countries to deliver ICT in health care, it is not yet available to all rural areas (Singh *et al.*, 2010:987). Effken and Abbott

(2009:439) have explored the roles nurses play in ICT to improve healthcare delivery in rural USA where ICT is fragmented. Challenges identified included insufficient funding to educate and prepare nurses; severe shortages in healthcare workers; lack of training and education opportunities; lower remuneration and ICT incompetence of educators. Canadian literature expounds similar challenges as in the USA. The use of ICT in Canada is most popular when applied to mobile ICT, as users resist the adoption of ICT in general (Herbert, 2007:6). Cocosila and Archer (2010:248) have identified that intrinsic motivation played a key role in ICT adoption in the Canadian health care context.

Research focussing on Africa indicates that a lack of local expertise and non-sustainable ICT projects in the developing world left a legacy of scepticism (Abbott & Coenen, 2008:240). Woreta *et al.* (2013) have explored the knowledge and utilisation of ICT among health sciences students in North-western Ethiopia and concluded that students from urban areas used ICT more than students from rural areas. Despite the fact that ICT was introduced into the curricula of preparatory schools and universities in North-western Ethiopia, the level of computer literacy remained low (Woreta *et al*., 2013:4). Woreta *et al.* (2013:4) have reasoned that poor access to computers and inadequate ICT courses cause low computer literacy. In Ghana, urban students in general showed positive attitudes towards ICT compared to students in rural areas (Woreta *et al.*, 2013:3-4). Rural-based students' knowledge was inadequate and their ICT utilization was poor and it was suggested that computer laboratories should be established to develop students' ICT utilization.

In South Africa ICT has only recently become part of strategic planning, therefore limited information is available on ICT in the public sector (South Africa, 2012b:9). South Africa still has to incorporate ICT into nursing education (South Africa, 2011a:46). In the District Health Management Information System Policy (South Africa, 2011b), one of the key challenges for ICT implementation is inadequate ICT infrastructure development and management. Funding for eHealth implementation is available only from the provincial and municipal budgets, which vary in the different provinces. The Free State, Northern Cape and North West provinces had the lowest budgets (South Africa, 2012b:13). In the eHealth strategy (South Africa, 2012b:13), South Africa was categorised at stage 3 of eHealth maturity, with some provinces at stage 1 or 2. Stage 3 implies that the migration of traditional district health information systems to electronic storage and reporting is in place. eHealth relates to several ICT terms. Jahangirian and Taylor (2013:2) have classified eHealth projects into 4 categories: telemedicine, health information systems, health-related research and health education. Jahangirian and Taylor (2013:15) have concluded that communities take time to adopt eHealth and that such technology should be introduced gradually to consider both infrastructural and cultural perspectives. Schreurs *et al.* (2008:268)

suggested that eLearning readiness should be determined before organisations introduce eLearning programmes.

It is evident from literature that there is a global need to adapt to ICT utilisation in health care and in health care education. Countries on other continents have progressed more than African countries regarding ICT infrastructure and policy in health care. In South Africa and other developing countries, ICT is predominantly available at higher education institutions, while a large part of the rural population does not have any access to ICT. Furthermore, the implementation of ICT in nursing education to promote health care is a challenge not limited to South Africa, but also in developed countries in general. Yet limited information is available regarding the adoption of ICT in nursing education as previous research was conducted mainly on post-basic nursing students who are professional nurses. Although literature has identified barriers to ICT adoption in general, insufficient literature was found on national and international databases regarding barriers to ICT adoption by undergraduate student nurses in basic nursing programmes in both public and private nursing education institutions in South Africa. Computer literacy courses were not part of nursing curricula over the past 2 decades (Asah, 2013:499).

Methods

A qualitative, explorative, interpretive descriptive, contextual design was followed to identify the barriers and enablers for ICT adoption of student nurses in a private nursing education institution, Free State (one of nine South African provinces). Student nurses enrolled at the private nursing education institution from January 2015 – 31 December 2015 participated in the research (N=17). The nursing programmes presented include training to sub-category nurses practicing under Regulation 2175 and Regulation 683 of the South African Nursing Council (SANC, 2014a). One year of training leads to registration as auxiliary nurse. Two years of training leads to registration as enrolled nurse. Enrolled nurses apply for the two-year bridging course, leading to registration as a general nurse. The population included thirty (30) predominantly female student nurses aged 18 to 46 years from different indigenous cultures and languages groups. Purposive sampling was conducted by a mediator based on the inclusion criteria (Botma *et al*., 2010:124). The inclusion criteria included being a registered pupil enrolled nurse or bridging nurse student at the private nursing education institution in the period between January 2015 and December 2015; being willing to provide written, informed consent to participate voluntary digitally voice-recorded focus group interviews and writing narratives; and being able to communicate in English as mode of instruction.

To prevent bias and coercion, the researcher, a nurse educator at the identified nursing education institution, had no direct contact with the participants. The participants were recruited by an

independent mediator. An advertisement was posted on the students' notice board, inviting participation in the research. An independent interviewer conducted focus groups of approximately one hour duration each. The research was conducted in two phases: Phase 1: Exploring barriers and enablers for ICT adoption, using digitally voice-recorded focus groups. Phase 2: Exploring participants' individual experiences through narratives to give more insight into participants' diverse perspectives. Field notes were kept throughout the research. It refers to a written description of what is seen, felt, heard, thought and experienced during the research process. Three types of field notes were kept, namely methodological, theoretical and personal notes (Polit & Beck, 2008:406-407).

The researcher received ethical clearance from the North-West University's Health Research Ethics Committee (HREC) and consent from Company A (pseudo name to protect the company's identify). The researcher was responsible for maintaining external anonymity of the participants by using codes, the safekeeping of the data in hard and digital format, the completion of the research report and feedback to Company A. The mediator (non-authorative to participants) recruited participants and explained informed consent at least 24 hours before data-gathering. The mediator was present during focus group interviews and narratives. The mediator wrote field notes during and after data gathering process. An independent interviewer ensured that all participants signed informed consent and participated voluntary.

Results

Demographic profile

[Preferred position for table 1]

Nursing in South Africa is a female-dominated profession. In congruence with the South African Nursing Council's (SANC), gender statistics as in December 2014 (SANC, 2014b), 246 376 of the South African nursing workforce was female. The female to male ratio was 1:0.09. Participants' ages ranged from 20 to 46 years, the average age was above 24 years. This average age of newly registered nurses (all categories) is 33 years (SANC, 2014c). Participants represented five of the 11 official languages in South Africa, the majority spoke Afrikaans as mother tongue. 70.5% of the participants were in their second year of studies. All the participants (n=17) wrote narratives after the focus groups. Transcribed focus group interviews were thematically analysed. Three main themes were formulated as presented in Table 2 (below).

Focus groups

[Preferred position for table 2]

ICT and eLearning as positive, negative and contrasting realities

ICTs weren't limited to academics or eLearning, but encapsulated any technology used, including clinical technology. It referred to everything related to technology and information transferred through communication. The **positive** aspects of ICT were *convenience* and *fast access*. Convenience referred to lightweight devices and use anytime anywhere with limited delays. The majority of participants indicated that ICT is convenient because information is accessible from home, after working twelve-hour shifts. Students don't have to travel to libraries and spend hours searching in books. "…*because sometimes you are busy, we are working from seven to seven so we don't have time to go to the libraries, to go to book shops to find information. So it saves time*" and *"It makes life easier."* Students can access information easily from mobile phones, tablets and computers with internet connectivity. Furthermore, technology improves facilitation by means of Microsoft PowerPoint slides compiled by both students and lecturers in large classes. This became a useful solution when students had limited time to make sufficient class notes. Students agreed that exposure to various types of technology enabled them to use ICT within the eLearning environment quicker.

Students experienced the access to information on various types of devices as fast. Information is available "*at their* (the students) *fingertips*". For participants it was easier to surf the Internet (especially using Google) than using textbooks and libraries. Assignments can be submitted via email and eLearning activities on the Intranet gave immediate results. Participants associated time efficiency with digital and electronic devices, also in hospital. ICT was perceived to be safe and information retrievable. "*..it makes it easier because with the eLearning they give you, they explain to you what you must do, how you must do it and what more or less will be in the test…"*. When it is very busy in ICU, data can be saved and retrieved later on life saving equipment to indicate whether treatment was effective or not. "…*if you are working in the intensive care units, where the patients are continually monitored ... the vital information's are being stored it's easier to just go back*." Participants perceived eLearning as valuable for self-assessment in preparation for examination. eLearning supports *evaluation of knowledge* during exam preparation, for example medication calculation. ICT helps with quality control and can be applied to learning and competence. Quizzes help to determine how much revision and extra study is needed. There is always an opportunity to learn when ICT is available.

ICT was also perceived as having specific **negative** aspects. Not all have *access* to ICT and the internet. Most students have mobile phones, but tablets or laptops are necessary to do assignments, "*..not most of us have access to like computers and laptops and some of us like myself, I never had background in school like of using a laptop or whatever*". Acces is limited when eLearning activities are only available on the intranet and not accessible from home. This was especially difficult for some students living in neighbouring towns or too far away from the hospital to access the intranet. The majority of participants still didn't have internet access from their homes and internet cafés are not available in all the townships. Access is impacted by cable theft and irregular load shedding. Furthermore, data and airtime are *expensive* and students have limited finances available. "*So I think that could also become a barrier point at some stage because some people just won't be able to afford it*."

Contrasting factors were that even if *access to information might have been easy,* the information sources are unreliable as general non-academic websites are unscientific *"…we aren't allowed to use specific websites such as Wikipedia…. , we aren't allowed to use it because anyone can add information on a certain website…"* Furthermore, ICT might be convenient, but it runs the risk of making users lazy to read books and read for a deeper meaning. "*I think it makes us lazy because the internet is here. You get everything there and the information is there.*" One participant stated "*..there is too much information that is accessed at a particular point compared to when you have a book*." In addition, students used the internet for quick fixes, impacting on their ability to reach deep holistic learning instead.

ICT and eLearning as a new dimension to a caring presence

The second main theme refers to the fact that ICT and eLearning bring a new dimension to the caring presence of nursing. Technology has entered the caring presence of nurses and might cause uncertainty and conflicting values when nursing has to occur in a technological environment. The first theme was that technology brings ambiguity regarding the a*ccuracy of manual versus new technology.* Manual devices are more trusted, especially by old school health care professionals, while electronic devices are more convenient and fast. Even when both options are available, students don't know when to select the manual or digital version. The second theme led to ask "w*ho is in control: humans or technology?*" Technology should remain an instrument in service of people and technology should be maintained (such as recharging batteries). There is interdependence between nurses and technology. Technology needs consistent maintenance by nurses to enhance its accuracy "*If batteries don't work correctly you get inaccurate results*." Technology can make certain functions faster and more convenient for nurses, yet, the accuracy of technology remains dependent on nurses' maintenance. In the fourth

place technology is applied to protect patients against students. This led the participants to a*dvocate technology to rule out human error.* When students had mistrust in their fellow student nurses' competence and honesty, they preferred to have technology as a back-up to protect patients.

The fourth theme was that participants acknowledged that nursing and care can be problematic within a technological environment. Participants voiced the view that technology in general necessitates a review of specific ethical-legal aspects. Firstly, there is an *ethical-legal challenge* when technology makes patient information easily available to all nurses. One participant captured the risk to patient confidentiality and privacy by stating: "*As long as I know your surname and your name I can just go into the system and get your results*". In addition to health information systems that include clinical information, social media is also viewed as a risk to patients' privacy *"…I think it has invaded people's privacy.*" Therefore, participants agreed that technology can be applied to nursing to strengthen care, or it can lead to maleficence. One participant stated "…*the patient is a first time in the hospital doesn't know our gadgets; they will have a fright of a life time*". Participants stated that technology is seen as an intruder rather than a fortifier of a caring ethos - "*So giving a patient emotional support and explaining all the procedures helps to benefit the patient because it relaxes the patient and it puts the patient in a more safe environment…*"

Incremental use of technology in eLearning

[Preferred position for figure 1]

The third main theme refers to the incremental use of technology in the eLearning environment of student nurses. Through the focus groups five levels of accessing eLearning through ICT were mapped. These five levels can be viewed as incremental steps in a process to improve student nurses' ICT use, namely:

Technology exposure: Techno-exposure introduces technology to student nurses on a basic level. Techno-exposure is positive and positions the inevitable realities of technology in healthcare and training.

Access through mobile devices for quick fixes: Students access ICT frequently through mobile devices (smart phones) including search engines such as Google. The goal is a quick reference, having a 'brain pocket' at hand.

Basic computer and Internet use: Students use computers (desk computer or tablet computer) to type assignments in addition to mobile devices. When students accomplish basic computer skills,

they become active Internet users. Yet, students access generic and non-scientific websites such as Wikipedia.

Non-scientific Internet use: Students' Internet use is activated by mobile devices. They are aware of their inability to access scientific Internet sources, but lack insight to improve the quality of selected web-based information.

eLearning for self-assessment and superficial learning: Students perceive eLearning not for learning purposes, but for self-assessment and recognise superficial learning opposed to deep learning.

Narratives

The narratives followed after the focus groups. The rationale for the narratives was to grant participants the opportunity to add socio-economic and cultural aspects that might have been too difficult to share during focus groups. The narrative stated: *Who I am and where I came from influence my ability to participate in eLearning*.... Participants could then continue to complete the narrative, should they want to. A summary of analysed results from narratives are presented below (Table 3).

[Preferred position for Table 3]

Student nurses' place of origin ("*I come from...")* presented external barriers to ICT adoption. Aspects in students' physical dimension such as poor connectivity, crime and poverty are realities. Student nurses viewed themselves from their intra- and interpersonal dimensions ("*Who I am..."*) on a continuum from ICT reluctance, unskilled and unable towards ICT adoption in eLearning.

Barriers and enablers

From the focus groups and narrative results, the barriers to and enablers for ICT adoption are synthesised as:

Barriers	*Enablers*
Poor access to ICT in student nurses' physical dimension (Internet, wifi, cost, theft, etc.).	ICT is very convenient with a busy work and study schedule.
ICT coverage is unreliable and inconsistent.	eLearning is perceived as useful for self-assessment.
ICT used for quick fixes leading to superficial learning and lacked deeper comprehension.	Exposure to any technology is worthwhile, be it clinical, personal or teaching-leaning related technology.
Technology brings ethical challenges into nursing.	All students have mobile devices that serve as a first line of exposure to any technology.
Student nurses perceive themselves as unskilled computer users.	Technology in teaching-learning is a compulsory standard forcing students to use ICT.
	Some participants perceived themselves as ICT literate, but with the potential to improve this literacy.

Discussion

Student nurses presented both barriers to and enablers for ICT adopting, including eLearning programmes. *Poor access* to networks is a barrier to ICT adoption in South Africa, although nurses held positive attitudes (Nkosi *et al.,* 2011:876) towards ICT and are keen to become accomplished ICT users (Mapi *et al.,* 2008:85). Mobile broadband is more inconsistent and unreliable in South Africa than fixed-line broadband (Chetty *et al.,* 2013:1). Institutional support is needed to overcome barriers to access, both to hardware and connectivity (Frehywot *et al.,* 2013:11-15). Incorporating the complexities of hospital life into an information system, might improve patient safety. Yet, physicians have reason for being sceptical about technology in hospitals. Health information systems with insufficient data capturing rules, alarm fatigue, combined with human error, multi-tasking and high workloads can become *unreliable* (Wachter, 2015). Digital medical equipment should be managed with caution, considering that the *reliability and accuracy* of a Dinamap 8100 (digital blood pressure machine) evaluated against international criteria concluded that systolic blood pressure was accurate, but not diastolic pressures (Heineman *et al*., 2008:1).

Technology might enhance *superficial (or surface) learning*. Superficial learning entails cognitively passive learning against cognitively active learning as deep learning (Weimer, 2012). Deep learning and organising comprehensive events into one long-term memory can be hindered by cognitive loading – an overload of over-stimulating web-based information (Stanger-Hall, 2012:1). Furthermore, *techno-ethics* in nursing needs further exploration (Korhonen *et al*., 2015:561) so that nurses can be interpreters of technology for their patients (Korhonen *et al*., 2015:572). Data security should be guaranteed as unauthorised access might be possible (Singh & Muthuswamy, 2013:1533). It seems to be an international reality that new generation nurses prefer the *convenience* and access to information (Mather, Cummings and Allan, 2015:1). *Exposure to technology* is essential as an introduction to ICT for student nurses (While & Dewsbury, 2011:1302). eLearning can be applied as a useful *self-assessment* tool when knowledge evaluation is the end goal (Mettiäinen, 2015:42). eLearning programmes can also be useful to teach nurses to conduct assessments, if not self-assessment (Smith, Arnold & Poppleton, 2010:1). In general *mobile phones* are the most used ICT tool in South Africa. It overtook fixed-line phones and is less dependent on ICT structure (Billon *et al.,* 2009:597). There is a movement towards *compulsory use of ICT* in teaching-learning in general in South Africa. Higher education institutions are moving towards the use of ICT to enhance education as directed by the National Plan for Higher Education and the Draft Paper on e-Education (2003) (Ravjee, 2007:29). Also in nursing, informatics have to be integrated into nursing (Sarfo & Asiedu, 2013:218) and midwifery curricula to improve competency levels (South Africa, 2011a:48). Nurses can comprehend the benefits of ICT in nursing in general and view themselves as capable of mastering electronic medical records and other types of ICT. eLearning programmes are beneficial to healthcare professional training, but needs more exploration (Dalhem & Saleh, 2014:1).

Conclusion

Student nurses can't distinguish between teaching-learning-related ICT and clinical technology. Student nurses think of ICT as a cluster of technologies, whether it is hospital-related technology, social use of technology via mobile devices or even simplistic teaching-learning technology such as PowerPoint presentations. Within this clustered view of ICT as all technology, student nurses need to position them within patient care and consider new questions in techno-ethics. A steep learning curve remains for student nurses before they will be more in control of ICT in healthcare and academically. Yet, poor access remains an undeniable reality in South Africa, as well as the high use rate of mobile devices as dominant means for internet access. Infrastructural support can assist students to overcome barriers to ICT in their physical dimension. Although students can access the Internet, they cannot distinguish between appropriate scientific literature versus generic and unscientific sources such as Wikipedia. Google is still used as the primary search

engine. eLearning programmes were perceived as a worthwhile exercise for self-assessment, but not for learning purposes. As students used more ICT and accessed more Internet pages, they risk becoming superficial and cognitively passive learners when a digital information overload cannot be categorised into long-term memory — a reality faced globally and an alert to nursing educators. Yet, the enablers for ICT adoption outweigh the barriers and pave a way for Company A to build on these strengths.

Practice points

The following practice points should be taken into consideration when ICT is implemented into the courses of student nurses:

- Align vocabulary – ICT might not have the same meaning to student nurses than nurse educators.
- ICT is convenient, a quick fix and mobile devices remains the dominant ICT tool – nurse educators should tap into this already known-device combined with any technology within students' practice environment to enhance their exposure.
- In South Africa nursing education institutions cannot assume that student nurses have access to ICT outside the boundaries of the institution's IT infrastructure.
- Techno-ethics is a reality in the clinical and teaching-learning environment and student nurses have to reconsider the role of technology within their caring presence with patients.
- Acknowledge that an information overload of digital origin can influence the natural filing of information from the short-term to long-term memory, risking superficial learning.
- Nurse educators should reconsider the use of ICT within a blended-learning environment and should follow a technology-enhanced learning approach to enhance deep and cognitive-active learning.

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Table 1: Demographic data of participants (N=17)

Criteria	Group 1 (n=6)	Group 2(n=5)	Group 3(n=6)
Age			
(mean age in years)	24.3	31.6	27.6
20-25 years	4	1	2
26-30 years	2	1	3
31-35 years	-	2	-
36-40 years	-	-	1
45-50 years	-	1	-
Gender			
Male	1	-	-
Female	5	5	6
Culture			
Black	3	2	2
White	2	3	3
Coloured	1	-	1
Language			
English	1	3	-
Afrikaans	2	2	4
Sotho/Southern Sotho	2	-	1
Zulu	1	-	-
Xhosa	-	-	1
Programme enrolled			
Pupil enrolled nurse 1st year	1	1	2
Pupil enrolled nurse 2nd year	2	2	2
Bridging course 1st year	1	1	-
Bridging course 2nd year	2	2	2

Table 2: Results from focus groups

Main themes	[A] ICT and eLearning as positive, negative and contrasting realities	[B] A new dimension to the caring presence of nursing	[C] An incremental use of technology in eLearning
Themes and sub-themes	**[A1] ICT and eLearning perceived as positive and negative.** Convenience of ICT. Fast access is available when needed. Save and fast retrieval of data. eLearning enhances knowledge and self-assessment. Limited access is a reality. Expensive data and airtime, students have limited funds available. **[A2] ICT and eLearning perceived with contrasting realities.** Easy access versus unreliability. Convenience versus superficial learning.	**[B1] Accuracy of manual versus electronic devices.** **[B2] Who is in control: man or technology?** **[B3] Advocacy for technology to rule out human error.** **[B4] Care in a technological environment can be problematic.** Ethical-legal aspects of technology in nursing should be addressed. Risk to care and confidentiality is a reality. Protection of patient information should be addressed.	**[C1 Five levels of accessibility of ICT in eLearning.** Mobile phones accessible to most students. Clinical technology enhanced eLearning by exposing students to electronic devices. Students need computers and internet for assignments. Use internet from non-scientific perspective. ICT is applied for superficial quick fixes. Deeper learning/meaning can be problematic.

Table 3: Narrative results

I am.....	I come from...
....a slow learner and eLearning and ICT make my studies more difficult. .....becoming more lazy to use manual skills. .....enjoying ICT and eLearning as I am skilled and can use this to the benefit of my studies. .....aware of the positive and negative aspects of ICT and eLearning. .....fortunate to have information at my fingertips. .....convinced that not even ICT can bring to me all the information I need. .....struggling to search the internet and process information obtained. .....unsure how to fully integrate ICT and eLearning into my studies.	.....areas where ICT is unreliable because of theft and/or poor network access and/or load shedding. .....a household that cannot afford ICT, airtime, data or proper maintenance of electronic devices. .....an environment where I wasn't exposed to ICT making me reluctant to learn new methods.

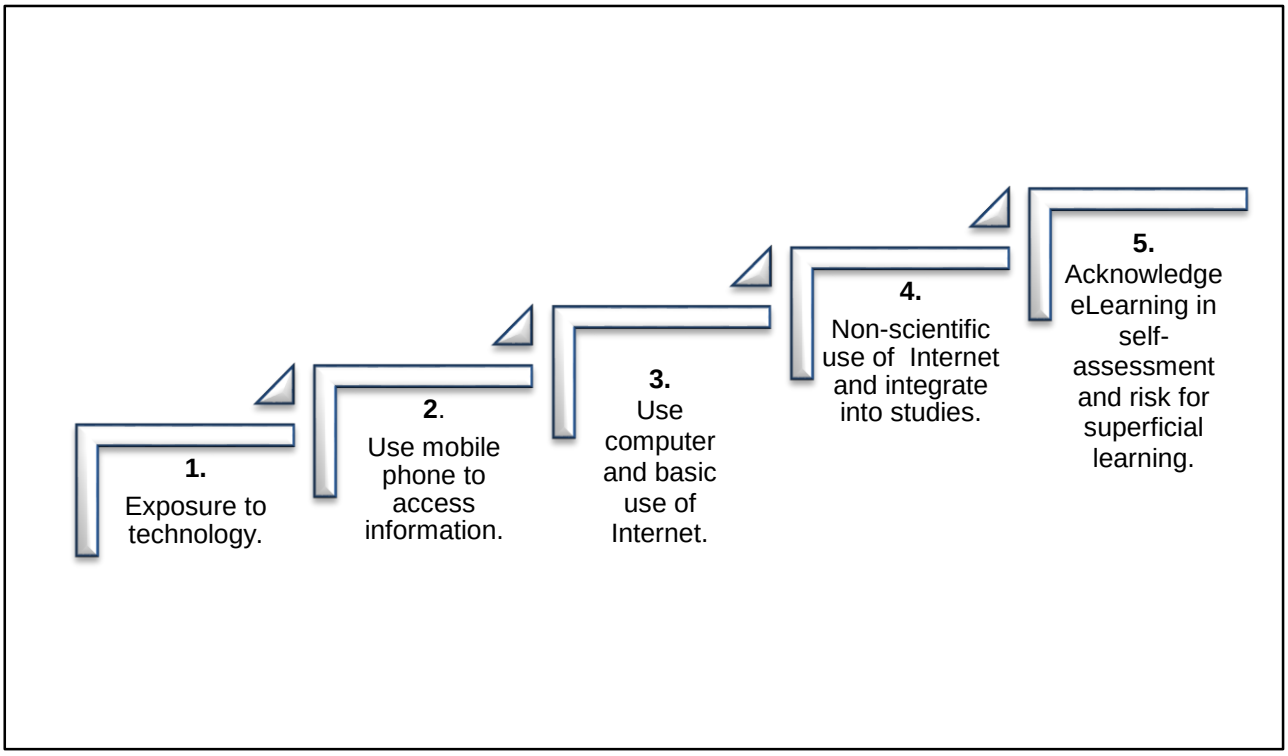

Figure 1: Five incremental levels of ICT in eLearning

SECTION 4: EVALUATION, LIMITATIONS AND RECOMMENDATIONS

4.1 INTRODUCTION

Section 4 concludes the research, evaluates the research and declares the limitations experienced. Recommendations are formulated regarding the barriers and enablers in ICT adoption. Special attention is granted to recommendations for nurse educators functioning within a technology-enhanced approached in a blended-learning environment.

4.2 EVALUATION

In the final section, the researcher conducted a self-evaluation of specific aspects of the conducted research as stipulated below.

4.2.1 Research methodology

A qualitative, explorative, interpretive descriptive, contextual design (Grove *et al*., 2013:66) was suitable for this research. An interpretive descriptive approach was followed because it acknowledged the constructed and contextual nature of the participants' experience, and simultaneously allow for shared realities (Thorne *et al*., 2004:5). Data saturation was reached during the focus groups with a total of seventeen (n=17 of N=30) participants. The chosen methodology was suitable for this study population because it gave the researcher insight into the specific group. The small population was able to identify the barriers and enablers they experienced regarding ICT adoption.

4.2.2 Aim and objectives of the research

The research aim and objectives were reached. The barriers to and enablers for ICT adoption as part of eLearning by undergraduate student nurses at a private nursing education institution were explored and described. Although the participants identified the most significant barriers to be cost and accessibility, they were positive regarding ICT in their work and study environments. Recommendations were formulated for nurse educators, researchers and the institution to enhance student nurses' adoption of ICT.

The research results exceeded what the researcher expected. The questions were structured around barriers to and enablers for ICT adoption in eLearning. Yet, results revealed the reality of technology that infiltrates the caring presence in nursing and that all types of technology is viewed as ICT and vice versa. In addition, the researcher was also able to map incremental steps in ICT access for nurse educators.

4.2.3 Central theoretical statement

This research was aligned with the central theoretical argument, as declared in Section 1, namely: *Insight into the barriers to and enablers for ICT adoption of undergraduate student nurses at a private nursing education institution assisted the researcher to formulate recommendations for the nursing education institution, educators and researchers to enhance ICT adoption by these students. Increased ICT adoption might imply enhanced utilisation of established eLearning programmes and enhanced competency amongst student nurses, which may in return improve health service delivery.*

4.2.4 Rigour

The research complies with the following five epistemological standards for trustworthiness (as outlined by Botma *et al*., 2010:233):

Truth value: The researcher engaged with relevant literature over a period of three years. Data triangulation was achieved by using focus groups and narratives for data collection. Peer review was done by the research supervisor and co-supervisor to facilitate accuracy. The truth value was obtained by discovering the experiences from the participants in this specific context. Focus group discussions and narratives were appropriate to reflect participants' experiences. The researcher declared all the negative information in the findings. The researcher aimed to remain neutral during the data collection process by using a mediator to recruit participants and an independent interviewer.

Applicability: The findings of this research are only applicable to the stipulated context. Yet, the research context was described in detail to assist in transferability of both the research methods and results.

Consistency: The findings from this research can be consistent if the research is repeated with the same participants in a similar context.

Neutrality: Freedom from bias was assured by the researcher by making use of an independent interviewer. The interviewer conducted similar research (Geiler, 2015) and reflected the participants' views by confirming statements made by participants.

Authenticity: The researcher provided a range of different realities. National and international literature was consulted to identify the broad reality. The participants' different experiences were described with consideration of their different backgrounds and underlying values.

4.2.5 Health research ethics

All the health research ethical principles declared in section one were applied. The researcher obtained written consent from Company A, the NWU's HREC and informed consent from participants. Participants received consent documents at least 24 hours before the research to discuss with friends and families to make an informed decision. Their privacy and confidentiality was maintained as stipulated in the informed consent document. No harm or any emotional trauma was experienced by the participants, and they were treated fairly. The participants were not identifiable, and all documentation, voice recordings, and transcripts will be stored for seven years at the study leaders' office at the NWU.

Furthermore, ethical considerations were maintained throughout the research. Guidelines were followed as stipulated by HREC (Health Research Ethics Committee), Botma *et al.* (2010:4) and Grove *et al.* (2013:164). These considerations were evaluated as follows:

Autonomy: The participants' right to self-determination was assured. The researcher obtained ethical approval from the HREC of the NWU (Potchefstroom campus) and from Company A. Participants were recruited by a mediator as they were approached as a vulnerable group. An independent interviewer conducted the focus groups. The researcher was not present during data collection. Written informed consent was signed by participants after they were informed regarding the research process and that they may withdraw from the research at any stage without negative consequences. Participants' identities were protected by limiting access to their information. The interviewer, mediator, transcriber, study leader and researcher signed confidentiality agreements.

Non-Maleficence: No harm was done to any participant. The study was non-invasive. Participants shared their experiences with the independent interviewer. No physical or emotional harm was experienced by the participants. The focus groups were audio-recorded and explained to participants. Although only partial anonymity could be assured with the focus groups (participants shared their experiences with the group), all information was restricted. Audio recordings, narratives and identifying information is restricted to the study

leader, co-supervisor and the researcher. All the data will be stored on the premises of the NWU for at least seven years, under lock and key, and where applicable, on a password-protected computer. Thereafter all the data will be destroyed. The transcriber erased audio recordings after completion of the transcriptions.

Beneficence: The benefits are indirect and will not be immediate, but were explained to the participants in the informed consent document. The findings of the research will be published to make recommendations to the research community, authorities and nurse educators regarding the barriers experienced by student nurses. The participants did not receive any incentives for participating in the study. Participation was entirely voluntary. The mediator explained the research process to the participants. The researcher was available to clarify prospective participants' questions. The independent interviewer communicated easily and ensured the participants' emotional and physical comfort. The mediator was present to oversee the process. Feedback will be available to participants on completion of the research.

4.3 LIMITATIONS OF THE RESEARCH

The researcher identified the following limitations:

- More focus groups were conducted, but they were not digitally recorded in full by the interviewer. The interviewer was busy with the third focus group when the digital voice recording terminated without warning. Due to time constraints and the participants' responsibilities in the hospital, the interviewer continued with the focus groups. The researcher could only use the narratives and field notes of the third group in the data analysis.
- Approval to use the information of the eLearning programmes at private hospital groups were declined by Company A's national management. The perspective of eLearning is therefore one-sided, reflecting only the views of student nurses in a semi-rural area.
- The population was small. A larger population would give more insight to the barriers and adopting factors experienced by student nurses. Comparative studies could point out differences in regions, towns and student groups.

4.4 RECOMMENDATIONS

The following recommendations are formulated for nursing practice, education and research. Recommendations conclude with a graphic depiction of the five incremental steps of accessibility as identified from the research results into a blended-learning continuum.

4.4.1 Recommendations for nursing practice

The following recommendations were formulated for nursing practice:

4.4.1.1 Accessibility of technology

The high cost of data and airtime poses to be the one of the main barriers. Students cannot afford internet due to financial constraints. Although computers with internet connectivity are available at the learning centre of Company A, participants indicated that there are not enough computers for the number of students in class. Participants need technology to type and submit assignments. Universal serial busses (USB ports) as standard cable connection interfaces between personal computers and consumer electronics can be activated to enable students to save work done at the learning centre on a memory stick. This is not possible with mobile phone access only (need for computers, laptops or tablets). As eLearning activities are only accessible at the hospitals or learning centres, alternative networks such as preloaded information to available devices can be considered. Students do have a need to continue with eLearning activities at home. It can be beneficial if a learning management system can assist students to upload assignments online.

4.4.1.2 Improve WiFi connectivity

WiFi availability will make online connectivity more efficient and assist students to work in an asynchronised manner — at any time, any place. Fixed line connections and broadband are more reliable, but this infrastructure is forced into dysfunction due to cable theft and lack of infrastructure maintenance, especially in semi-rural to rural South African environments.

4.4.1.3 Clinical training regarding the accuracy and reliability of hospital-based technology

Technology includes ICT, simple and advanced devices used at the hospitals and learning centres. Data collection revealed that participants were concerned about the reliability of some devices used at the hospital. Training regarding the specific devices is of great

importance to ensure accuracy. Computer literacy courses should be introduced as early as possible, and should be compulsory nursing curricula.

4.4.1.4 Technical support to hospital-based technology

Maintenance of equipment, batteries, and components of devices is important to ensure accuracy of monitoring systems.

4.4.1.5 Integration of ethics with technology in patient care

Nurses and student nurses are at the patients' bedside most of the time, therefore they are the interpreters of technology. Due to the changing role of nurses, patients feel threatened by the devices. Nurses should inform and explain technology and its supportive function to the patient. The caring presence of technology should reinforce a caring presence. Human rights, patient rights and the dignity of the patient should be respected. .

4.4.1.6 Confidentiality of patient information

The right to privacy should be respected at all times. Patients' information should be protected and access to systems (electronic X-rays, blood results, diagnosis) should be limited to key health personnel (the treating doctor, registered nurse). Computers with patient information should be away from the public eye, in a computer room. Passwords to the system should be protected. Additional passwords to protect sensitive information could be implemented.

4.4.2 Recommendations for nursing education

Interesting recommendations are presented for nursing education, namely:

4.4.2.1 Nursing education curricula

The researcher recommends that eLearning programmes should be included in the nursing curricula. The eLearning activity should support the subject. Educators should be aware of the contents of the eLearning activity. Theory and practical integration could benefit from a combined approach, for instance, when administration of medication is demonstrated, students do a similar eLearning activity to do self-assessment.

4.4.2.2 Technology-enhanced learning approach within a blended-learning environment

Pedagogy based on a strong curriculum should always direct the use of technology. The challenge is to maintain deep, cognitive active learning while moving away from traditional face-to-face lectures and to prevent technology as a meaningless add-on. Therefore eLearning should not be the only way of instruction, but will add value to existing methods. Exposure to hospital-based technology and the integration of techno-ethics can also benefit in this environment. In the following graphic depiction (refer to figure 4-1) on the following page), the researcher presents the five incremental steps that student nurses use to embrace ICT amidst accessibility challenges. These five incremental steps are positioned on a blended-learning continuum by Christensen *et al.,* (2013). The Clayton Christensen Institute for Disruptive Behaviour positioned blended-learning within a school environment where technology-enhanced learning is integrated into an already established infrastructure of buildings. Within this blended-learning environment, student nurses can be directed to integrate established face-to-face and formal lecturers, practical exposure in their clinical and practice environment with technology.

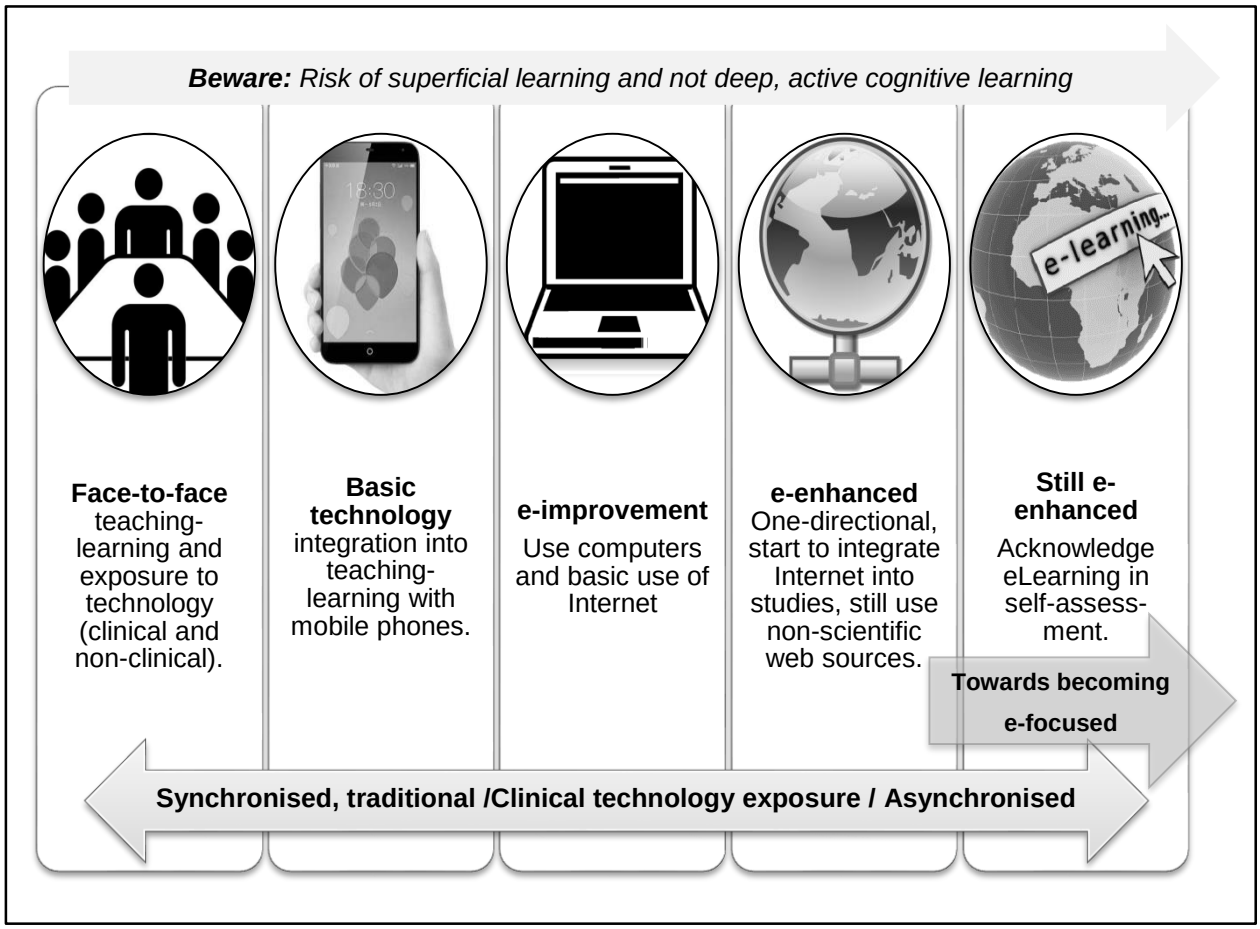

Figure 4-1: Five incremental levels of accessibility from research results applied to a blended-learning continuum

In figure 4-1, the blended-learning continuum entails the movement from synchronised and traditional teaching-learning known as formal, face-to-face lecturers. The objective is to improve towards asynchrony where student nurses can learn and participate while not in the same place than the rest of their class mates. In this figure the researcher added a third aspect to the continuum bar, namely from synchronised learning to clinical technology exposure to asynchronised learning as research results confirmed that hospital-related technology exposure is beneficial to students. However, this specific sequence should be followed. Through this figure nursing educators can see that **face-to-face** teaching-learning can be combined with all types of technology (clinical and non-clinical). As student nurses improve towards **basic technology**, nurse educators can use this space on the continuum towards the deliberate use of mobile devices (smart phones preferably as participants indicated their access to the internet from their smart phones). By directing students through access and competency to use computer technology within their teaching-learning, students are moving towards **e-improvement**. From e-improvement nurse educators can teach student nurses to distinguish between scientific and non-scientific sources of information available on the Internet. This refers to a deliberate attempt to broaden student nurses' scope of the Internet (also referred to as the World Wide Web). Nurse educators can find user-friendly applications that student nurses can use on their mobile phones with immediate access to scientific search engines, free of charge. Free accredited medical dictionaries can be downloaded on student nurses' mobile phones, giving student nurses more credible information. The latter refers to the movement towards being **e-enhanced**. The researcher is of the opinion that student nurses' use of eLearning programmes at Company A is **still not e-focused,** but remains on the continuum as an e-enhancement. In other words, while students view eLearning programmes as a self-assessment tool only, more direction is necessary to facilitate students towards being e-focussed. Being e-focused refers to the stage when student nurses are able to experience deep and meaningful, cognitive active learning while not in the same place or time than educators or class mates.

Throughout the integration of technology-enhanced learning within a blended-learning environment, nurse educators should revisit basic learning theory. Integrating the principles of deep and meaningful learning where information is moved within the human brain from short-term to long-term memory, will improve student nurses' comprehension of what they are learning and why it is learned.

4.4.2.3 Recommendations for nurse educators based on complex adaptive blended-learning systems (CABLS)

In addition to the mapping of the current status of student nurses' ICT utilisation on the blended-learning continuum by Christensen *et al.* (2013), the researcher also applied the CABLS by Wang *et al*. (2015). The CABLS can assist nurse educators to integrate technology devices with teaching-learning methods as a dynamic and multimodal option. Please refer to Table 4-1 for an outline of the recommendations based on the CABLS applied to this research and aimed for nurse educators.

4.4.3 Recommendations for nursing research

During this research the following areas have been identified for future research topics, namely:

- Levels of accessibility for student nurses who use technology.
- The skills gap between superficial and deep learning.
- Educator's adoption and perception of ICT.
- Techno-ethics—when technology infiltrates the caring presence of nursing.
- Privacy to protect patients from technology – systems should have limited access – not a "for all to see".

Table 4-1 Recommendations for nurse educators according to the framework of Complex Adaptive Blended-learning Systems (CABLS) (adapted from by Wang *et al.,* 2015:383)

A: Complex Adaptive Blended-learning Systems (CABLS) by Wang *et al.* (2015:383)						
Blended learning	**The institution**	**Technology**	**Learning support**	**The learner**	**The teacher**	**The content**
The conscious, well-planned, curriculum and pedagogically directed actions to combine traditional classroom teaching-learning with technology exposure in students clinical environment and other technology devices towards an environment where students can move from synchronised to asynchronised learning.	Infrastructure provided by the institution is the major driving force behind the subsystems around it. It elevates blended-learning from the course level to an institutional level. Includes strategies, policies, support and service. The mechanisms are interrelated and informed by the teacher, learner, technology, content and learning support.	Multiple interactions with technology and between technology and the environment. Online, offline, synchronous and asynchronous. New technologies undergo a dynamic, adaptive process of emergence, adoption and establishment. Retaining technologies that facilitate blended-learning he best.	Learning support is pushed to the foreground. It Includes academic support to learners (time management and collaborative skills) and technical support (helping learners to understand the tools which they use).	The learner co-evolves with other sub-systems, acquiring new identities. Learners transform from passive to active participants in learning, being researchers, practitioners and collaborators.	Teachers co-evolve with other subsystems, particularly with learners. Teachers facilitate, moderate, advise and guide on the side. Teachers become a generation of teachers with multi-disciplined professional skills.	Rich content Includes blending online and offline learning; blending self-paced and live, collaborative learning, blending structured and unstructured learning towards deeper learning.

B: Technology-enhanced learning (TEL) by Trepule *et al.* (2015:848-852)						
Technical enhanced learning (TEL)	**The institution**	**Technology**	**Learning support**	**The learner**	**The teacher**	**The content**
The selection, planning and operationalisation of technology aimed to enhance learning within a blended-learning environment.	Shift to a learner-centred approach. Teacher is the central figure in technology integration.	Support of learners' meta-cognitive activities like reflection and self-reflection through support and guidance. Online discussions motivate learners and build a community feeling amongst those in the course. Learners need to manage their learning pace and task performance.	Teachers need to be able to apply TEL and become learner-centred.	Advantages of technologically enhanced learning is availability of more information. Disadvantages are lack of interaction and feelings of isolation due to lack of support, guidance and community.	The teacher, being learner-centred, facilitates social interaction between students and students and teachers. This deliberate social interaction has an impact on motivation, morale and achievement.	Not all academic content can be forced into TEL. A critical assessment of the curriculum, learning outcomes and appropriate pedagogy should direct the selection of the correct content.

C: Specific recommendations for nurse educators based on the CABLS and TEL applied to this research				
Exposure of student nurses to all types of technology (step 1).	**Mobile phones a dominant TEL device (step 2)**	**Laptop, tablets and basic Internet use (step 3)**	**From non-scientific to scientific Internet searches (Step 4)**	**eLearning programmes valued for self-assessment only (Step 5).**
Motivate to Company A the need for IT infrastructure, the importance of connectivity and availability of eLearning) activities. Increase students' exposure to technology in daily activities by using electronic equipment in the clinical departments. This introduces the usage of new technology. Expose students deliberately during classes with computer-based activities, including the Intranet and Internet. Reconsider that eLearning activities supports their curriculum and activities should be accessible from home, not only in classrooms	Most students have mobile phones with internet connection. Information can be accessed by using mobile phones and can be a general mode for introductory activities. Communication can be facilitated by implementing groups e.g. Facebook, WhatsApp. Explore free-of-charge and user-friendly applications for smart phones that can be available to students when offline.	Students' next level of ICT in their teaching-learning is access to laptops or desktop computers to type assignments at home. Educators should consider that data and financial constraints are problematic, therefore consider preloaded information that brings asynchronised activities into action that can be linked in a synchronised manner once students are connected. Prolonged battery life of laptops and tablets is needed in case of load shedding and power failures.	Training to student nurses to distinguish between scientific and non-scientific information. Students should understand how to conduct proper Internet searchers. Introduce students to accredited search engines. Utilise time in class for students to access these search engines and invest in open-source offline versions as well. Start an awareness	Step five requires evaluation and consolidation from the nurse educators within the nursing education institution. Evaluate students' comprehension of eLearning programmes. Now consolidate how eLearning programmes can be positioned better within a blended-learning environment as a TEL mechanism towards deep, cognitive active learning. Communicate these consolidations as applied to the curriculum to Company A. Activate a nurse educators' forum between different nursing education centres within Company A to share best

C: Specific recommendations for nurse educators based on the CABLS and TEL applied to this research				
Exposure of student nurses to all types of technology (step 1).	**Mobile phones a dominant TEL device (step 2)**	**Laptop, tablets and basic Internet use (step 3)**	**From non-scientific to scientific Internet searches (Step 4)**	**eLearning programmes valued for self-assessment only (Step 5).**
			campaign that technology should improve accuracy and reliability (students should be able to distinguish between these concepts) and that scientific information is acceptable.	practices of the integration of TEL within the blended-learning continuum whilst moving towards being learner-centred.

4.5 SUMMARY

In Section Four the reader walked with the researcher through the process of evaluating the research and declares limitations. Recommendations were formulated for nursing practice, nursing education and nursing research with a strong focus on a blended-learning environment with technology-enhanced learning approaches. The recommendations were also contextualised as the researcher acknowledges the realities of poor and expensive connectivity in semi-rural areas and the cost implications for infrastructural improvements. Yet, the central message remains that the enablers for ICT adoption outweigh the barriers and the deliberate application of a TEL approach within a blended-learning environment that follows a well-formulated curriculum, can improve ICT adoption of Company A's eLearning programmes.

The research results have been formulated into a manuscript that is at present submitted for peer review. The manuscript has been prepared for the *Medical teacher journal*. This section concludes the research report titled *Information technology adoption by students at a private nursing education institution.* The researcher also committed herself to share this research report with the applicable nursing education institution, learning centre and the national education team of Company A.

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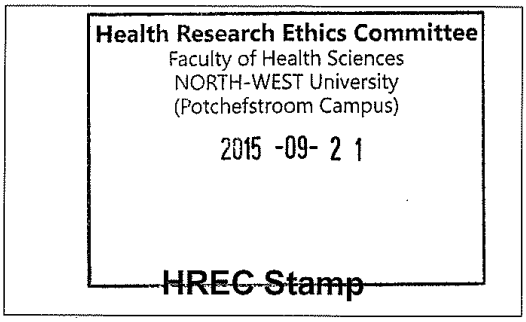
ANNEXURE A: INFORMED CONSENT

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



PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM FOR FOCUS GROUPS AND NARRATIVES

TITLE OF THE RESEARCH PROJECT: Barriers and enablers in information communication technology adoption by students in a private nursing education institution

REFERENCE NUMBERS: NWU-00094-15-S1

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CONTACT NUMBER:

Tel: +27 (0) 57 916 5277, Mobile: +27 (0) 82 854 7628, email: maryke.debeer@gmail.com

You are being invited to take part in a research project that forms part of Maryke de Beer's dissertation submitted as partial fulfilment of the degree *Magister Curationis* in Health Science Education at the Potchefstroom Campus of the North-West University. Please take some time to read the information presented here, which will explain the details of this project. Please ask the mediator any questions about any part of this research that you do not fully understand. It is very important that you are satisfied that you clearly understand what this research entails. Your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever.

You are also free to withdraw from the research at any point, even if you do agree to take part. Your choice to participate or not will not impact on your studies in any way.

This study has been approved by the **Health Research Ethics Committee of the Faculty of Health Sciences of the North-West University (NWU-00094-15-S1)** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki and the ethical guidelines of the National Health Research Ethics Council. It might be necessary for the research ethics committee members or relevant authorities to inspect the research records. This research has also been approved by the Ethics Committee of the Mediclinic Group and goodwill permission was granted by hospital management.

What is this research study all about?

- This study will be conducted at Mediclinic Central Region Learning Centre, Welkom campus, and will involve focus group interviews and narratives (writing a story almost like an essay). The size of these focus groups will be four to eight participants.
- An independent interviewer will conduct the focus groups and narratives.
- The objectives of this research are: to understand the barriers and enablers for ICT adoption in eLearning by undergraduate student nurses in a private nursing education institution where students have to complete eLearning programmes as part of their curriculum and to formulate recommendations for nurse educators to enhance student nurses' adoption thereof.

Why have you been invited to participate?

- You have been invited to participate because you are either a pupil enrolled nurse, or a bridging student registered between January 2015 and December 2015.
- You can participate in focus groups and write narratives in English.
- You might be able to provide insight into the barriers and enablers in ICT as you are now familiar with the eLearning programmes that are part of your studies.

What will your responsibilities be?

You will be expected to attend one focus group with other student nurses (enrolled and bridging students) and share your views on the barriers and enablers in information communication technology in your studies Focus groups will be conducted in a lecture room

which will be communicated to you in advance. The date and venue for the focus groups will be negotiated with you and will not impact on your academic work. The focus group will be approximately one (1) hour. After the focus group, you will be requested to write a narrative. This will give you the opportunity to write about your personal views of ICT adoption. It will take approximately 30 minutes to complete a narrative. The focus group discussion will be audio recorded.

Will you benefit from taking part in this research?

- There are no direct benefits for your participation in this research.
- The indirect benefit will also be to the research community and nurse educators, to gain better understanding of the topic, and to have a better understanding of the barriers and enablers students experience with ICT adoption, to support their studies.

Are there risks involved in your taking part in this research?

- The risks in this study are minimal and will mainly be due to partial loss of confidentiality by sharing information in the focus group.
- The benefits outweigh the risks.

What will happen in the unlikely event of some form of discomfort occurring as a direct result of your taking part in this research study?

Should you have the need for further discussions after the focus group due to possible emotional discomfort, an opportunity for counseling will be arranged for you, free of charge.

Who will have access to the data?

External anonymity will be ensured by the researcher. Confidentiality agreements will be signed by the researcher, interviewer and mediator. Confidentiality will be ensured by setting ground rules before the focus group. Reporting of findings will be anonymous. Only the researcher and study leader will have access to the data. Data will be kept safe and secure by locking hard copies in locked cupboards in the researcher's study and the office of the study leader at the Potchefstroom Campus of the North West University. All the electronic data will be password protected. As soon as data has been transcribed it will be deleted from the recorders. Data will be stored for 7.years.

Will you be paid to take part in this study and are there any costs involved?

No, you will not be paid to take part in the study.

Is there anything else that you should know or do?

- You can contact Monieke Myburg at 079 62 700 87 if you have any further queries or encounter any problems.
- You can contact the Health Research Ethics Committee via Mrs Carolien van Zyl at 018 299 2089; carolien.vanzyl@nwu.ac.za if you have any concerns or complaints that have not been adequately addressed by the researcher.
- You will receive a copy of this information and consent form for your own records.

How will you know about the findings?

The findings of the research will be shared with you by the researcher after final submission of the research project. The researcher will avail a presentation to the hospital management and you will be invited to be present during the presentation.

Declaration by Participant

By signing below, I _____ agree to take part in a research study entitled: *Barriers and enablers in information communication technology adoption by students in a private nursing education institution.*

I declare that:

- I have read this information and consent form and it is written in a language that I could understand.
- I have had a chance to ask questions to the mediator, Monieke Myburg, and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) _____ on (*date*) _____ 20__

_____ ..... _____

Signature of participant **Signature of witness**

Declaration by person obtaining consent

I Monieke Myburg declare that:

- I explained the information in this document to _____.
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she understands all aspects of the research, as discussed above
- I did not use an interpreter.

Signed at (*place*) _____ on (*date*) _____ 20__

_____ ..... _____

Signature of person obtaining consent **Signature of witness**

Declaration by researcher

I *(name)* ..... declare that:

- the information in this document was explained to the signed participant.
- the participant was encouraged to ask questions and adequate time was taken to answer them.
- I am satisfied that the participant adequately understoods all aspects of the research, as discussed above
- The person that obtained informed consent did not use an interpreter.

Signed at (*place*) ..... on (*date*) ..... 20....

....

Signature of researcher **Signature of witness**

ANNEXURE B: ADVERTISEMENT

Research: Barriers and Enablers in Information Communication Technology Adoption by Students in a Private Nursing Education Institution

Student nurses are invited to participate in research. Data will be collected through focus groups and written stories.

DATE AND PLACE

Data will be collected during August 2015 at the Training Facilities at Welkom Mediclinic. The exact date and time will be confirmed with participants. Participation will take approximately one hour and a half hours of your time.

WHO TO CONTACT

For more information, contact

Monieke Myburg at 079 62 700 87.

We want to understand the barriers and enablers for ICT adoption – especially in the eLearning programmes

ANNEXURE C: MEDIATOR CONFIDENTIALITY AGREEMENT

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

CONFIDENTIALITY UNDERTAKING

entered into between:

I, the undersigned

Prof / Dr / Mr / Ms Ms Maniele Mybergh

Identity Number: 9112020167080

Address: Dane Hof 1 President str 3 Hennenman

hereby undertake in favor of the **NORTH-WEST UNIVERSITY**, a public higher education institution established in terms of the Higher Education Act No. 101 of 1997

Address: Office of the Institutional Registrar, Building C1, 53 Borcherd Street, Potchefstroom, 2520

(hereinafter the "NWU")

1 Interpretation and definitions

1.1 In this undertaking, unless inconsistent with, or otherwise indicated by the context:

1.1.1 "Confidential Information" shall include all information that is confidential in its nature or marked as confidential and shall include any existing and new information obtained by me after the Commencement Date, including but not be limited in its interpretation to, research data, information concerning research participants, all secret knowledge, technical information and specifications, manufacturing techniques, designs, diagrams, instruction manuals, blueprints, electronic artwork, samples, devices, demonstrations, formulae, know-how, intellectual property, information concerning materials, marketing and business information generally, financial information that may include remuneration detail, pay slips, information relating to human capital and employment contract, employment conditions, ledgers, income and expenditures and other materials of whatever description in which the NWU has an interest in being kept confidential; and

1.1.2 "Commencement Date" means the date of signature of this undertaking by myself.

1.2 The headings of clauses are intended for convenience only and shall not affect the interpretation of this undertaking.

ANNEXURE D: INTERVIEWER CONFIDENTIALITY AGREEMENT

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

CONFIDENTIALITY UNDERTAKING

entered into between:

I, the undersigned

~~Prof~~/~~Dr~~/~~Mr~~/ Ms CAROLINE GEILER

Identity Number: 5602180117085

Address: 94 AB Dull Street Bentpark KROONSTAD 9500

hereby undertake in favor of the **NORTH-WEST UNIVERSITY**, a public higher education institution established in terms of the Higher Education Act No. 101 of 1997

Address: Office of the Institutional Registrar, Building C1, 53 Borcherd Street, Potchefstroom, 2520

(hereinafter the "NWU")

1 Interpretation and definitions

1.1 In this undertaking, unless inconsistent with, or otherwise indicated by the context:

1.1.1 "Confidential Information" shall include all information that is confidential in its nature or marked as confidential and shall include any existing and new information obtained by me after the Commencement Date, including but not be limited in its interpretation to, research data, information concerning research participants, all secret knowledge, technical information and specifications, manufacturing techniques, designs, diagrams, instruction manuals, blueprints, electronic artwork, samples, devices, demonstrations, formulae, know-how, intellectual property, information concerning materials, marketing and business information generally, financial information that may include remuneration detail, pay slips, information relating to human capital and employment contract, employment conditions, ledgers, income and expenditures and other materials of whatever description in which the NWU has an interest in being kept confidential; and

1.1.2 "Commencement Date" means the date of signature of this undertaking by myself.

1.2 The headings of clauses are intended for convenience only and shall not affect the interpretation of this undertaking.

ANNEXURE E: TRANSCRIBER CONFIDENTIALITY AGREEMENT

Confidentiality Agreement

Project title - **Information communication technology adoption by students at a private nursing education institution**

I _Michelle Christina Dos Santos Jardim (full name and surname) the _transcriber_ (indicate specific role in this research, eg. researcher, consultant, transcriber, analyst, administrative support, ...)

I agree to -

keep all the research information shared with me confidential by not discussing or sharing the research information in any form or format (e.g., questionnaires, data sets, transcripts) with anyone other than the *Researcher(s)*.

keep all research information in any form or format (e.g., questionnaires, data sets, transcripts) secure while it is in my possession.

return all research information in any form or format (e.g., questionnaires, data sets, transcripts) to the *Researcher(s)* when I have completed the research tasks.

after consulting with the *Researcher(s),* erase or destroy all research information in any form or format regarding this research project that is not returnable to the *Researcher(s)* (e.g., information stored on computer hard drive).

other (specify).

Michelle M.C.J	28 September 2015	
(Print Name)	(Signature)	(Date)

Researcher(s)

(Print Name)	(Signature)	(Date)

The plan for this study has been reviewed for its adherence to ethical guidelines and approved by Health Research Ethics Committee of the North-West University. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at 018-299 2094.

ANNEXURE F: ETHICS APPROVAL CERTIFICATE

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

Private Bag X6001, Potchefstroom
South Africa 2520

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

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

ETHICS APPROVAL CERTIFICATE OF PROJECT

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

Project title: Information communication technology adoption by students in a private nursing education institution

Project Leader: Dr P Bester

Ethics number: N W U - 0 0 0 9 4 - 1 5 - A 1
(Institution – Project Number – Year – Status)

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

Approval date: 2015-09-21 **Expiry date:** 2016-06-01 **Risk** Minimal

Special conditions of the approval (if any): None

General conditions:

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

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

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

Yours sincerely

Linda du Plessis

Digitally signed by Linda du Plessis
DN: cn=Linda du Plessis, o=NWU, ou=Vaal Triangle Campus, email=linda.duplessis@nwu.ac.za, c=ZA
Date: 2015.09.21 18:19:02 +02'00'

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

ANNEXURE G: CONSENT AND GOODWILL PERMISSION FROM COMPANY A (HOSPITAL MANAGER AND HEAD OFFICE)

[redacted]
CONFIDENTIAL

03 July 2015

[redacted]

Health and Research Ethics Committee (HREC)

North West University, Potchefstroom

Legal and Ethical Review

Dear Sir,

Study: Sr M de Beer

[redacted]

It is my understanding that Sr. Maryke de Beer will be conducting a research study at Mediclinic Welkom on "Information technology adoption by students in a private nursing education institution". Mrs. Maryke de Beer has informed me in writing of the design of the study as well as the targeted population.

I hereby approve this effort. If you have any questions, please do not hesitate to call.

Kind regards

F.X van Niekerk

Hospital Manager

[redacted]

[redacted]

De Beer, Maryke

From: de Lange, Dewald
Sent: 21 August 2015 07:11 AM
To: De Beer, Maryke
Subject: RE: FW: Amended ethics application: Bester - de Beer

Dear Maryke

Following our previous correspondence and your submission of the required documents, the company has approved your research project subject to the conditions set out below:

1. The company will be provided with a complete copy of the final research project/thesis once it has been submitted and graded.

2. Any interviews or surveys will be done only at the designated hospitals and you must contact the HR Manager directly to discuss your visit to the respective facility.

3. The research process may not interrupt the daily operations of the hospitals and should preferably take place during off-peak times.

4. The HR Manager may limit the amount of staff that is allowed to participate in the research project subject to operational requirements.

Your research project is approved for [redacted]

Please contact the HR Manager, **Gerhard van der Westhuizen** for further arrangements.

Kind regards

Dewald de Lange
Manager | Employee Relations
[redacted]

[redacted]e
Strand Road
Stellenbosch, 7600
T +27 21 809 0632
F +27 86 557 0906
C +27 82 728 2157

[redacted]

From: De Beer, Maryke
Sent: 20 August 2015 03:27 PM
To: de Lange, Dewald
Subject: RE: FW: Amended ethics application: Bester - de Beer

Confidential

10 December 2015

To: Maryke de Beer
Nurse Educator
[redacted]

Dear Ms de Beer

APPROVAL OF RESEARCH PROJECT

Following our previous correspondence and your submission of the required documents, the company has approved your research project subject to the conditions set out below:

1. The company will be provided with a complete copy of the final research project/thesis once it has been submitted and graded.
2. Any interviews or surveys will be done only at the designated hospitals and you must contact the HR Manager directly to discuss your visit to the respective facility.
3. The research process may not interrupt the daily operations of the hospitals and should preferably take place during off-peak times.
4. The HR Manager may limit the amount of staff that is allowed to participate in the research project subject to operational requirements.

Your research project is approved for **Mediclinic Welkom**.

Please contact the HR Manager, **Gerhard van der Westhuizen** for further arrangements.

Kind regards

Dewald de Lange
Manager | Employee Relations
[redacted]

[redacted]

ANNEXURE H: EXCERPT FROM TRANSCRIPTION OF FOCUS GROUP 1

Interviewer: "Ok, today is the 25th, it's Friday morning. The time is 09:00. We are starting to do the focus group for a data collection for Mrs Maryke De Beer, who is one of the North West students doing her M. So we are about to start with the students and the questions. Thank you. So our first question is, you have to complete an eLearning program on the computer and using the internet part of your nursing studies, share with me what are the barriers, the obstacles, the hurdles, and things that enables you to assist, to help or to use these eLearning programs?"

Participant 1: "I think one of the other big problems is, ok most of the people of today, they do have you know cell phones and that, but I think a lot of people as we saw it when they introduced the x-ray program. A lot of the people do not have that training and the understanding of using the computer and that. So I think that is going to be maybe be one of the problems if we have to go into the eLearning. You see, some of them do do it, they work a lot slower because of the way they type and all that. So I think that could be one of the problems that we'll face".

Interviewer: "Anybody else with another idea?"

Participant 2: "Actually I feel where we have to quote our references with the eLearning program, how it's done. Personally I'm struggling with it, so I find it for me personally, it's a difficulty that I'm encountering with currently with my eLearning studies".

Participant 5: "When it comes to the eLearning, the usage of the internet, we find many sources like from Google. We find sources and some of the sources are not reliable. For instance with like Wikipedia we could just log into Wikipedia and edit whatever information that has been there. So the liability of the information that is found there, it's not good and not as vital as whatever research we should be doing at that time. So I think the barrier there is, the information is obtained, may be wrong to what you are actually looking for".

Interviewer: "So what you actually wanted to say, it's not trustable, you can't trust what is there on Wikipedia?"

Participant 5: "Yes"

Interviewer: "Anybody else?"

Participant 3: "I think the availability of the internet is a problem because not all of us have it available to us. Not all of us have laptops, not all of us have internet. We've all got cell phones but they can't go do a whole project on a cell phone. So I'm being able to type the project and to

go onto internet to find the information it becomes a struggle if you don't have the availability of the laptop and the internet and so forth".

Interviewer: "Ok, thank you".

Participant 1: "Sorry and I think also because lately you see there is a lot of copper theft in that. So I think your opvangs of the certain internet types is a problem because we pick that up for instance I'm a Cell C, we stay in Bedelia, we have terrible opvangs in Bedelia".

Interviewer: "Ok. Can we dwell off that question then. The follow up questions will be the following: What do you see as Information Communication Technology? ICT on its own. What do you see is enhancing or not enhancing your Information Technology? You have just spoken about it now. Your opvangs ok".

Participant 1: "I think on a positive view on this whole thing is, making the paper work less because nurses in general, today we spend much more time on nursing papers then what we do on patients. So I think also if we look at it in whole to, where does paper come from? So I think environment, we will also be, it will be a positive because we will be using less papers. So there will be less of cutting down of trees. I'm very positive about this eLearning, because you see it they introducing it in the schools; I know schools that are bringing it in everything".

Interviewer: "Anybody else to add up to that for us? Ok, if I can come in there also to just give you some form of guidance is, ICT in today's world is everything that works with technology. Its things like the new blood pressure machines, the ones you push around in the ward, that's technology. It's communicated from the patient to the nurse who is taking it. As you have mentioned the X-ray machine earlier on, it's new technology; it communicates what is happening with the patient to whoever is interested in it. Your cell phone, its technology. If you want to speak to someone on the other side of the world, things like that. Your emails, sending your emails, it's part of Communication Technology. Ok, Anybody else to add to that?"

Participant 4: "I also think it's time effective, in connection with the blood pressure machine and when it comes to projects or assignments you have to hand in. If you say via email, then it's less complications. The chances of the assignment itself getting misplaced or lost is less. If for example I'm busy with it and then I misplace some papers if it's already saved on the laptop then I can just get it back that way".

Interviewer: "Anybody else to add to that? So can we go onto the next question? Your next question will be, what does ITC make easier or more difficult in your studies? You have

mentioned a few already. Can we still have a few? What makes it easier, what makes it gaa gaa?"

Participant 4: "I think what makes it difficult is if you don't have exposure. Some of us, you are not that exposed to laptops, we don't have them so when you have to do a project with it, you think no let me stick to what I know. So I think that's what makes it difficult not wanting to learn how to use that method".

Interviewer: "Beautiful".

Participant 2: "I think the storing of information can either store it on a hard drive or you can save it on the internet. Especially on your email address. Once you send it, it's there for you. You can retrieve it again in the future".

Participant 1: "I think also for instance, if you not at home and you've got some time and you are working on a project, there is not ten books that you have to carry around and papers. You just have your laptop and you always got, you can't complain that you don't have your things with you. The availability is, can always be there".

Participant 6: "Ok, I think with the uhm, it's more uhm time effective. It's also easier for the books but then what about the PC's getting viruses? Such as going on websites like Wikipedia and new experiences. Also with the load shedding I've been receiving but then you won't get anymore, in those cases".

Interviewer: "Ok, that's nice. Anybody else with something? Are we Ok with that? Do you feel you are Ok with that? Ok, then our next question will be, what about the ICT in the learning programs are easier or more difficult to use? Like in your eLearning's? What do you find that is difficult for you when using it and what is easy for you when you use it?"

Participant 2: "Where we did our yearning in Bloemfontein, where we do an assignment, our resort assignments. We go look for the MAP-points. Once you've complete the questionnaire, you the feedback immediately. They are computerised, you don't have to wait a day or two on that project that you did on the computer. I think that for us is more effectively for us in that way. Thank you".

Interviewer: "Anybody else?"

Participant 6: "It also makes it easier going on the internet and you just type in what you want and you get it".

Participant 3: "Ok, my view is that eLearning is mostly positive. I don't really see negatives in it because it is faster, it's easier. The world is improving and we have to improve with the world. So everything is becoming easier for us to do, easier to understand, easier to obtain all the information. So I don't really see a negative part in it. The negatives might be yes we've got load shedding, we've got theft especially in Welkom, cable theft is a big thing. The biggest part of it is positive. Moving forward".

Interviewer: "That's nice".

Participant 5: "For us nursing students, the eLearning makes it very easier for us to present cases that we given, like an assignment. It is easy to just to present it on a PowerPoint, which is also easier to obtain the information from, the internet and present it for everybody and that whatever you are presenting orally, you can also demonstrate on the PowerPoint. So it makes it easier for us there because the things that we do with, there are a lot of structures we are dealing with. So it makes it easier, we don't have to put in posters but we can present it on as PowerPoint's".

Interviewer: "Ok, that's nice. Anything else?"

Participant 2: "This is a negative that I have picked up. With the ICT, everything is digital. When you grasp a concept, certain information. When on the internet, the weight of it becomes lesser but when you physically go look for it in the books I think for me personally you get the feeling that you understand and that you adapt quickly more quickly compared to the information that you get on the internet because you just browse through everything where with the books there is more focus in terms acquiring information. With the internet you just tap a word and you get all these other information that is not necessarily relevant to what you specifically want to find out. So with the internet I find there is too much information that is accessed at a particular point compared to when you have a book. That's more specific to what you want and I think the weight information is better compared to the internet".

Participant 1: "I also think what a problem is, is that the internet when using it on your tablet or mobile, it's very expensive. You don't have your uncapped internet. So I think that could also become a barrier point at some stage because some people just won't be able to afford it".

Interviewer: "Anything else?"

Participant 6: "Also with the internet usage, plagiarism is more where some of the educators wouldn't know the site and then the student would just go there and just write anything that is there without understanding exactly what's going on. So your assignment or project might be

right and get all the full marks and stuff but you personally won't understand what the content is about. That's my problem also about it".

Interviewer: "That's nice. Anything else as far as that?"

Participant 5: "When using the eLearning, it's sometimes difficult to retrieve information. Let's say for instance your laptop now loses everything, it's formatted. It's going to be very difficult to retrieve that information because you going to need certain software's to be able to do that. Which is going to be costly to do that. So when using pen and paper, there will always be proof. The proof that you can touch with that. Although it's reliable, but once it's lost it's difficult. It's lots of stages to retrieve that information you have lost. Yes".

Interviewer: "Anything else? Ok, can we then go to the next question? We are almost through. What will you say are the barriers, obstacles, hurdles in the use of the ITC in your eLearning programs? What did you find in the eLearning system that you are using here for your studies? What barriers and what obstacles did you find in the eLearning system itself?"

Participant 1: "We have a lot of problems with our X-ray technology that the systems go off line. Then we struggle for long periods of time, then the Doctor is not able to access the X-rays and that because it's off line. Then the people must be contacted from Joburg and they have to come in from Joburg and all that so we find that that happens quite often. Also another thing for instance, our blood pressure machine. The people don't take care of it from the beginning. When they are finished with it, they don't plug it in. So you will always come to a patient's bed and she won't take the blood pressure unless it is plugged in. So it is also frustrating because sometimes the plugs are all in use at the patient's bed side already. So if the people don't take care of the machine's, from day one, it can in the end give you some problems".

Interviewer: "That's nice. Somebody else?"

Participant 2: "With specific reference to the blood pressure machine. Some Doctors still prefer the BP taken manually. They feel it's more accurate and I encounter this problem with the electronic system where you find on the manual reading, where the glucose is four plusses where on the machine itself, is two plusses for the glucose in the human. There is always a variance between the manual and electronic gadgets because they certainly are important they always calibrated to a certain, not an international system but to specific countries system. I think there they get between the two. That's why certain Doctors prefer the manual readings compared to the electronic readings. We also have to KB for them to be calibrated from time to time. For us as nurses specifically might lead us to address a patient wrongly or treat the patient wrongly".

Interviewer: "That's nice".

Participant 1: "We see it a lot with the thermal flashes that we have. If the battery is almost running down, your thermal flash readings is very inaccurate according to the patient will have a temperature, you can feel it, you can check it and see it on the patient's pulse and that when you come with the thermal flash and you do the temperature with them and it shows it is normal. So the Doctors, we pick it up with the temperature they don't trust the thermal flash that we are using".

Interviewer: "Anything else that you have discovered? Can we go onto our last question?"

Participant 2: "I think if you are to take a food direction moving from people. ICT, I think things like thermal flashes, the BP readings and pulse readings. Whenever we do them I think it would be better for them to be automatically uploaded to our patient's virtual profile instead of it for us to write it down because things like a pulse. A patient's pulse is not always constant. It is always dropping and then picking and going up again. I think for the machine to be specific on which pulse to take and then for it to be uploaded to the patient's file. Like the way the thermal flashes work is, I think if the patient's tests could be bar coded, like whenever we do something on the patient, we just scan the patient's bar code then the things are uploaded there. I think on the road show they said they are going to upload everything that is directly related to theatre on a system that they can do a procedure for this amount compared to other medical facilities. I think if we could have a patient's profile, it would also help using people for us. Personally I think".

Participant 3: "Just to add to what participant number two said, it is a very good idea and it's going to be more accurate because I know sometimes some if the nurses says they don't do it but they do. They get to a patient and they are in a hurry so they don't really count the respiration. Hulle skat. So it's going to be more accurate if we are able to do things more electronically, if we could get something to electronically read the respiration and the temperature that is accurate. So that we have accurate readings because one of the biggest problems we have right now is the readings that we are obtaining are not accurate".

Participant 2: "With our pulse, I think some people have not a lazy mentality but taking short cuts. Instead of having an abnormal patients BP out of range, we will just take and write down whatever they feel is normal, for them not to follow up or really not report it. I think if it's uploaded on the patients profile anyone could see the reflection from the readings and those that have been noted down. I think in that sense we go a long way decreasing people taking short cuts because I think when a patient's temperature is 37 or 8 just minus 0.2 you'll just so that it falls down into the normal range so that it's been written down as normal. Therefore decreasing the effort in having to go back to the patient an hour later. That's why I think for me it

was build up virtually, we could see this was the patients BP reading at a certain time period whether or not it was followed up. Thank you ma'am".

Interviewer: "Ok, thank you. Ok then if you are satisfied with that question and you feel that the answers that you got through it was ok then we will go through to the last question. The last question will be: What will you say are the enablers or the assistance or help in the use of ICT learning programs? How does eLearning assist you in your working environment? You have called out a few already but I think ok".

Participant 1: "I think we could get quick references. If the Doctor comes here and his got this diagnoses that you don't know. I do it a lot. I go to my phone and Google it. So we don't have to wait because some people maybe don't know what it is and the Doctors are very busy and don't always have time to explain it to you. So when you come across a new diagnoses and nobody else is not sure, I just go to the TV room and go to my phone and Google it and then we know what it is. So the availability is always there, we don't have to walk around with all your books. It's always available".

Interviewer: "Anything else to add?"

Participant 2: "Let's say we have 32 patients per ward and maybe have one side which has 16 patients and you know you have to do the BP, the saturation, the pulse, the temperature all of those things for all those 16 patients when you have these electronic devices, you are more able to do them faster compared to when you have to do everything manually for all 16 patients. I think that for us is has happened with time constraints with the applying of the electronically devices".

Interviewer: "Anything else?"

Participant 5: "For us students specifically the eLearning that we get, it has questions that are constructed any way that we are going to get them in an examination. Like for instance with us when we did our medication we did the eLearning, we had calculations and all that. So that truly helped us a lot because the things we thought we knew we actually didn't. The way, I remember it was a calculation we thought we actually did right but then at some point we did wrong because of the units that we were using. We should have changed it to the same units but we didn't. So for me, when it comes to the preparation for examination and test the eLearning helps a lot because you now you learn to think broad then what we think we know so ja it helped me".

Participant 6: "It also helps in patients and cases of emergencies. Like resuscitation. There's no need to count manually how much is the pulse or the BP. So the patient gets to be attended quickly ja. So also the mortality rate".

Participant 4: "As well as for example if you are working in the intensive care units, where the patients are continually monitored. Sometimes you could get an admission and then it gets busy and you must go assist and you can't go to your patient at a certain time. But because the vital information's are being stored it's easier to just go back".

Interviewer: "Anything else?"

Participant 2: "I think with we doing resus for example, there is a normal cut in the machine that I choose when the compressions were done accurately or wrong but I could always go back on that and asses whoever was doing the rhesus team, whether they did anything right or wrong. If need be, they can begin even in our last training for that because doing resus I don't think they will remember who did what where how. I think that it also helps with the quality control analysing the person as a whole for me personally".

Interviewer: "Are we happy? Are you comfortable now with the eLearning system and the do's, the don'ts, the why's, ok".

Participant 1: "I just feel I've read it recently it was in a nursing magazine or something they want to bring in a robot that starts operations and that. I think the one thing that we must be careful of is that we don't totally move away from the patient because after all nursing is that touch and caring and that. So I think that is one thing that we must be very careful about. We must still, even though there is going to be less paper work. We must be afraid that we don't totally move away from the patient".

Interviewer: "I think that was a mouthful".

Participant 5: "To add on to what the other participant has said. The usage of robots, I think whatever the robot is going to do I'm not going to agree with that, because the way the robot is going to assist a patient may be different from what I see, because a robot is a machine. What is going to happen if it's not well, I can't see the word, it's not well calibrated well. So it is going to give us the wrong reading, so we going to treat the patients wrongly and with the wrong diagnosis. So with me I agree with her that there still needs to be that contact between us and the patients. Not the robots and the patients".

Interviewer: "Beautiful. I hope that time doesn't come because your patient does need that touch. Ok, we have come to the end of the questions that we wanted you people to answer. We

are very glad for you participation. It was very good. It was really, we have learnt from each other. What you didn't know, the other one knew and you get that thing you know of the thermal flash. I mean some of them didn't even take notice of it but now that you have mentioned it, the next time they are going to use it, they will be more careful looking at it. What he just said about profiling the patient, that data is there and it is there forever, because once you started profiling patients there data is stored. It is like confidential; it's under confidentiality because it is a patient. So there will always be a back-up to go back or look on later on when you need it but for my experience with new students I'm very glad. So I'm going to put this off now. This was session number 1. We are going to go into session number 2 in a few minutes time. Thank you".

ANNEXURE I: TURN-IT-IN REPORT

Turnitin Originality Report

11311738:M_de_Beer_feedback_19_Nov_2015_PB.docx
by PETRA BESTER

From Maryke de Beer (92cea0df-bbc7-4a87-8119-048e247447e5)

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http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2834.2011.01315.x/abstract;jsessionid=15D52F77CB05D8C0B18F603C37F5071C.f04t04

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http://www.biomedcentral.com/1472-6947/13/31

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http://dspace.nwu.ac.za/bitstream/handle/10394/11006/Balovi_TS.pdf?sequence=1

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ANNEXURE J SYNTHESIS OF BARRIERS AND ENABLERS

The synthesis of barriers to and enablers for ICT adoption by student nurses as declared in the manuscript

Barriers from focus group and narratives results	Clustered barriers	Enablers from focus groups and narratives results	Clustered enablers
Limited access a reality.	**Poor access in physical dimension.**	Convenience of ICT	**Convenience**
Expensive data and airtime, students have limited funds available.		Convenience versus superficial learning.	
Challenges in physical dimension.		Easy access versus unreliability.	
Easy access versus unreliability.	**Unreliability**	Save and fast retrieval of data.	
Convenience versus superficial learning.	**Superficial use of technology and - learning**	eLearning enhances knowledge and self-assessment.	**Self-assessment**
Accuracy of manual versus electronic devices.		Perceived ability and potential in intra- and interpersonal dimension.	**Perceived skill and potential**
Who is in control: man or technology?		Five levels of accessibility of ICT in eLearning.	**Exposure clinical technology, mobile phones, use internet, needs computers and internet in studies**
Advocacy for technology to rule out human error.	**Ethical realities**		
Ethical-legal aspects of technology in nursing needs to be addressed.			
Risk to care and confidentiality is a reality.			
Protection of patient information should be			

addressed. Perceived inability/being unskilled in intra- and interpersonal dimensions.	**Perceived as being unskilled**		

ANNEXURE K: LETTER FROM LANGUAGE EDITOR

cumlaude
languagepractitioners

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DECLARATION OF LANGUAGE EDITING

I, Christina Maria Etrecia Terblanche, hereby declare that I edited the research study titled:

Information technology adoption by students at a private nursing education institution

for Maryke de Beer for the purpose of submission as a postgraduate dissertation. Changes were suggested and implementation was left to the discretion of the author.

Regards,

CME Terblanche

Cum Laude Language Practitioners (CC)

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