INFORMATION TECHNOLOGY IN NURSING EDUCATION: PERSPECTIVES OF STUDENT NURSES

by

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SUPERVISOR: Prof TE Masango

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Student number: 45618712

DECLARATION

I declare that **INFORMATION TECHNOLOGY IN NURSING EDUCATION: PERSPECTIVES OF STUDENT NURSES** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the dissertation to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other education institution.

15 November 2018

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SIGNATURE **DATE**

Fiona Singh

INFORMATION TECHNOLOGY IN NURSING EDUCATION: PERSPECTIVES OF STUDENT NURSES

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ABSTRACT

The purpose of this study was to explain and describe the perspectives of student nurses at a private nursing education institution (NEI) in the province of KwaZulu-Natal (KZN), South Africa, on the use of information technology (IT) in nursing education.

A quantitative, non-experimental descriptive research design was selected to determine the respondents' perspectives on IT and identify challenges that they encountered. The target population included all student nurses registered at the private NEI for the Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and the Advanced Diploma in Medical and Surgical Nursing Science with specialization in either Critical Care, Trauma and Emergency, or Perioperative Nursing (R212). The researcher developed and used a structured self-administered questionnaire for data collection.

Data was analysed using descriptive and inferential statistics. The study highlighted that the respondents acknowledged the importance and benefits of IT in nursing education and the profession, but encountered challenges in using IT. The study found that the respondents owned at least one IT device, used IT frequently for study and work purposes, reported IT competence, and had positive attitudes to IT. The researcher made recommendations to improve the use of IT in nursing education and for further study.

Key concepts

Information technology; nursing education; nursing education institution; perspectives; student nurses.

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Dedication

I dedicate this dissertation to my family with deep appreciation and gratitude for their unconditional love and support.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
App	Application
Apps	Applications
CDSS	Clinical Decision Support Systems
EHR	Electronic Health Records
HIT	Health Information Technology
IALCH	Inkosi Albert Luthuli Central Hospital
IT	Information Technology
KZN	KwaZulu-Natal
LAN	Local Area Networks
M	Mean
NEI	Nursing Education Institution
NEIs	Nursing Education Institutions
PEU	Perceived Ease of Use
PU	Perceived Usefulness
R	Regulation
SANC	South African Nursing Council
SD	Standard deviation
SPSS	Statistical Package for the Social Sciences
TAM	Technology of Acceptance Model
TRA	Theory of Reasoned Action
UK	United Kingdom
UNISA	University of South Africa
USA	United States of America
USBs	Universal Serial Buses
UTAUT	Unified Theory of Acceptance and Use of Technology
WiFi	Wireless Connectivity
www	World Wide Web

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

Advances in information technology (IT) have impacted the healthcare landscape globally. Numerous private and public healthcare institutions have implemented and utilise high technology medical equipment, electronic patient records, automated appointment reminders and decision support systems to improve the quality of healthcare services. While developed countries remain the pioneers and at the forefront of IT, developing countries like South Africa acknowledge and slowly respond to the need of IT in the healthcare environment (Britnell 2013:158). This changing environment requires healthcare practitioners to keep pace with practice innovations such as health information technology (HIT) and telehealth. The King Saud University in Saudi Arabia has made IT available to all registered student nurses. However, nurses must be motivated and willing to utilise IT for the advancement of science and nursing practice (Samarkandi, Bashatah, Mobrad, Abdulqader, Aljelifey, Alnajada, Alomairy & Mukhtar 2015:47-49).

It is therefore pivotal that nursing education equip nurses with the necessary knowledge, skills and competencies to utilise IT effectively and efficiently. Akman, Erdemir and Tekindal (2014:423) recommend the inclusion of an IT education model for nursing education programmes to improve student nurses' awareness of IT. Increased awareness and exposure to IT will allow student nurses to become proficient through practice. In Ethopia, Alwan, Awoke and Tilahun (2015:[6]) found that IT training and continuous follow-up were necessary for the success of IT in developing countries. Sukums, Mensah, Mpembeni, Kaltschmidt, Haefeli and Blank (2014:[1]) confirmed the need of ongoing support to facilitate the success of IT in rural African healthcare facilities. Poor acceptance of or resistance to IT may be as a result of insufficient knowledge. Affording student nurses an opportunity to experience IT first hand during education and training may ensure better adoption and acceptance of IT in healthcare environments.

In an era of technological revolution, there is no denying of the existence of IT. Healthcare facilities and educational institutions in South Africa are embracing IT. Private nursing education institutions (NEIs) are leading the way by the compulsory integration of IT into nursing programmes. While this is the case, little is known of the student nurses perspectives of IT in nursing education.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

Health leaders of many developing countries including South Africa recognise the significance of IT for better quality healthcare (Britnell 2013:158). Public and private healthcare institutions in South Africa have incorporated IT in varying degrees from computerised medical equipment, digital imaging, automated systems for admissions and stock controls to electronic health documentation (Seahloli 2016:52-56). Nursing forms a major component of the healthcare sector. The effective and efficient utilisation of IT is dependent on nurses' knowledge, attitudes and facilitating conditions (Garavand, Mohseni, Asadi, Etemadi, Moradi-Joo, & Moosavi: 2016:2713). A study at a Japanese university hospital where an advanced IT system was implemented revealed that nurses who were highly skilled in IT demonstrated better nursing competency (Fujino & Kawamoto 2013:249). Chand and Sarin (2015:3508) state that nursing institutions must be challenged to include IT studies as part of nursing programmes.

Nursing education in South Africa is experiencing change. Many of the post millennium student nurses entering into the profession are techno-savvy. These "techno geeks" seek innovative, exciting and interactive IT enhanced learning platforms. Learning can occur through simulation, games, videos and social networks. Incorporating these non-traditional learning strategies into nursing programmes will meet the needs and interests of the next generation student nurses. WhatsApp has been utilised to improve primary healthcare education at a university in the Western Cape, South Africa (Willemse 2015:[1]). In a comparison of learning satisfaction and performance between online and campus-based nursing students in the second year of a four-year preregistration baccalaureate nursing programme, Mgutshini (2013:[6]) found that students who took the online course had greater satisfaction in learning and performed better in examinations than those who had attended the lecture-based course. Motivation and enthusiasm for learning can improve student nurses' theoretical and clinical performances which could ultimately improve the quality of healthcare service delivery.

Private NEIs in South Africa are integrating IT into nursing programmes in order to prepare student nurses to meet the demands of a contemporary healthcare industry. While public NEIs lag behind, private NEIs are committing to adopting and implementing best practices from abroad with the aim to create dynamic, highly competent, evidence based nurse practitioners who are able to function competently in IT driven healthcare systems.

Nursing education aims to create accountable, responsible, critical thinking practitioners who take the lead, exercise creativity and do not shy away from challenges. IT encourages student nurses to develop and groom such characteristics. IT is a powerful and valuable tool for supporting learning (Gonen, Sharon, & Lev-Ari 2016:[1]). IT engages the student, is more interactive and learning can occur through a variety of contexts. Student nurses can decide when, where and how fast learning will occur at a "click of a button". Independent learning builds confidence in student nurses and reduces dependence on lecturers.

Nursing education is offered at both public and private education institutions in South Africa from universities to accredited nursing colleges. There are three main private healthcare groups that contribute to nursing education in South Africa namely Life, Mediclinic and Netcare. Each private healthcare group has a registered nursing education division with multiple private NEIs across the provinces of South Africa. One of the private NEIs in the province of KwaZulu-Natal (KZN) has taken active steps to integrate IT into nursing programs. Samarkandi et al (2015:47-49) emphasise that IT knowledge and skills are essential components in nursing education. While the concept is relatively new at the private NEI, there has been more motivation to engage the student nurses with IT in nursing education and training. IT is no longer an option but a requirement. Both nurse academics and student nurses are expected and compelled to utilise IT in teaching and learning. IT utilisation is measured and submitted as part of the balance scorecard to the head of department on a monthly basis.

All new students registered for any of the nursing programmes at the private NEI receive a mandatory short course on computer and research literacy to assist with programme requirements. Students are expected to work with Microsoft Word, Excel, PowerPoint Presentations and Outlook. It is compulsory and stipulated in study material for all assignments to be typed in specified formats. Assignments are submitted via

TurnItIn to detect plagiarism. Students are also required to participate in mini research projects, conduct research and make informed decision supported by evidence based practices where IT knowledge and skills becomes an absolute necessity. Students utilise their own laptops, tablets, smartphones as well as desktop computers at the campus computer laboratory where Internet access is freely available including photocopying and facsimile services.

Nurse academics use IT in presentation of lectures: from laptops, projectors, eBeams and SMART Board to the incorporation of videos, applications, games and research articles. Preparatory and self-study exercises for the student nurses include referral to the computer laboratory where students are asked to access medical websites, journals and applications for learning purposes. Students are exposed to simulation manikins for training. Student nurses are trained on the utilisation, calibration, care and trouble shooting of technological medical devices in the nursing units. Communication between students and academics occur via SMS, email and even social network applications (Apps) such as WhatsApp, Instagram, Twitter and Facebook.

Historically nursing education followed traditional teaching and learning methodologies. Learning was a passive process with the student dependent on the educator for the transfer of knowledge. IT integration into nursing curriculum provides innovative teaching and learning strategies to actively engage the student into the learning process (Neal 2013:41). Passive learning is transformed to interactive learning. Student nurses are encouraged to take responsibility for own learning and actively participate in acquisition of knowledge via IT.

IT has been introduced and implemented into nursing education at the private NEI ensuring ample opportunities for exposure and experience to IT. It is expected and assumed that both nursing academics and student nurses will automatically respond and adjust to the transformation. At the same time, there is no evidence to confirm this assumption. This motivated the researcher to determine student nurses' perspectives towards IT in nursing education.

1.3 STATEMENT OF THE RESEARCH PROBLEM

There are numerous benefits to IT, but challenges are also a reality. Developing countries often face challenges related to technological, financial, and organisational factors. Lack of infrastructure, financial constraints, poor quality hardware and software (Biruk, Yilma, Andualem and Tilahun 2014:[2]) can lead to frustration, impaired learning and resistance to IT in nursing education. Threats related to cyber viruses and malware attacks plague individuals' willingness to utilise IT. In addition, inadequate training and supervision in IT can cause student nurses to feel overwhelmed by the "information overload". Learning may occur from inaccurate and irrelevant websites. In addition to IT skills, student nurses need to be taught about cyber safety, plagiarism, IT accountability and responsibility.

The private NEI in the study is committed to improve the quality of nursing education by adequately preparing student nurses for the technology rich healthcare environments. IT has been adopted and integrated into the nursing programmes. The researcher, who is a lecturer at the private NEI observed and noted that while some students nurses embraced the idea of IT and appeared ever enthusiastic and motivated to utilise IT effectively, many others tended to avoid, were resistant and often needed coercion to participate in IT related activities.

The student nurses often complained of feeling lost in a vast web of internet jargon resulting in frustration, impaired learning and resistance to IT. Negative attitudes and challenges can threaten acceptance, adoption and effective utilisation of IT (Kipturgo, Kivuti-Bitok, Karani & Muiva 2014:[1]). IT related learning activities and trips to the computer laboratory at the private NEI proved futile. Fears related to cyber viruses and corruption of universal serial buses (USBs) were often uttered. Many students did not follow the instructional guidelines, failed to deliver on expected outcomes and chose to utilise IT for personal networking and downloading. Nyangeni, Du Rand and Van Rooyen (2015:[2]) reported a lack of accountability and unethical use of social media by South African student nurses. In some incidents, private and sensitive information had been posted and shared without consent thereby breeching individuals' rights to privacy and confidentiality.

There is no shying away of IT in this digital era. In order to make IT more attractive and acceptable to student nurses, it is vital to gain a better understanding regarding their perspectives to IT in nursing education. There is little information regarding the student nurses' perspectives on the use of IT in nursing education since no study had been conducted at the private NEI. Nurse academics could utilise information from the findings of the study to better plan and support learning that meets needs of the student nurses.

1.4 AIM OF THE RESEARCH

The aim of the study was to explain and describe the perspectives of student nurses at a private NEI on the use of IT in nursing education.

1.5 OBJECTIVES OF THE RESEARCH

The objectives of the study were to

- determine student nurses' perspectives on the use of IT in nursing education
- identify challenges encountered by student nurses regarding the use of IT in nursing education
- recommend strategies that could be employed to improve the use of IT in nursing education

1.6 RESEARCH QUESTIONS

The study addressed the following research questions:

- What are student nurses' perspectives regarding the use IT in nursing education?
- What are the challenges encountered by student nurses regarding the use IT in nursing education?
- What strategies are recommended to improve the use of IT in nursing education?

1.7 SIGNIFICANCE OF THE STUDY

There is constant pressure to challenge the status quo and improve the quality of nursing education and nursing practice in order to keep up to date with contemporary developments and challenges in the healthcare landscape (Lambert, Erickson, Alhramelah, Rhoton, Lindbeck & Sammons 2014:1). One pivotal change is the adoption and implementation of IT in nursing education at the private NEI. IT is a compulsory component in the nursing programmes, yet little is known about student nurses' perspectives on IT in nursing education.

The study should provide a better understanding of the impact of IT on the key role players. Andragogy and student-centered education is vital to ensure a positive learning environment where the student feels motivated and in control of learning. The findings should ultimately benefit student nurses through giving nurse academics insight into the strengths and challenges posed by IT on student nurses. A better understanding should promote changes in nursing curriculum and lesson plan design to better support and integrate IT into learning. This should ensure better quality nursing education and better quality nursing practice.

Solutions to identified challenges will be sought and appropriate strategies can then be implemented to overcome them. The aim is to create the most positive experiences of IT. The findings should motivate policy makers to develop and implement policies to ensure that IT remains a key component in nursing education. Programme changes should ensure that student nurses receive adequate and up-to-date education and training in IT. The findings should lead to future research at both public and private NEIs.

1.8 DEFINITION OF KEY CONCEPTS

Conceptual definitions refer to the theoretical description of a concept while operational definitions describe how the concept will be measured (Tappen 2016:30-31).

1.8.1 Conceptual definitions

1.8.1.1 Information technology (IT)

Information technology is defined as the use of systems (especially computers and telecommunications) for processing, storing, retrieving, and sending information. Information technology is commonly referred to IT and includes both hardware and software systems (Marakas & O'Brien 2013:691; Valacich & Schneider 2014:47).

Hardware refers to physical components of a computer system while software refers to programmes involved in the operation of a computer system (Stair & Reynolds 2014:12-14). Software consists of specialised programming language involving bits and bytes that instruct hardware to perform a specific function (Ferreira & Bothma 2015:41-45).

Communication systems connect individuals and institutions (Valacich & Schneider 2014:47-49). Communication systems provide various services and applications such as videoconferencing, gaming and e-learning enabling interaction between people (Ferreira & Bothma 2015:40).

1.8.1.2 Perspectives

Collins English Dictionary (1991:1163, sv "perspective") defines perspective as "n 1. A way of regarding situations, facts, etc., and judging their relative importance". A perspective is a particular way of considering something. Perspectives refer to an individual's various outlooks and viewpoints on a specific topic, occurrence or phenomenon. Perspectives may include attitudes, opinions and behaviours as influenced by the individual's beliefs and experiences (*Oxford Paperback Dictionary and Thesaurus* 2009:682, sv "perspective").

1.8.1.3 Nursing education

Nursing education refers to teaching and training of individuals in nursing. Nursing education provides facilitation, guidance, assistance and empowerment to learn the art and science of nursing. Nursing education aims to equip an individual with knowledge,

skills, values and attitudes in preparation for the role of a nurse (Bruce & Klopper 2017:4-13).

1.8.1.4 Student nurses

According to the Nursing Act (Act 33 of 2005), student or learner nurses refer to individuals who are undergoing education or training in nursing. A student nurse undertakes a formal course in nursing in order to obtain certification in a nursing programme (South Africa 2005:s 32).

1.8.1.5 Nursing Education Institution (NEI)

Nursing education institution (NEI) refers to any nursing education facility accredited by the South African Nursing Council (SANC) in terms of the Nursing Act (Act 33 of 2005). NEIs offer nursing education and training programmes to prepare individuals for practice in any one of the categories contemplated in section 31 of the Act (South Africa 2005:s 42).

1.8.2 Operational definitions

1.8.2.1 Information technology (IT)

IT was defined in the context of the study as all hardware and software including communication systems used in nursing and nursing education. IT hardware referred to all high tech or computerised devices and /or equipment that were used in rendering or teaching nursing care. IT hardware included computers, Smart Boards, smart phones, tablets, mannequins and simulators. IT software included the Internet, computer programs such as Microsoft Outlook, Word, Power Point Presentations and Excel. IT communication technologies included social media and network technologies such as Facebook, WhatsApp, Twitter, Instagram, LinkedIn, WeChat and YouTube.

1.8.2.2 Perspectives

In the study, perspectives referred to the views, outlooks, opinions and behaviours of student nurses as influenced by exposure and experience with IT in nursing education.

1.8.2.3 Nursing education

In the context of the study, nursing education referred to formal programmes of education and training approved by the SANC and provided by the accredited private NEI.

1.8.2.4 Student nurses

Student nurses in the context of the study referred to learners who were registered for nursing programmes at the private NEI. Student nurses referred to learners who were registered for the Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and Advanced Diploma in Medical and Surgical Nursing Science with specialisation in either Critical Care, Trauma and Emergency or Perioperative Nursing (R212) (Regulation R683, Regulation R212) (SANC 1989, 1993).

1.8.2.5 Nursing Education Institution (NEI)

In the study, NEI referred to the private NEI in the province of KZN, South Africa. The private NEI is accredited by the SANC to offer approved nursing education and training programmes. The private NEI offers nursing programmes namely Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and Advanced Diploma in Medical and Surgical Nursing Science with specialisation in either Critical Care, Trauma and Emergency or Perioperative Nursing (R212) (Regulation R683, 1989; Regulation R212, 1993) (SANC 1989, 1993). The private NEI also offers short in-service certificate programmes in Critical Care, Trauma and Emergency Nursing, Perioperative Nursing, Infection Prevention Nursing and Neonatal Intensive Care Nursing.

1.9 THEORETICAL FOUNDATIONS OF THE RESEARCH

A theoretical framework provides structure, direction and appropriate methods to address research questions. The researcher used the Unified Theory of Acceptance and Use of Technology (UTAUT) model to guide the study.

1.9.1 Research paradigm

A research paradigm is an accepted model or pattern of enquiry (Kuhn 1996 cited in Tappen 2016:48). It represents a worldview that encompasses a set of philosophical assumptions that guides the research process (Polit & Beck 2012:736). The researcher used the positivism paradigm, which is often associated with quantitative research designs, in the study.

Positivism uses scientific methods to generate knowledge. The researcher was interested in an ontological approach, which asks what the nature of reality is. Positivism assumes reality exists and can be studied. Positivism in humanities emphasises the rational and scientific. Positivism assumes nature is orderly and regular and values objectivity. Orderly and disciplined procedures are followed to understand phenomena. Deductive processes are used for theory verification. The researcher is distant from the respondents and does not influence the study findings. Data is often collected from large representative samples in an attempt to generalise findings. Data is quantitative and measured by statistical analysis (Polit & Beck 2012:11-13).

The researcher followed a series of logical and orderly steps to gain understanding of the research problem and used deductive reasoning, which moves from the general to specific (Gray, Grove & Sutherland 2017:7). The researcher acknowledged the benefits and challenges posed by IT in healthcare environments and nursing education. The researcher sought to identify specific issues from the perspectives of the student nurses at the private NEI. The researcher was objective, remained distant in data collection so as not to introduce bias, and used structured methods to collect data from a large representative sample. The data was quantitative and measured using statistical analysis.

Although positivism is frequently used in nursing research, it is not the only approach to solve problems. Limitations of positivism include problems with measurement, and an inability to fully describe human experience due to the complexities and diversities of human participants (Polit & Beck 2012:14).

The researcher considered a positivist paradigm well suited to gathering scientific evidence to accurately describe the nature of student nurses' perspectives on IT in

nursing education. A structured data-collection instrument and descriptive statistical analysis ensured objective reporting of data.

1.9.2 Theoretical framework

A theoretical framework provides structure, direction and appropriate methods to address the research questions. The researcher used the UTAUT model to guide the study. IT is a valuable tool in teaching and learning environments; however, its full potential can only be realised with acceptance from users (Gonen et al 2016:[1]). The UTAUT assesses IT acceptance and use in order to make recommendations to ensure IT success in various settings (Venkatesh, Morris, Davis & Davis 2003:425-426). The model provided an appropriate framework to determine the perspectives of student nurses regarding IT in nursing education. The respondents in the study were exposed to IT in theoretical and clinical environments and had opportunities to practise and experience IT in the course of learning. The UTAUT was used to determine factors that influenced the student nurses' acceptance and use of IT at the private NEI.

Venkatesh et al (2003) developed the UTAUT (see figure 1.1). The UTAUT was based on studies of previous acceptance theories and models and combines eight different models into one. The model has four main determinants of intention and usage and four moderators that influence the fundamental relationships (Venkatesh et al 2003:425).

The four determinants are performance expectancy, effort expectancy, social influence and facilitating conditions and the four moderators are gender, age, experience and voluntariness of use. The moderators exert an influence on the relationships between the four determinants and behavioural intention and use behaviour. Performance expectancy, effort expectancy, and social factors influence behavioural intention to use a technology, while behavioural intention and facilitating conditions influence technology use behaviour (Venkatesh et al 2003:447).

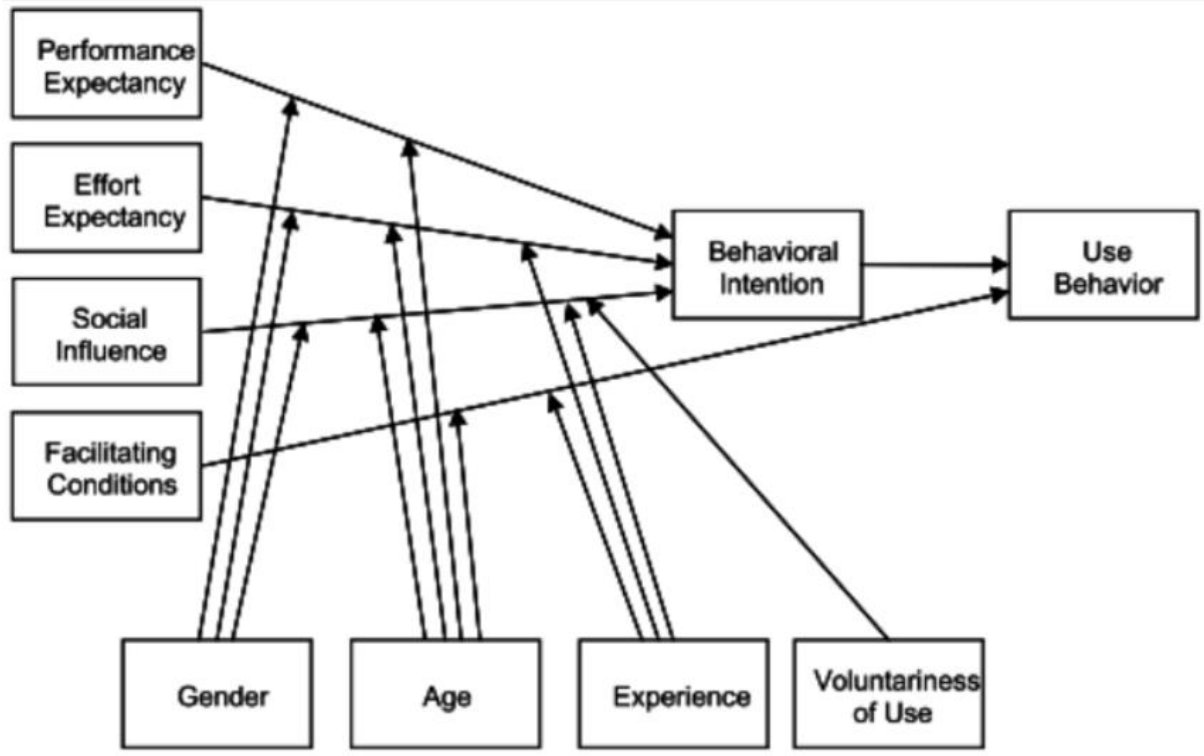

Figure 1.1 UTAUT

(Source: Venkatesh et al 2003:447)

Extended versions of the UTAUT are often used to examine IT acceptance and use in various settings (Venkatesh, Thong & Xu 2016:329-332). The UTAUT has been integrated with other theoretical models to study technology acceptance, use and related issues.

UTAUT is often described as a modified extension of the Technology of Acceptance model (TAM) developed by Fred Davis in 1985. The TAM with extended variables as in the UTAUT provides better holistic understanding of nurses' use of healthcare technology. The TAM and/or UTAUT have been used to determine IT acceptance by nursing personnel (Strudwick 2015:190-197).

The researcher guided by the key factors and moderators of the UTAUT model developed a data-collection instrument to determine the student nurses' perspectives on IT in nursing education. Chapter 2 discusses the UTAUT and the TAM models in detail.

1.10 RESEARCH DESIGN AND METHODOLOGY

A research design is a detailed plan that directs the steps of the research process. The choice of research design depends on the data to be collected in order to provide answers to the research questions (Moule & Goodman 2014:171). The choice of research design is often influenced by the researcher's skills, expertise of supervisors, and time and resources available. A research design includes a plan for data collection, measurement and analysis (Gray et al 2017:52).

Research methods are "the techniques used to structure a study and to gather and analyse information in a systematic fashion" (Polit & Beck 2012:741). Gray et al (2017:683) describe research methods as specific ways the researcher follows in conducting a study within the chosen design.

1.10.1 RESEARCH DESIGN

A quantitative non-experimental, descriptive research design was selected for the study. Quantitative research is the systematic empirical investigation of phenomena characterised by objective measurements and statistical analysis, often involving rigorous and controlled designs (Polit & Beck 2012:739).

The design was appropriate to the research problem and aim and allowed for a better understanding of the phenomenon in an area of limited knowledge (Gray et al 2017:28). No research has been conducted at the private NEI and little is known about the topic. In non-experimental studies, the purpose is to explain and describe phenomena; there is no manipulation of variables or introduction of interventions (Brink, Van der Walt & Van Rensburg 2012:112). The researcher wished to identify and describe the student nurses' perspectives on IT in nursing education. There were no applied interventions. The researcher was intrigued by and intended to describe and understand student nurses' reactions to the integration of IT in the nursing programmes.

Descriptive designs are used to identify problems with current practice and/or justify current practice. The study allowed the researcher to identify challenges pointed out by the respondents regarding IT in nursing education. Descriptive studies are concerned with gathering information from a representative sample of the population through

structured data-collection instruments. According to Tappen (2016:78), simple descriptive designs collect data on the sample's characteristics, attributes and experiences and report the findings, using descriptive statistics. A typical descriptive study is merely intended to describe phenomena, and searches for accurate information about characteristics of a single sample or about the frequency of phenomena (Brink et al 2012:114). The researcher was interested in the perspectives of a single sample of student nurses at a private NEI. The researcher aimed to describe the information collected by means of a structured self-administered questionnaire and use descriptive statistics to analyse the data as accurately as possible.

1.10.2 Research setting

Life, Mediclinic and Netcare are the three main private healthcare groups that contribute to nursing education in South Africa. The study was conducted at a private NEI which is a sub-division of one of the three main private healthcare groups. The private NEI is situated in the province KZN, South Africa. The private NEI has adopted and integrated IT into the nursing programmes. All student nurses that register for the Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and Advanced Diploma in Medical and Surgical Nursing Science with specialisation in either Critical Care, Trauma and Emergency or Perioperative Nursing (R212) (Regulation R683; Regulation R212) (SANC 1989, 1993) at the private NEI have been exposed to IT and are expected to be conversant with and utilise IT in their learning.

1.10.3 Population and sample

1.10.3.1 Target population

The target population is the entire population that the researcher is interested in and to which the study findings can be generalised (Polit & Beck 2012:744), while Gray et al (2017:694) include that the target population meets the sampling inclusion criteria in the study. In this study, the population included all student nurses registered at the private NEI for the period 2017 and 2018 for the Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and Advanced Diploma in Medical and Surgical Nursing Science with specialisation in either Critical Care, Trauma and Emergency or Perioperative Nursing (R212) (Regulation R683; Regulation R212)

(SANC 1989, 1993). All the student nurses received in-housing training in basic computer and research literacy and were exposed to IT in the nursing courses. The target population comprised student nurses with six and more months of experience in the nursing programmes. These student nurses had received fair exposure to and experience of IT in learning and were therefore suitable to provide data related to the research questions. An estimated two hundred and sixty (260) student nurses comprised the target population.

1.10.3.2 Sampling approach and technique

A sampling approach is the process by which the researcher selects respondents that meet the sampling criteria (Botma, Greeff, Mulaudzi & Wright 2010:125). A sampling technique refers to the process of selecting a sample within a given sampling approach (Gray et al 2017:691).

The researcher used non-probability convenience sampling in the study. Non-probability and convenience sampling is often used in nursing research because it is practical, requires less resources, and is particularly useful in cases where there are time and financial constraints or limited accessibility to the population (Botma et al 2010:125; Gray et al 2017:342; Polit & Beck 2012:279-278).

In non-probability sampling, respondents are selected by non-random techniques and there is no way to estimate the chances of each individual being included in the study (Polit & Beck 2012:275; Gray et al 2017:342). Non-probability sampling occurs when the researcher uses discretion or preference in the sample selection (Tappen 2016:122). Convenience or accidental sampling includes respondents in a study who are at the right place at the right time (Gray et al 2017:671).

Limitations associated with non-probability sampling include samples that under-represent a segment of the population, sampling bias, misleading results and an inability to generalise findings (Botma et al 2010:125; Polit & Beck 2012:279-278).

1.10.3.3 Sample

A sample is a subset of the population included in the study (DePoy & Gitlin 2016:380). While it is more feasible to collect data from a sample instead of the entire target population, there is a risk that the sample may not reflect the characteristics of the population. In quantitative research, the quality of the sample depends on the size of the sample and how representative the sample is of the population (Polit & Beck 2012:59).

Inclusion criteria refer to requirements identified by the researcher that must be present in respondents in order to be included in the sample (Gray et al 2017:680). In this study, respondents had to have six or more months of experience in the nursing programmes. Exclusion criteria refer to requirements that are absent in respondents resulting in elimination from the study, in spite of meeting the inclusion criteria (Gray et al 2017:331). Student nurses with less than six months of experience in the nursing programmes were excluded from the study. The sample was taken from the accessible population, namely individuals who were available for the study and a subset of the target population (Polit & Beck 2012:719). The accessible population was student nurses who met the inclusion criteria and were present, available and willing to participate on the days of data collection.

In an effort to overcome possible limitations to sampling, the researcher collected data from the accessible target population. A large number of respondents ensures representativeness and increases generalisation (Polit & Beck 2012:284). Generalisation refers to the degree to which quantitative research findings can be applied to individuals other than those who participated in the study (Polit & Beck 2012:14).

1.10.4 Data collection

Data was collected using a self-administered structured questionnaire. Questionnaires are used to collect information and/or characteristics about an identified population (Gray et al 2017:407). Questionnaires allow for a large number of respondents to be reached with minimal time and expenditure (DePoy & Gitlin 2016:147). While structured questionnaires are frequently criticised for being superficial since they do not probe deeply, they are ideal when brief responses are required for numeric data analysis

(Brink et al 2012:155-156). Questionnaires are limited by the extent to which the respondents are able and willing to report on the topic (Botma et al 2010:135).

Self-administered questionnaires allow respondents to read the questions and give their answers (Polit & Beck 2012:265). Although complete anonymity is afforded to respondents, responses may not necessarily reflect the truth. Respondents may answer in a way that shows them in a positive light or according to perceived expectations. In this study, the researcher remained distant during data collection to prevent any researcher bias. The researcher ensured that the items on the questionnaire were short, clear, and unambiguous to prevent confusion.

1.10.4.1 Development of the data collection instrument

The researcher developed the data-collection instrument after extensive review of literature. Polit and Beck (2012:264) state that structured questionnaires take considerable time and effort to develop but are relatively easy to administer and analyse.

The self-administered questionnaire consisted of four sections. The items in section A covered the respondents' demographic profile; section B examined their knowledge, and section C examined their perspectives, attitudes, perceptions, behaviours and characteristics. The response sets varied from simple dichotomous responses and rating scales to graded 5-point Likert scale options. This prevented a burden on the respondents since it was easier to choose from options than to write out answers, thereby allowing for more questions to be answered in a fixed period of time. Closed questions also allow for statistical analysis making description and comparison possible (DePoy & Gitlin 2016:222). There was no need to explain or qualify responses, although it is argued that respondents may object to being forced to choose from options that do not readily reflect their opinions (Polit & Beck 2012:298). Section D of the questionnaire included an open-ended question on recommendations to improve the use of IT in nursing education.

A statistician was consulted to review the questionnaire for its statistical validity and ability to draw meaningful statistical conclusions from the results. The questionnaire was pre-tested with a small number of student nurses to detect any errors. Identified flaws

and errors in the questionnaire were adjusted and rectified based on the statistician's recommendations and the results of the pre-test.

1.10.4.2 Pre-testing of the data collection instrument

A pilot-test or pre-test of questionnaires determines the effectiveness of a data-collection technique (Gray et al 2017:410). The questionnaire was pretested with five (5) student nurses in order to detect flaws and assess for clarity, unintentional repetition, ambiguity and time adequacy of the questions.

1.10.4.3 Data collection process

Data was collected over several days at the private NEI in order to allow for data to be collected from all student groups. The questionnaire was handed out to all student nurses who were present, available and willing to participate in the study. A covering letter and informed consent form accompanied the questionnaire. The covering letter explained the aim of the study and ethical considerations pertaining to the respondents. Respondents who agreed to participate in the study signed the accompanying consent form. The respondents were afforded forty-five (45) minutes to complete the questionnaire in private. The respondents were asked to detach the consent forms from the questionnaires and place each into the separate boxes provided.

1.10.5 Data analysis

Excel and the Statistical Package for the Social Sciences (SPSS) are often used for data analysis (Moule, Aveyard & Goodman 2017:360). The raw data from the completed questionnaires were captured onto an Excel spreadsheet. The spreadsheet was formulated based on pre-coding of items in the questionnaire. The Excel spreadsheet was checked and cleaned of any errors. Data were then analysed with the assistance of a statistician using the SPSS version 22 program.

Statistical analysis can take the form of descriptive and/or inferential statistics. Descriptive statistics are used to estimate parameters while inferential statistics are used to make inferences about the population (Polit & Beck 2012:379). Statistical

analysis ranges from simple averages to complex calculations (DePoy & Gitlin 2016:285-294).

Descriptive statistics were used to address the research questions which were descriptive in nature. Descriptive statistics are useful for understanding quantitative research evidence and enable researchers to summarise, interpret and understand numeric information (DePoy & Gitlin 2016:285). Descriptive statistics provide summaries of data which can be presented in tables or graphs (Botma et al 2010:148). The results were presented in frequencies, percentages and graphs. Frequencies refer to "the number of times that a result occurs" (Brink et al 2012:180-186). Descriptive statistics include numerical measures, using mathematical calculations (Saks & Allsop 2013:217). Means and standard deviations were used where applicable. The mean is the average of all the scores in a distribution (Gray et al 2017:523). Standard deviation specifies "how values vary about the mean of distribution". Standard deviation is the most popular measure of dispersion (Evans 2013:65).

Inferential statistics draw conclusions about populations from sample data (Evans 2013:163). The p-value, t-test, analysis of variance (ANOVA), chi-square test and binomial test were used in the data analysis. Inferential statistics use p-values, which refer to "the probability that the outcome is owing to chance – and used to communicate the significance or non-significance of the differences" (Brink et al 2012:179). The p-value is used to determine the statistical significance of results. A very small p-value indicates that the probability that the result was due to error or chance is also very small. A p-value greater than 0.05 indicates the probability that the results were due to an error is very large and the researcher cannot draw conclusions (Houser 2015:356).

The t-test is the most common parametric statistical test. Parametric statistics are associated with data that meet specific assumptions (Gray et al 2017:567). The t-test compares the means of two groups to establish if differences are significant or by chance. There are two forms of the t-test, namely one sample and independent samples t-tests. The one sample t-test is used when samples are dependent, and determines whether a mean score is significantly different from a scalar value (Polit & Beck 2017:385). The independent samples t-test is used when samples are independent, and compares two independent groups of cases (Brink et al 2012:191).

ANOVA is an extension of the t-test and allows for the comparison of more than two means at the same time (Evans 2013:182). ANOVA is a test for several independent samples that compares two or more groups of cases in one variable (Brink et al 2012:191). ANOVA tests for differences between the groups (Gray et al 2017:572).

The Chi-square test is the most widely used test in health science research, and compares sets of data in the form of frequencies (Brink et al 2012:191). The Chi-square goodness-of-fit-test refers to a univariate test used on a categorical variable to test whether any of the response options are selected significantly more or less often than the others. The null hypothesis assumes that all responses are equally selected. A univariate analyses a single variable in order to provide description (Botma et al 2010:148-149).

A binomial test examines whether a significant proportion of respondents select one of a possible two responses. This can be extended when data with more than two response options are split into two distinct groups.

Limitations associated with descriptive data analysis include inadequacy of information, incorrect statistical indexes, and inability to present data in a clear and efficient manner. Limitations with inferential statistics relate to uncertainty with generalisation to a population that has not been fully measured and the possibility of errors (Polit & Beck 2012:402).

1.11 DATA AND DESIGN QUALITY: VALIDITY AND RELIABILITY

Validity and reliability are closely related concepts which aim to ensure quality of the study and data-collection instrument. Internal validity refers to the ability of a research design to accurately answer the research questions and external validity refers to the capacity to generalise the study findings and develop inferences from the sample to the study population (DePoy & Gitlin 2016:122-124). Reliability of the research design refers to consistency of measure (Gray et al 2017:370). The study was well planned, so if repeated under similar circumstances should yield similar results.

The questionnaire was assessed for face and content validity. According to Polit and Beck (2012:336), face validity is concerned with whether the instrument appears to be

measuring the target construct while content validity refers to the ability of the instrument to accurately measure questions in the context of the study. Reliability of the data-collection instrument refers to the degree to which the instrument can produce consistent and stable results if repeated over time or if used by different researchers (Brink et al 2012:169). Reliability is equated to measures of stability, consistency or dependability, and accuracy (Polit & Beck 2012:331).

In order to ensure validity and reliability, the researcher developed the questionnaire after conducting the literature review. The researcher ensured construct validity of the instrument and its fit to the focus of the study by means of complete and adequate conceptual and operational definitions of key concepts. A statistician reviewed the questionnaire for statistical validity and its ability to draw meaningful statistical conclusions from the data. Identified flaws and errors in the questionnaire were adjusted and rectified according to recommendations from the statistician.

The questionnaire was pretested with five (5) respondents who were not included in the main study to assess for clarity, unintentional repetitions, ambiguity and time adequacy. No flaws were detected and the questionnaire did not require any amendment following the pre-test.

1.12 ETHICAL CONSIDERATIONS

Ethics in research pertains to the integrity of the study, expected behaviours of the researcher, and protection of the participants' rights (DePoy & Gitlin 2016:375). Accordingly, the researcher obtained permission to conduct the study and upheld the principles of self-determination and informed consent, beneficence, justice, and privacy, anonymity and confidentiality.

1.12.1 Ethical considerations related to the institution

1.12.1.1 Approval and permissions

The researcher obtained approval and ethical clearance from the Higher Degrees Committee of the Department of Health Studies at the University of South Africa (UNISA) (see Annexure A). The private NEI is one of the divisions of a private

healthcare group, therefore approval and consent for the study was obtained from the private healthcare group's Ethics and Research Committee (see Annexure B). Permission to conduct the study was also obtained from the campus manager at the private NEI.

The private NEI was assured that the results of the study would not be linked to and/or cause damage to the name or reputation of the institution or group.

1.12.2 Ethical considerations related to the respondents

1.12.2.1 Self-determination and informed consent

The principle of self-determination refers to respect for the respondents' autonomy to decide whether or not to participate (Gray et al 2017:162). Informed consent means that respondents should receive the necessary information about the purpose and objectives of the study, benefits and risks and rights as a respondent (Gray et al 2017:176-178).

Full disclosure refers to a full description of the nature of the study (Polit & Beck 2012:154). The respondents were informed of the nature and aim of the study and that participation was voluntary. A covering letter explained the aim of the study and provided the researcher's details (see Annexure C). The respondents' right to self-determination was upheld. The respondents were reassured that participation in the study was completely voluntary. The respondents who were willing and consented to participate in the study were asked to sign informed consent forms (see Annexure D). Informed consent are documents that inform the respondents of the purpose and requirements of the study, which respondents complete on consenting to participate in the study (DePoy & Gitlin 2016:33-34),

The respondents were student nurses. Botma et al (2010:7) point out that students are considered vulnerable and in a subservient position. The researcher was in a position of authority as a lecturer at the private NEI but did not exploit any relationship with the respondents. The researcher visited the student nurses in the classrooms to explain the aim and objectives of the study and answer any questions or concerns and provide clarification, if required. The researcher, however, remained distant in terms of interaction and administration of the questionnaire. The administration personnel at the

private NEI acted as research assistants only to assist in data collection. The research assistants administered the questionnaire to the respondents on the days of data collection. The assistants were briefed on the process to follow in administering the questionnaire so as not to influence the respondents in any way. The research assistants went into the classrooms after the researcher had spoken to the respondents and left. The research assistants handed out the questionnaires to the respondents thereby minimising any undue obligation to participate in the study (see Annexure E for copy of the questionnaire). The respondents were allowed forty-five (45) minutes to complete the questionnaire in private during which time the research assistants remained in the classroom and oversaw the process. The respondents were directed to place the signed informed consent forms and completed questionnaires in the separate boxes provided. Both boxes were handed over to the researcher at the end of the data collection session.

1.12.2.2 Beneficence and non-maleficence

The researcher ensured that the respondents' rights were protected at all times. Beneficence refers to the act of doing good and non-maleficence refers to doing no harm (Grove, Gary & Burns 2015:98). In conducting research there should be a balance of benefit-risk ratio (Gray et al 2017:174). Benefits should be maximised and risks minimised (McIntosh-Scott, Mason, Mason-Whitehead & Coyle 2014:206).

The benefits of the study included a safe venue for the respondents to describe their perspectives on IT in nursing education. The results of the study should give nurse educators better insight into the strengths and challenges of IT for student nurses. A better understanding should lead to changes in nursing programmes to better support and integrate IT into student nurses' learning.

The study posed no harm in terms of physical, psychological, social or financial risks to the respondents. No reward, reimbursement, gifts or services were given to the respondents. The questionnaire was administered at the private NEI and the respondents incurred no financial cost. The respondents were not coerced to participate. The respondents were also informed of their right to not participate or to withdraw from the study without fear of any repercussion or discrimination.

1.12.2.3 Justice

Justice refers to the right to fair treatment (Gray et al 2017:172). Respondents must receive fair treatment in terms of the benefits and risks of the study (Grove et al 2015:98).

All the student nurses that met the study inclusion criteria were afforded an opportunity to participate in the study. There were no preferences given to the respondents. The study provided a safe venue for the respondents to describe their perspectives on IT in nursing education. The benefits of the study will be the creation of positive IT experiences for all student nurses. The study posed no risks to the student nurses.

Data was collected consistently from the respondents at the private NEI during their college block times. Respondents received a participant information leaflet, informed consent form and questionnaire. The researcher was available to answer any questions or address clarifications before data collection. The respondents were afforded a fair amount of time of forty-five (45) minutes to complete the questionnaire.

The researcher assured the respondents that the results of the study would be made available on completion and upon request. Promises made to respondents must be upheld (Gray et al 2017:172).

1.12.2.4 Privacy, anonymity and confidentiality

The respondents' right to privacy, anonymity and confidentiality was maintained throughout the study. Privacy refers to respondents' right to decide what, when and how much information to share in a study (Grove et al 2015:105). Anonymity means that responses may not be linked to individual respondents whilst confidentiality means that respondents' private information should not be shared with others without the respondents' authorisation (Gray et al 2017:170). Confidentiality also includes safe management of data that must be protected and kept private from others (Grove et al 2015:107). Personal information provided in a study must be safeguarded (Moule & Goodman 2014:60).

The respondents completed the questionnaires in private without any distractions. No names or identifying codes appeared on the questionnaires. The completed consent forms were placed in a box separate to the completed questionnaires. Thus, it was not be possible to link responses to any respondents. This ensured the anonymity of responses and the respondents felt safe to answer honestly.

The respondents were reassured that no unauthorised persons would have access to the data. The data would not be used against the respondents in any way. The completed informed consent forms and questionnaires were protected and locked away for safety in a fireproof cupboard. Electronic data was password protected. The data will be destroyed after a period of time as stipulated by the Research and Ethics Committee at UNISA.

1.12.3 Ethical considerations related to the scientific integrity of the study

The researcher maintained scientific integrity throughout the study. There was no misconduct or conflict of interest on the part of the researcher. Polit and Beck (2012:169) define research misconduct as falsification, fabrication and/or plagiarism during research. Data was not made up or manipulated in any way and relevant authors were credited in the text. The study was not beyond the researcher's scope and experience. The researcher was supervised and guided by an expert research practitioner throughout the study.

1.13 SCOPE AND LIMITATIONS OF THE RESEARCH

Limitations are weaknesses in a study that may potentially reduce the generalisability of the study findings (Gray et al 2017:57).

The quantitative research paradigm adopted in the study may not capture and explain the full depth of student nurses' perspectives on IT in nursing education. The study population and sample were from a single private NEI and reflected the respondents' perspectives, therefore the findings cannot be generalised to other private or public NEIs. Student nurses at other NEIs may not have the same exposure to, training or working experience in IT in nursing education.

1.14 STRUCTURE OF THE DISSERTATION

The dissertation consists of five chapters:

Chapter 1: Orientation to the study

Chapter 2: Literature review

Chapter 3: Research design and methodology

Chapter 4: Data analysis and interpretation, and results

Chapter 5: Findings, limitations, recommendations and conclusion

1.15 CONCLUSION

IT is being adopted and implemented to varying degrees across clinical and educational healthcare institutions in South Africa. Private NEIs aim to provide student nurses with adequate exposure and experiences to IT, so to better prepare these future nurse practitioners for the technologically rich work and learning environments.

This chapter discussed the research problem, purpose, research design and methodology, and significance of the study. The ethical considerations were presented and key concepts defined.

Chapter 2 discusses the literature review conducted for the study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The digital era, characterised by information technologies, has infiltrated and continues to infiltrate all spheres of life. This chapter discusses the literature review conducted for the study. The literature review covered IT in nursing education; the influence of IT in the twenty first century healthcare landscape; prominent learning theories in relation to IT; technology acceptance models; user attitudes to and perceptions of IT, and challenges to IT.

The researcher investigated and collated studies to obtain a comprehensive and deeper understanding of IT in nursing education. The researcher found that while there were numerous international studies regarding IT in nursing education, there were limited studies pertaining to South Africa. This study should therefore make a valuable contribution to the knowledge base regarding the use of IT in the context of the South African nursing education system.

2.2 A WORLD REVOLUTIONALISED BY IT

The twenty-first century has been described as the digital era, with infinite technological possibilities and a constant state of connectedness. IT has penetrated every sector of life (Fujino & Kawamoto 2013:244). The speed and efficiency of manufacture and production has been revolutionised through IT. Retail therapy is most pleasurable with a simple click of the button through online shopping enabling for the perfect item to be sourced and delivered to the door in next to no time. No more rushing to the banks or the inconvenience of long queues with Internet banking. Business work environments are transformed from brick and mortar to virtual environments. Human replica robots and computer driven cars will soon be a reality in many countries (Fujino & Kawamoto 2013:244). Time and distance no longer separate or isolate people. Individuals can connect to clients, colleagues and loved ones at anytime and anywhere in the world through instant messaging and video calling. Weather and news updates keep people

informed and aware. Chat rooms allow people to share similar likes and interests. Friends and partners can be found through online dating sites (Fujino & Kawamoto 2013:244).

Healthcare landscapes are not immune to the developments in IT. State-of-the-art assessment and diagnostic tests and equipment allow for more accurate results in shorter waiting periods. Treatment modalities are streamlined and procedures are less invasive. Decision support systems reduce the risk of life-threatening errors. Faster and ready access to patient information improves the quality, accuracy and comprehensiveness of healthcare records (Mantas & Hasman 2017:20).

Education and training systems are also transitioned to keep pace with advancements in IT (Lambert et al 2014:6). Traditional pedagogies make way for electronic-learning or E-learning models to create enhanced learning experiences that meet the demands of the twenty-first century learner.

2.3 A CASE FOR IT IN HEALTHCARE AND NURSING EDUCATION

This section discusses the influence of IT in healthcare and nursing education, including the magnitude of IT in healthcare: health information technology (HIT), electronic health records (EHR), and clinical decision support systems (CDSS).

2.3.1 Magnitude of IT in healthcare

IT has impacted healthcare environments globally and demonstrated the ability to improve the overall quality, safety and efficiency in healthcare landscapes (Rajagopal 2013:79). While many developed countries boast of the successful integration of high-tech IT into healthcare systems, developing countries like South Africa are slowly following in the footsteps of their counterparts (Britnell 2015:158). Public and private healthcare institutions acknowledge the benefits of IT and make deliberate efforts to invest in IT to improve health outcomes and service delivery in the country. A study at two public hospitals in South Africa that invested extensively in IT revealed that healthcare practitioners acknowledged the benefits of IT to improve quality care, enhance information privacy, smooth workflow and decrease financial costs (Cline & Luiz 2013:[4]). Disparities between the public and private health sectors are often a

reality. Healthcare practitioners at three public hospitals in Ethiopia reported less access and exposure to IT (Biruk et al 2014:[4]).

Health institutions adopt and implement IT in varying degrees from high tech medical equipment and robots, fully computerised health records, automated appointment reminders to support applications with the aim of improving the effectiveness and efficiency of healthcare service delivery (Cline & Luiz 2013:[1]). IT has been incorporated in varying degrees across hospitals in South Africa but Inkosi Albert Luthuli Central Hospital (IALCH) is the only fully computerised public health facility functioning as a paperless institution (Seahloli 2016:61-62).

Health information technology (HIT), electronic health records (EHR), telehealth, clinical decision support systems (CDSS) and nursing informatics are among the commonly used IT systems in healthcare.

2.3.1.1 Health information technology (HIT)

Health information technology (HIT) refers to all computer hardware and software involved in the storage, use and sharing of health-related information for communication and decision making (Brailer & Thompson cited in Rajagopal 2013:80). HIT includes EHR, health management systems and telemedicine. Reduced costs, better time management and streamlined workloads are some advantages of HIT. HIT plays an instrumental role in ensuring the accuracy, privacy and accessibility of health information. Treatment protocols are improved through appropriate recommendations from support systems (Rajagopal 2013:81-88).

HIT improves healthcare services through better data management, communication, and decision making (Biruk et al 2014:[2]). Patient safety and evidence-based practice are promoted with HIT (Abdrbo 2015:509). The speed and efficiency of services rendered to patients and clients are vastly improved. Problems related to patient registration and follow-up visits are reduced (Rajagopal 2013:81). Healthcare facilities utilise IT in the management of human resources and logistics (Dean 2013:8-9). IT ensures accurate statistics in terms of personnel profiles and turnover. Patient demographics, infection and disease rates, bed occupancies, length of stay and patient outcomes can be tracked using HIT. HIT assists healthcare practitioners to compare,

identify patterns of disease occurrence, measure impact of treatment, make inferences and prompts research.

IT has become part and parcel of healthcare. Healthcare practitioners, including nurses, are required to utilise high tech equipment and machinery in rendering care, ensure proper input and capture of data onto computer systems, use decision support systems to guide practice and educate the healthcare user on health-related applications (Apps) (Dowding 2013:31). It is imperative that nurses embrace IT. According to Garavand et al (2016:2714), HIT may fail if rejected by healthcare users. Rajagopal (2013:89) emphasises that the proper facilitation of HIT depends on the IT competency of its users.

2.3.1.2 Electronic health records (EHR)

Electronic health records (EHR) refer to computer-based documents of patient health information and records (Rajagopal 2013:83). The quality and accessibility of patient documentation is improved with EHR.

The most commonly occurring problems related to handwritten patient documentation include poor record keeping. Nursing notes are often inconsistent, unstructured and fail to capture all relevant and vital data resulting in substandard documentation. Planning of care is lacking, inappropriate and not evidence based. Incomplete admission and treatment records, including reported evaluation of care, result in failed communication structures (Chand & Sarin 2015:3503-3504). EHR has the potential to improve patient safety due to increased legibility and clarity of patient records, reduction of duplication, and expansion of access (Whitt, Eden, Merrill & Hughes 2017:45).

EHR contributes positively to workflow and smooth running of processes. The responsibility for the vast majority of patient documentation falls on the shoulders of nurse practitioners. Accordingly, it is imperative that nurses understand, accept and embrace EHR (Chand & Sarin 2015:3504-3505). Dowding (2013:31) states that nurses require IT knowledge and skills to access and use information sources. Nurses must have knowledge about EHR features to ensure maximum utilisation of the system. EHR training must be provided to nurses to ensure correct recording, communication and accessibility to promote quality documentation and patient safety (Whitt et al 2017:51-

52). Competency in IT skills is no longer an advantage but a key requirement for nurse practitioners for job performance (Puckree, Maharaj & Mshunquane 2015:511).

2.3.1.3 Clinical decision support systems (CDSS)

Clinical decision support systems (CDSS) refer to IT Apps that provide recommendations to healthcare practitioners in terms of diagnosis and treatment protocols (Rajagopal 2013:83). There are numerous Apps available on the market from medical textbooks, formularies to calculators (Moore & Jayewardene 2014:18). Apps provide guidance in diagnosis, treatment options, medication prescriptions and care plans.

Nurses are encouraged to use CDSS in practice. A survey in England in 2014 found that only 82 nurses compared to 333 doctors used CDSS Apps (Moore & Jayewardene 2014:18). CDSS can improve the quality of healthcare rendered by suggesting treatment plans and protocols that are most suitable and effective to meet patient needs. This means that the patient is treated correctly from the start and there is no wastage of time and resources from failed treatments. Patient safety is enhanced through prescription and calculation assistance.

The challenge in CDSS is that there are so many on the market. Moore and Jayewardene (2014:18) found that less than one quarter of practitioners performed any risk assessment before using CDSS. Nurses must be able to identify the suitability, correctness and risks associated with each App. Clinical knowledge including IT skills is required to navigate through systems and correctly use CDSS. In their study of health workers' knowledge of and attitudes towards computer applications in rural African health facilities, Sukums et al (2014:[8-9]) recommended that IT training be implemented before the roll-out of HIT and CDSS to augment the low levels of IT knowledge.

2.3.1.4 Telehealth

Telehealth refers to the use of IT that has been specially developed to provide healthcare to patient and clients across distances. Telehealth allows for healthcare practitioners to connect with patients in spite of being in different locations. Clinical

data, digital images and video conferencing allow for interaction at anytime and anywhere. Patients can be treated in home environments and even at locations which may be inaccessible, remote and rural. Patients would be spared from lengthy travel times and financial burdens (Benavides-Vaello, Strode & Sheeran 2013:112-113).

Healthcare practitioners are able to assess, diagnose, treat, evaluate and educate patients through telehealth (Benavides-Vaello et al 2013:112-117). Remote patient monitoring enhances evidence-based practices (Hay, Carr, Dawe & Clark-Burg 2017:9). Alwan et al (2015:[2]) states that IT integrated into healthcare systems as done in Ethiopia can be used to overcome difficulties related to poor service delivery and shortage of healthcare practitioners. Telehealth would allow one healthcare practitioner to reach hundreds of patients across the board.

If telehealth is the future of healthcare, then it is imperative that nurses become proficient in IT in order to use equipment effectively and efficiently to provide quality service that meets patients' needs. Nurse practitioners will also be expected to educate patients and clients on the use and troubleshooting of IT devices and Apps (Dowding 2013:31). Fujino and Kawamoto (2013:248) found that nurses who were skilled in IT displayed better interpersonal communication abilities; therefore, nurses should be encouraged to develop the relevant IT skills and competencies.

2.3.1.5 Nursing informatics

Today, it is almost impossible to separate IT from healthcare. Nurse practitioners are the heart of healthcare service delivery and therefore must commit to use IT for the advancement of the profession (Samarkandi et al 2015:47). Nurses must show a willingness to adjust, adapt and adopt IT in practice. Knowledge and skills in IT are a prerequisite for safe quality nursing practice. While many nurse practitioners lack IT knowledge and skills, inclusion of IT modules and skills development programmes can equip nurses to utilise IT safely and effectively (Abdrbo 2015:509-514). IT training is a necessity for the successful adoption of IT in healthcare systems (Alwan et al 2015:[6]). Fujino and Kawamoto (2013:248) emphasise that it is vital to educate all nurses on IT to reduce resistance in practice.

Nursing informatics refers to a “combination of scientific knowledge and technology in nursing”. Nursing informatics is a discipline which integrates IT into the scientific nursing process. This ensures that the profession becomes dynamic and adjusts to contemporary changes (Gonen et al 2016:[2-3]). Nurse practitioners must develop informatics competencies to use and manage IT and high-tech medical devices, EHR, telemedicine, patient portals and mobile Apps (Murphy, Goossen & Weber 2017:1). Nursing education must move towards the inclusion of nursing informatics as a core module. Nursing informatics teaches basic computer use, information management, issues related to IT, communication skills and teamwork, including legal and ethical conduct (Murphy et al 2017:34).

2.3.2 Demand for IT in nursing education

This section describes service demands and pressure to meet the learning needs of digital era student nurses.

2.3.2.1 Pressure from service demands

The healthcare landscape is in a state of transition responding to developments in the technological environment (Murphy et al 2017:34). Nurses have a responsibility to use IT effectively and efficiently in work performance (Gonen et al 2016:[1]). The successful adoption of IT in healthcare systems depends on adequate IT education and training (Alwan et al 2015:[6]). IT must be perceived as beneficial in order to be accepted and used (Mittal 2015:9).

Nursing education is under pressure to provide student nurses with the ability to meet the demands of the contemporary health environment (Olele 2014:113). Student nurses must be prepared to fulfil their expanded roles, using IT in healthcare facilities (Puckree et al 2015:518; Puerta 2016:168). Nursing education institutions need to be challenged to include IT in basic nursing courses (Garavand et al 2016:3508). Gonen et al (2016:[5]) emphasise the need for nursing curriculums to incorporate IT education and training to equip student nurses with the necessary IT skills and competencies for practice. Student nurses who are exposed to IT early in learning will be better prepared to utilise IT in clinical environments and for continued life-long learning (Samarkandi et al 2015:67).

Hay et al (2017:10) maintain that IT knowledge and usage provide student nurses a competitive advantage in the labour market ensuring skill sets that are able to keep abreast with contemporary innovations and issues pertaining to healthcare. In the United Kingdom (UK), 64% of job descriptions require nurses to possess IT skills to use EHR, use support systems to inform patient care and improve service quality and efficiency, support communication utilising mobile technologies between all healthcare customers and stakeholders (Dowding 2013:36). Garavand et al (2016:2716) state that IT in healthcare systems requires not only infrastructure that supports IT but also readiness for IT use on the part of nurse practitioners. Thus IT knowledge and skills have become essential in nursing education (Samarkandi et al 2015:47), to create dynamic, highly competent, evidence-based practitioners who are able to function competently in IT-driven healthcare systems.

2.3.2.2 Pressure to meet the learning needs of the digital era student nurse

Transformation of education by IT is a continuous global effort and its effect is yet to be fully unleashed and measured (Puerta 2016:181). The twenty-first century student is accustomed to a dynamic, fast paced technologic environment (Olele 2014:117). IT stimulates the student's cognitive, affective and aesthetic abilities and can therefore improve the standard of learning. While the pressure is on to utilise IT to harness the learning potential of the digital era student, it must be emphasised that "technology should not drive education" but rather educational objectives, demands and careful balance must steer the use of technology in nursing education (Olele 2014:113-115).

IT is a "powerful and valuable tool" for supporting learning (Gonen et al 2016:[1]). Countries across the world acknowledge the power of IT on learning. Latin American and Caribbean countries have developed policies to ensure integration of IT into educational systems (Puerta 2016:187). Education institutions in South Africa are also incorporating IT in learning models. Private NEIs are leading the way by the compulsory integration of IT into nursing programs. The private NEI in the study has taken active steps to integrate IT into nursing programmes. The use of IT in teaching and learning for both nurse academics and student nurses is not negotiable.

Traditional pedagogies are blended with IT to create a captivating and exciting experience of learning. IT in nursing education has the potential to intrigue, motivate

and stimulate student nurses. Olele (2014:117) states that this contemporary pedagogy sparks students' imaginative and intuitive abilities. IT in nursing education has the potential to improve student nurses' abilities to understand difficult concepts and improve performance (Mittal 2015:9). IT in nursing education can improve students' learning experience and performance but IT must be accepted by the users to be fully effective (Gonen et al 2016:[1]).

Traditional pedagogy paradigms in nursing education emphasised the transfer of knowledge and skills from the nurse educator to the student (Olele 2014:117). The adoption of IT in nursing programmes transforms learning from traditional approaches to more participative methods (Clark, Glazer, Edwards & Pryse 2017:94). IT exposes the student to different educational methodologies, content and activities (Puerta 2016:170). IT engages student nurses for more cooperative learning (Gonen et al 2016:[1]). Passive learning is transformed into interactive modes of learning. Nevertheless, it must be noted that IT use alone does not guarantee success in learning (Zayim & Ozel 2015:460).

Educators must assist students to become comfortable with IT, develop IT skills to use search engines effectively and manage distractions during E-learning (Thompson 2013:23). Nurse educators need to embrace IT in education in order to successfully motivate students to integrate IT into learning (Mittal 2015:1). Educators must become co-learners to IT to bridge knowledge gaps and develop instructional principles to encourage learning with IT (Olele 2014:117).

Clark et al (2017:91) point out that strong leadership, commitment and adequate technological planning and support are required for the adoption of IT in teaching and learning. NEIs must create a culture shift that welcomes the use of IT to facilitate transformation in nursing education and the nursing profession. Nursing curriculums must be reviewed and revised to include IT to best prepare the students for the realities of the world and work environments. IT paves the way for life-long learning. Web-based learning affords students flexibility in learning in terms of time, place and pace (Caglar & Turgut 2014:43).

Sukums et al (2014:[9]) stress the importance of IT training for continuous education and professional development. Online discussions on contemporary nursing trends by

students and alumni add value to the profession (Hopkins & Wasco 2016:[2]). IT allows individuals to maintain work-life balance whilst studying (Lambert et al 2014:8).

2.3.2.2.1 Using IT in the classroom

Nursing education must provide student nurses with first-hand experience in IT to engage and promote learning (Hay et al 2017:8). Increased awareness and exposure may reduce resistance related to unfamiliarity with IT. NEIs must provide the necessary infrastructure in terms of hardware, software, connectivity and human resource assistance to facilitate the integration of IT in traditional classrooms (Olele 2014:116). Garavand et al (2016:2714) state that the effective and efficient utilisation of IT depends on nurses' knowledge and attitudes, and facilitating conditions in educational and clinical environments.

As role models for student nurses, nurse educators must display positive attitudes to IT. Nurse educators must lead by example and incorporate IT into traditional teaching and learning methodologies to create awareness and exposure. The traditional classroom is transformed with IT. Smart Boards and eBeams replace overhead projectors. Handwritten transparencies give way to professional presentations and slide slows. Updates and corrections are no longer a painstaking process. The addition of pictures, and audio and video clips add new dimensions to boring lectures.

Classrooms with web-enable facilities allow nurse educators' access to the Internet, which provides a wealth of information to augment teaching. Nurse educators can use medical websites to display pictures and videos. Students can be guided to connect to websites and access medical journals to facilitate evidence-based learning. Assignments in typed formats using Word, Excel and PowerPoint Presentations provide students with the opportunity to practise and perfect basic IT skills. Various medical related Apps and games provide a new, exciting and competitive element to learning. Procedures become more realistic with high-fidelity simulation and mannequins.

Nurse educators must have updated IT knowledge and skills to incorporate IT in learning environments (Puckree et al 2015:515). Nurse educators must encourage the use of IT in learning ensuring that delegated learning activities encompass some form of IT to actively engage student nurses. Repeated exposure and practice has the potential

to strengthen students' IT competencies. A study in Hong Kong found that using IT in classrooms through innovative learning approaches improved IT literacy and critical thinking in students (Kong 2014:172).

2.3.2.2.2 Mobile technologies in nursing education

Today's "net generation" are born and bred in technology (Prensky cited in Olele 2014:117). It is almost impossible to separate these "digital natives" from their mobile devices. The digital era individual is accustomed to a constant state of connectedness.

Mobile technologies refer to portable devices such as smartphones, tablets and laptops (Zayim & Ozel 2015:456). Smartphones refer to cellular phones that have additional functions to basic phone and text messaging and include Internet access and the ability to support a range of Apps (Chipps, Pimmer, Brysiewicz, Walters, Linxen, Ndebele & Gröhbiel 2015:[3]). Tablets and laptops have the same capabilities.

Mobile technologies provide immediate access to information and instantaneous communication. Provision of fast and on-demand accessibility propels student nurses to self-directed active learning. IT encourages student nurses to take responsibility for their own learning and actively participate in the acquisition of knowledge A study in Turkey found that the majority of the students displayed readiness for mobile learning (Zayim & Ozel 2015:456-459).

Mobile technologies allow student nurses access to evidence-based databases, clinical guidelines, e-books and Apps (Hay et al 2017:8). The Internet makes information such as journal articles, reports and books available to education systems with limited resources. IT is instrumental in bridging the gap between social disparities in education. Latin American education systems are using IT to resolve prominent problems in the teaching and learning environments. Learning environments unrestricted by physical boundaries and time are created via IT platforms. Cloud computing allows content to be loaded into the cloud and is readily available at any time and on any device owned by the student (Puerta 2016:166-210).

Mobile technologies in education promote collaborative learning by encouraging interaction between students, educators and subject experts (Olele 2014:119). The

creation of virtual learning environments connects students with professionals across the globe (Samarkandi et al 2015:48). Hay et al (2017:8) point out that mobile devices afford students instant communication and networking. Chipps et al (2015:[4]) found that rural-based midwives in South Africa found smartphones facilitated learning and used them to contact peers and educators to discuss course and work-related topics and search for information related to the clinical context.

In Australia, Hay et al (2017:16) found that undergraduate student nurses used mobile devices and social media for learning and preferred to continue to do so. Thus it is highly recommended that nursing education incorporate IT use in nursing curriculums to meet the demands of students. Social networks provide convenience to students absent from class to interact with fellow students and lecturers from any location (Nyangeni et al 2015:[2]). Asian healthcare practitioners use social networks to engage in virtual professional communities and educational content such as quizzes and case studies (Chipps et al 2015:[2]). Virtual communities created via the Internet allow students to connect and chat at any given time (Hopkins & Wasco 2016:[2]). Ideas, experiences and new content are exchanged and created in learning (Puerta 2016:171). Discussion boards, chat rooms and blogs provide an avenue for critical discussion and debate, facilitating learning at higher cognitive levels (Mgutshini 2013:[2]). Apps such as WhatsApp provide a readily available resource for preparation, discussion and clarification of content and are useful for integrating theory with clinical practice (Willemse 2015:[1]).

IT engages the student in learning and creates an active participant (Olele 2014:121). Students with disabilities who would otherwise become isolated in traditional pedagogies are actively involved in the learning process. Text enlargers and read-aloud technologies, for example, assist students experiencing visual challenges (Haddad & Drexler cited in Puerta 2016:177).

2.3.2.2.3 Electronic-learning (E-learning) trends

Electronic-learning or E-learning is an “emerging new paradigm of modern education” (Caglar & Turgut 2014:43). E-learning refers to educational processes that use IT. Teaching and learning content is delivered via IT platforms. E-learning enables the conveyance of educational content in the form of text, audio, animations, and videos.

E-learning is a student-centered approach with various learning strategies that cater for learning preferences and different learning styles. E-learning provides opportunities for assessment, reflection and integration of theory with clinical practice fostering deep learning (Neal 2013:43).

Students' right to autonomy in learning is facilitated by flexible learning environments and the student has a choice of when to learn and at what pace (Mittal 2015:1-3). E-learning caters for practising nurses wishing to study whilst maintaining full-time employment (Mgutshini 2013:1). E-learning becomes fully effective when educators are able to identify student needs and develop tailor-made programmes to best suit the student (Mittal 2015:3).

According to Neal (2013:42), E-learning aims to assist with theoretical and clinical integration, provide support services to enhance learning experience, achieve excellence in education, remove barriers to learning, improve knowledge, skills and attitudes of healthcare practitioners, and provide a blended approach to teaching balancing web-based strategies with face-to-face interaction.

2.4 LEARNING THEORIES AND ASSOCIATION WITH IT

Several theories attempt to describe the process of learning. A theory is a conceptual framework employed to explain facts and events. Theories are based on different philosophical views. Learning theories refer to assumptions and beliefs and explanations related to learning (Keating 2015:64). Learning theories describe how knowledge is assimilated, processed and retained. Each theory attempts to describe components of learning and intellectual development (Bruce & Klopper 2017:58-95).

Knowledge of the different learning theories assists nurse educators to better instruct, facilitate and support the learning needs of students in nursing. Curriculum design and development is often influenced by learning theories. Traditional teaching methodologies may not meet the needs of the "new era" student nurse. Innovative contemporary models are necessary to stimulate, motivate and captivate the interest of student nurses for learning to occur. IT provides numerous advantages to education, including ready access to extensive amounts of data, opportunities for networking,

active student engagement and learning environments that are not restricted by time and place (Lambert et al 2014:9).

Knowledge of learning theories is used to influence the adoption and integration of IT in nursing education.

2.4.1 Prominent learning theories: Application to IT

The most commonly known learning theories include behaviourism, cognitivism, and constructivism. Bruce and Klopper (2017:134) state that educational paradigms have changed from behaviourist to cognitivist and most recently, constructivist-based models. Learning is transformed from a previously passive process to active engagement with the student at the centre.

These prominent learning theories influence the integration and adoption of IT in nursing education.

2.4.1.1 Behavioural learning theory

Behavioural learning theories are based on the works of renowned psychologists, Ivan Pavlov, John Watson and BF Skinner. Behaviourist models of learning propose that the educator transmits knowledge to the student (Keating 2015:62). Students are considered passive learners who only respond to positive or negative stimuli in the environment (Bruce & Klopper 2017:135). Behaviourism is also known as stimulus-response. Learning occurs due to stimulus conditions and the response refers to the behaviour that follows. The stimulus-response theory asserts that for behaviour to change there should be a change in the environmental stimulus. Behavioural theories do not take into account the mental processes of the student (Keating 2015:66).

Keating (2015:66) notes that the learning process is often influenced by stimulus and associations. Associations are often unconscious and repeated exposure to the stimulus can arouse a conditioned response. The inclusion of IT in nursing education can be a positive experience for student nurses provided that the nurse educator adequately supports and role models IT competencies. If the nurse educator fails to

create a pleasant experience for student nurses, it is possible that IT will not be welcome or accept in learning.

Ouyang and Stanley (2014:161) state that rewards and punishments in the educational context change learning performance. Learning is said to occur with the emergence of new behaviours. Student nurses may feel inspired to use IT in learning when rewards of praise, encouragement and marks are afforded for good efforts. Punishment in the form of disappointment, low marks and failure to progress through programmes may also serve as motivators to encourage IT utilisation by student nurses. Criticism of behaviourism includes that it is a teacher-centered approach that emphasises extrinsic motivators instead of intrinsic ones (Keating 2015:67).

Behaviourist models are accepted in nursing education to teach only basic knowledge and skills. It fails to promote higher levels of cognitive reasoning such as critical thinking and problem-solving, which are paramount for informed clinical decision making in nursing. Therefore, behaviourist models must be used in conjunction with other learning theories (Keating 2015:62).

Behaviourist models of learning are applied to teach basic IT skills. The educator provides student nurses with specific instructions to be followed in order to learn the principles of IT operation from switching on of hardware to navigation of software. The educator exposes the student nurses to the concept of IT. The IT learning process is a passive one with the student nurses dependent on the educator. Nursing education must guide student nurses beyond this dependent phase to create nurse practitioners who accept responsibility for their own learning and exercise independence in learning.

2.4.1.2 Cognitivist learning theory

Cognitivist learning theories are concerned with the way students store information in the brain (Bruce & Klopper 2017:135). Cognitivism looks at the mental processes involved in receiving, processing and using information (Ouyang & Stanley 2014:161). The emphasis is on the organisation of content (Keating 2015:65).

The educator facilitates the process of learning by providing instruction in an organised manner and the student decides what is to be learnt (Keating 2015:74). Learning occurs

through structured purposeful methods; for example, illustrations, mind maps, metaphors and reflective thinking (Ouyang & Stanley 2014:161).

IT in learning occurs through structured manuals and guidelines. Flow charts and diagrams facilitate the process of learning IT. Step-by-step instructions are provided on the use of computer systems and Apps including sophisticated machinery. Student nurses memorise learning content and recall information for practice.

Cognitive theories fail to capture the complexity of human learning (Candela cited in Keating 2015:74). Murphy et al (2017:33) describe the student as an "information processor" in cognitivism. Cognitivism does not recognise student nurses as unique individual beings possessing different learning capabilities and experiencing varied challenges.

2.4.1.3 Constructivist learning theory

Constructivist learning theories acknowledge the uniqueness of each individual student (Olele 2014:113). Constructivism recognises that students have different learning approaches and styles including preferences for teaching and learning strategies and media. For meaningful learning to occur, it is imperative that learning strategies be consistent with the learning outcomes and needs of the student (Keating 2015:74). The fundamental principle in constructivism is discovery learning. The student "learns by doing". Learning occurs when knowledge is put into practice. Knowledge obtained must be applied to real life for learning to be purposeful (Ouyang & Stanley 2014:162).

Learning becomes an active process when information is organised to create students' own meaning influenced by experiences and experimentation (Arab et al citied in Bruce & Klopper 2017:135). Learning is influenced by past or present knowledge, social interactions and motivation (Olele 2014:113).

IT is most closely aligned to constructivist learning (Olele 2014:118). Student nurses take an active role in building new knowledge from prior knowledge based on learning experiences (Neal 2013:41). Learning of IT occurs through practice. Opportunities for practice are created in educational and clinical contexts, making IT relevant and

beneficial for learning and work environments. The nurse educator facilitates and supports the process of learning (Keating 2015:75).

Five conditions must be present for learning in constructivism (Woolfolk citied in Keating 2015:74-75). The first refers to the creation of a learning environment that is relevant, with all the complexities of the real-life world. Learning tasks must be authentic and similar to what is experienced in real life. In the beginning the educator may transmit much of the information to the students, but as the students learn and grasp, they progress to independent learning. Nurse educators must ensure that IT-related learning activities are relevant and appropriate to course content and objectives so as to meet the demands of the clinical environments. Intensive guidance may be offered to teach student nurses how to “surf the net”, use medical websites and analyse correctness of Apps, among other things. Once IT basics are mastered, student nurses learn through independent exploration.

The second condition is to provide social interaction and responsibility. Peer collaboration either in person or online provides cooperation and/or a healthy dose of competiveness between individuals. IT facilitates social interaction in learning through participation in online discussions, forums, blogs, social networks and virtual classrooms. Subject experts’ knowledge and experience can be shared with student nurses across the globe. Online gaming adds new learning dimensions of cooperation, problem-solving and competiveness. The third condition is to provide multiple perspectives on content to stimulate critical thinking. IT in learning means that student nurses are no longer reliant on just the nurse educator and prescribed books for learning. IT provides a “treasure box” with a wealth of information incorporating different thought processes on subject material. Biases in learning are reduced when student nurses learn through critical analysis and thinking. The fourth condition is to create self-awareness in students so that they understand how knowledge is structured. IT in nursing education creates awareness of self. Student nurses’ strengths and challenges to learning are exposed through the use of IT. It is important that this could serve as a catalyst for change or hinder acceptance of IT in learning. The fifth condition is to facilitate ownership of learning in the student. The nurse educator must provide ample opportunities for student nurses to execute IT-related learning activities in both theoretical and clinical environments thus fostering responsibility for their own learning (Woolfolk citied in Keating 2015:74-75).

2.4.2 Other learning theories relevant to IT

While behaviourism, cognitivism, and constructivism are the most well-known learning theories, there are other relevant and frequently used theories pertaining to education and IT. The andragogic learning theory and connectivism in learning are discussed next.

2.4.2.1 Andragogic learning theory

The andragogic learning theory was developed by the American adult educator, Malcolm Knowles. Andragogy refers to the teaching of adults. There are four basic assumptions of andragogy: adult learners are self-directed and take responsibility for their own learning; have a wealth of experience and learning is built on this experience; exhibit a readiness to learn depending on needs and what is considered important, and want to use newly acquired knowledge and skills in real-life situations (Bruce & Klopper 2017:123).

Andragogy proclaims that adult learners develop a self-concept. They are mature, independent, autonomous and self-directed in learning (Muller & Bester 2016:504). A self-directed student identifies own needs, sets own objectives, plans own learning, chooses own strategies and self-evaluates (Gravett cited in Bruce & Klopper 2017:124). IT in nursing education permits student nurses to exercise autonomy and independence in learning. Student nurses can direct own learning by deciding when and what to learn in order to address their own needs. Learning is not restricted by time or place.

Adult student nurses come with life experiences and expectations that influence their learning needs, success and learning strategies (Lambert et al 2014:1). New learning is often integrated with the adult student's experiences. Correlation between theory and practice makes learning meaningful. It should be noted that firmly held beliefs and opinions may interfere with the adult learner's ability to be objective. Discussions, critical debates and reflective thinking provide valuable learning opportunities for the learner. Discussion blogs and online chat rooms provide ideal spaces to share experience and learn through collaboration. Learning is an interactive process where the educator provides continuous constructive feedback (Bruce & Klopper 2017:125-126).

Muller and Bester (2016:506-507) state that the adult learner experiences a readiness to learn based on a need and/or desire to learn something new, solve problems or fulfil gaps in roles and functions. The learner exhibits interest, motivation and takes responsibility for learning. IT is an integral component of healthcare service delivery and education systems. The adult student nurse must acknowledge the demands of IT competencies in today's technological age. Driven by service demands and awareness of limitations, the digital era student nurse appreciates the inclusion of IT in nursing education.

An adult's learning orientation is often directed by problem-solving and task-orientated activities. Learning orientation is often influenced by interest in specific subjects or contents. The adult learner wants to apply new knowledge immediately to real-life situations (Bruce & Klopper 2017:127; Muller & Bester 2016:506). IT in nursing education allows student nurses to learn content that is current and evidence based for application to educational and clinical environments.

IT relates well to andragogy. IT provides multiple diverse opportunities for adult learners to be self-directed and in control of learning, integrate new learning with experience, and apply new learning to real-life problems (Caruth 2015:47).

2.4.2.2 Connectivist learning theory

The concept of connectivism was developed by George Siemens and Stephen Downes in 2005 (Goldie 2016:1064). Connectivism is a theory developed for the digital era since traditional learning theories fail to fully explain digital learning (Duke, Harper & Johnston 2013:4). Connectivism is an emerging learning theory used to explain the process of learning in a rapidly changing social digital environment (Foroughi 2015:21). The Internet creates golden opportunities for individuals to access knowledge information and communicate inside and outside of formal education institutions (Goldie 2016:1064).

The model uses the concept of a network with nodes and connections for learning. Networks consist of two or more nodes connected to share information. Nodes refer to information sources such as databases, websites, journals, libraries and organisations and learning communities (Siemens 2006:10). Knowledge is distributed in networks

and the connections lead to learning. Connectivism prescribes that students use IT to connect and participate in learning communities. Learning communities consist of individuals interested in similar subject matter and where discussions occur (Goldie 2016:1065).

Connectivism holds that knowledge and knowing knowledge occur via connections of networks formed by interactions between people. Knowledge resides within networks stored in various software formats. Knowledge in networks can be added, removed or revised. Knowledge incorporates various views and opinions of individuals including experts. Learning occurs when individuals transverse through networks (Goldie 2016:1065).

The focus of connectivist learning theory is learning progression from the “know how or know what to know where” to obtain knowledge. Connectivist learning occurs through the use of social media when student nurses form networks and communities to support learning. Connectivism emphasises the use IT to communicate, collaborate and network (Murphy et al 2017:33-37).

Connectivism refers to connected learning. Anderson (2016:43-44) argues that competence stems from being connected which fosters the capacity to know more. Learning environments are created and used by students to “access, process, filter, recommend and apply information” through IT and collaboration with peers, colleagues and experts (Anderson 2016:43). Students have an increased pool of expertise and resources to use in learning. Connectivism creates learning networks to expand knowledge from traditional learning methodologies (Anderson 2016:43-44).

The goal of connectivity learning is to be able to see, navigate and develop connections between nodes. Connectivism teaches how to create paths to knowledge rather than learning facts and concepts (Anderson 2016:43). Students can learn critical decision making through diversity in opinions. The ability to surf through enormous databases propels students to search for further information. The capacity to acquire knowledge facilitates research and assists in interpreting patterns (Duke et al 2013:4).

Nodes within networks are continuously updated with a resultant benefit to the entire structure (Carreno 2014:113). Human knowledge has grown over the last century and

advancements in science and society are ascribed to the ability to connect. Information is constantly changing and students must be able to access new information, critically analyse the relevance of information and filter out irrelevant information. The core skill in connectivism is the ability to see connections between information sources and to maintain that connection to facilitate continual learning (Duke et al 2013:5). Foroughi (2015:14) states that knowledge rests in diversity of opinions. Students must learn to find meaning and make connections between specialised learning communities (Carreno 2014:112). IT skills become an important component of learning. Decisions are driven by rapidly changing foundations. New information alters decisions made yesterday (Goldie 2016:1068).

Connectivism purports that learning is not an intrinsic construction of knowledge but rather that which students reach in external networks. Knowledge is found in networks and learning occurs through exploitation of networks (AlDahdouh, Osório & Portugal, 2015:3-4). Connectivism is "social learning that is networked" (Duke et al 2013:5). Academics have important roles to play in online learning (Goldie 2016:1066). Educators should be subject experts and creators of learning. Educators must provide support and guidance but do not direct learning (Foroughi 2015:17).

Siemens (2005:4) identified seven principles of connectivism. Learning and knowledge rest in diversity of opinion. Learning is a process of connecting specialised nodes or information sources. Learning may reside in non-human appliances. Capacity to know is more critical than what is currently known. Nurturing and maintaining connections is needed to facilitate continual learning. The ability to see connections between fields, ideas, and concepts is a core skill. Accurate, up-to-date knowledge (currency) is the aim of all connectivist learning activities. Decision-making is a learning process in itself.

As a learning theory, connectivism fails to describe the significant role of the educator in the learning process as well as the critical role of the motivated self-directed learner (Duke et al 2013:4). Connectivism describes the ultimate goal of education (Kerr in Anderson 2016:46). Bell (cited in Foroughi 2015:20) argues that for connectivism to be accepted as a learning theory, rigorous studies must be conducted to test its effectiveness in practice. Connectivism does not address how learning takes place, does not provide new ideas or principles, and artificial intelligence and machine learning principles are not applicable to human learning (Verhagen cited in AlDahdouh et al

2015:17). According to Duke et al (2013:5), the ability to sift through information requires a certain amount of core knowledge to be able to understand and scrutinise any material presented. Therefore, Duke et al (2013:6) recommend that connectivism be used as a tool in the learning process for instruction and guidance rather than a stand-alone theory.

While connectivism as a learning theory is hotly debated, it should be noted that nursing education, particularly in developing countries, has a long way to go before fully accepting the principles of connectivism. Student nurses must first learn basic IT literacy, progress through to information management and then decision support (Murphy et al 2017:31). Opportunities for IT exposure must be created. The acceptance and use of IT in life, work and educational environments must be fostered. Connected learning activities should be introduced slowly under the guidance of nurse educators. Skills related to critical analysis must be developed before student nurses can progress to fully online nursing programmes.

2.5 GENERATION TYPES AND IMPLICATIONS FOR IT IN HEALTHCARE LANDSCAPES AND EDUCATION

Nurses differ in age. Some are young and newly qualified, enthusiastic to take the reins and lead in the digital world. Some are old, reaching retirement yet still passionate, advocating for care in the profession. Others are in between and trying to bridge the gap between the two.

Nurse educators and students come from different generations and each generation differs in terms of “values, ideas, ethics and actions” including learning characteristics. These characteristics influence how learning occurs (Bruce & Klopper 2017:179). Differences between the generations influence the acceptance and adoption of IT in learning and work environments. Fujino and Kawamoto (2013:248) found that healthcare practitioners differ in practical skills in using IT-related information in healthcare facilities. Among rural-based midwives in KwaZulu-Natal, South Africa, Chipps et al (2015:[1-8]) found that the older midwives experienced difficulty in using IT and demonstrated low levels of IT competency.

Johnson and Romanello (cited in Bruce & Klopper 2017:180) identify five different generations, namely the Silent Generation; Baby Boomers; Generation X; Millennials, and Generation Z. Most academics come from the Baby Boomers and Generation X while students come from Millennials, also known as the “Net Generation” (Johnston 2013:261).

2.5.1 Silent generation

The Silent Generation refers to people born between 1925 and 1942. These individuals value commitment and loyalty and often have difficulty understanding the younger generations, especially Generation X and the Millennials. The Silent Generation were not exposed to IT and therefore mostly do not possess IT skills (Johnson & Romanello cited in Bruce & Klopper 2017:180).

2.5.2 Baby boomers

Baby Boomers were born between1943 and 1960. People from this generation enjoy structure and order in learning. Lectures and note taking are preferred to self-directed learning and E-learning. Most Baby Boomers do not possess IT skills but are motivated and willing to learn. These individuals have to make deliberate efforts to learn IT to keep up with environmental changes (Johnson & Romanello cited in Bruce & Klopper 2017:180).

In a study on health-seeking behaviours among Baby Boomers and older adults, Tennant, Stellefson, Dodd, Chaney, Chaney, Paige and Alber (2015) found that many were using the Internet and social media to locate and evaluate health information. The results revealed that being younger than the silent generation with higher education levels equated to higher IT literacy among baby boomers and older adults.

2.5.3 Generation X

People belonging to Generation X were born between 1961and1981. Generation X is often described as goal driven. There is an emphasis on learning progression through a system of points or credits. Learning must be beneficial and add value to life. These individuals like to learn in the easiest and quickest way possible. Generation X enjoys

leisure time and this often exceeds the learning time. These individuals adapt to change and are comfortable with technology (Johnson & Romanello cited in Bruce & Klopper 2017:180).

Generation X often learns to use IT in work environments. Appreciating the need to grow in a contemporary world makes this generation "bilingual" in face-to-face work contact and the operation of IT. The two older generations, namely the Baby Boomers and Generation X, are still becoming comfortable operating in the virtual world, but accept IT as beneficial to managing work and life (Haeger & Linghamb 2014:321-322).

2.5.4 Millennials

Millennials were born between 1982 and 2002. This generation was exposed to IT and is "computer literate", is comfortable with IT, and has the necessary skills to use IT effectively. Millennials are accustomed to "continuous and speedy" access to information on the Internet. Therefore feedback to learning is expected to be similar; that is, immediate and ongoing. Learning through collaboration and group projects is highly valued (Johnson & Romanello cited in Bruce & Klopper 2017:181).

Millennials are often referred to as the "always on" generation or "Net" generation. They have grown up with IT and virtual environments are a norm in work and life. Millennials do not know life without technology (Haeger & Linghamb 2014:321).

In a study on the differences in smartphone adoption between Generation X and Generation Y, also known as the Millennials, Gafni and Geri (2013:20-21) found that although both groups show no difference in terms of Internet usage, Generation Y are more inclined to use mobile internet on smartphones than laptops. Millennials become comfortable with features of smartphones with longer exposures and prefer to use the internet on the smart devices. Moore and Jayewardene (2014:20) examined patterns of smartphone usage and noted that younger individuals used smartphones more.

2.5.5 Generation Z

Generation Z are described as highly skilled in IT (Bruce & Klopper 2017:181-182). Generation Z were born after the millennials and between 1995 and 2010. Generation Z are socially aware and connected via the Internet and social media networks. Short-and-sweet and to the point communication is preferred. Instant messaging is used more often than emails. Learning activities must be interactive and self-directed learning is often preferred to lectures. Individuals from Generation Z appreciate E-learning. IT gadgets, such as laptops, tablets and smartphones, are used instead of printed material. For them, it is vital that learning environments are adequately equipped to support IT (Johnson & Romanello cited in Bruce & Klopper 2017:181-182).

Generation Z is also referred to as the “iGeneration” due to exposure to itechnologies. Both the Net and iGeneration expect instantaneous access to information, need to be continuously connected to others, and use multiple IT devices to do so. Challenging learning approaches and learning styles are preferred. Academics should embrace IT to create interaction and practical learning to stimulate students. In Africa, IT infrastructure and resources are not fully realised, and accessible educational systems are confronted with the strenuous task of meeting the needs of digital era students in South Africa (Johnston 2013:263-271).

In a study in seven South African universities, Johnston (2013:261-273) identified gaps in perceptions and usage of IT across the different generations. The findings indicated that academics underestimated students’ affinity for interactive online learning and failed to grasp the impact of smartphones and social networks on students’ learning styles.

Thompson (2013:23) examined digital learners’ technology use patterns and approaches to learning and found that students may not utilise the full benefits of IT in a learning context. Thompson (2013:23) added that learning approaches were “varied and complex” and that IT “is not a deterministic force that usurps the role of the teacher while moulding students’ brains according to its own ends”.

According to Haeger and Linghamb (2014:317-318), older generations are affected by the behaviour of younger techno-savvy individuals who text, use instant messaging and

social media in work and educational environments. There is a change in communication techniques from face-to-face interaction to new virtual methods. As the younger generations mature and arrive at educational institutions, they will expect dynamic IT integration into learning programmes (Lambert et al 2014:12).Traditional expectations and norms of behaviour have to change to avoid conflict between the generations.

2.6 ACCEPTANCE AND ADOPTION OF IT IN NURSING EDUCATION

The existence and influence of IT in life does not guarantee acceptance and adoption of IT. IT use and acceptance is influenced by individual and technological factors (Zayim & Ozel 2015:45). IT availability, accessibility and ease of use, and individuals' attitudes and preferences impact on the acceptance of IT in healthcare landscapes. Garavand et al (2016:2717) recommend that NEIs and healthcare institutions examine the factors that influence acceptance and adoption of IT before implementation in order to provide the necessary support required.

2.6.1 Acceptance and adoption models of IT

Various theories attempt to explain individuals' acceptance of and intention to use IT (Lai 2017:22). IT adoption models theorise the response of users to IT. IT theories and adoption models predict and describe the response of end-users to IT (Garavand et al 2016:2714). Successful integration of IT in nursing education requires knowledge of the factors influencing acceptance and adoption of IT. IT acceptance and adoption theories and models include the Theory of Reasonable Action (TRA); Theory of Planned Behaviour; Task-technology Fit Theory, and Diffusion of Innovations Theory (Lai 2017:22). The most commonly referred to IT acceptance models are the Technology Acceptance Model (TAM) and the modified extension of TAM, the Unified Theory of Acceptance and Use of Technology (UTAUT). The researcher used the UTAUT as the theoretical framework of this study.

2.6.1.1 Technology Acceptance Model (TAM)

The TAM provides theoretical explanations of factors that influence technology adoption by users (Shore, Power, De Eyto & O'Sullivan 2018:1). The TAM is the most widely

used model to determine factors that influence the adoption of IT in healthcare systems (Garavand et al 2016:2713). The TAM is also the most widely used model to explain students' use of technology in education (Nagy 2018:162).

The TAM was developed and introduced by Fred Davis in 1985 to explain computer usage behaviour (Davis 1985). The TAM is an analytical model that examines IT functionality, user's beliefs and influence on behaviour (Pierce, Willy, Roncace & Bischoff 2014:129). External variables may influence a user's beliefs towards IT. The TAM provides information about user acceptance of IT in terms of influences between system design features, perceived usefulness, perceived ease of use, perceived usefulness, attitudes toward use, and actual usage behaviour" (Davis 1985:24-25).

Davis (1985:15) used the Fishbein model as the basis for the development of the TAM. The TAM is an adaptation of the Theory of Reasonable Action (TRA) (Lai 2017:6; Ventakesh & Davis 1996:452) which was developed by Martin Fishbein and Icek Ajzen in 1975 (Pierce et al 2014:130). The TRA holds that individuals consider the consequences of decisions before engaging in behaviour. Thus the TRA examines beliefs, attitudes, intentions and behaviours in order to determine an individual's attitude to IT (Azjen & Fishbein cited in Shore 2018:[3]).

The original TAM (see figure 2.1) holds that perceived usefulness (PU) and perceived ease of use (PEU) influence users' attitudes and these impact on system use. Perceived usefulness refers to "the degree to which an individual believes that using a particular system would enhance his or her job performance" and perceived ease of use refers to "the degree to which an individual believes that using a particular system would be free of physical and mental effort" (Davis 1985:26).

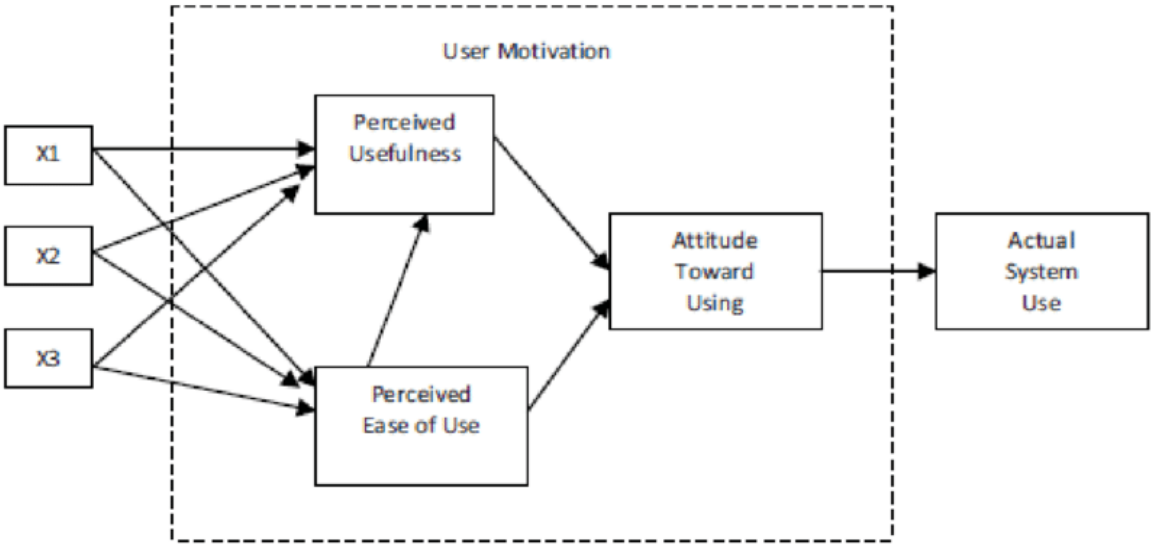

Figure 2.1 Original TAM

(Source: Davis 1985:24)

The final version of the TAM was developed by Venkatesh and Davis in 1996 (see figure 2.2). Venkatesh and Davis concluded that PU and PEU had a direct impact on behaviour intention and eliminated the "attitude towards using" construct. External variables include system features, user involvement in design, training and nature of implementation (Venkatesh & Davis 1996:453).

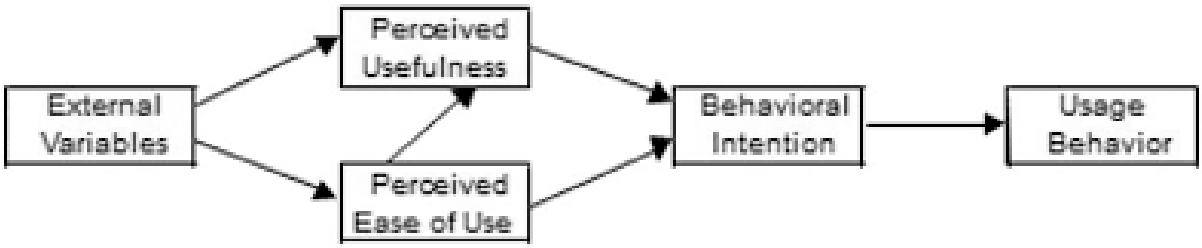

Figure 2.2 Final TAM

(Source: Venkatesh & Davis 996:453)

Venkatesh and Davis revised the original TAM and produced the TAM2 model (see figure 2.3) in 2000 which provided more detailed explanations for perceived usefulness (Lai 2017:8). According to Venkatesh and Davis (2000:187), the "TAM2 incorporates additional theoretical constructs spanning social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output

quality, result demonstrability, and perceived ease of use)" (Venkatesh & Davis 2000:187).

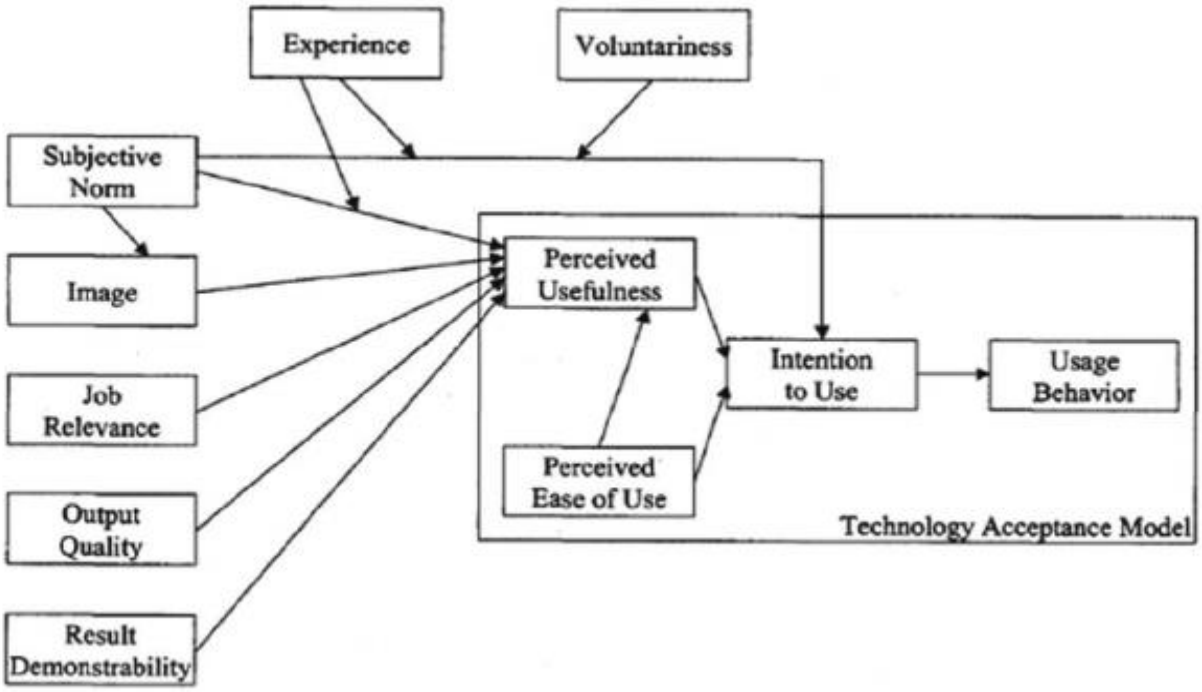

Figure 2.3 TAM2

(Source: Venkatesh & Davis 2000:188)

The integrated model of the TAM, the TAM3 was developed by Venkatesh and Bala in 2008 by combining the TAM2 and the model of determinants of PEU (Venkatesh 2000). TAM3 (see figure 2.4) refers to individual differences, system characteristics, social influence, and facilitating conditions as determinants of PU and PEU. Subjective norm, image, job relevance, output quality, result demonstrability, experience, voluntariness, computer self-efficiency, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment and objective usability are factors considered to impact on PU and PEU. All the factors combined influence behavioural intention and use behaviour (Venkatesh & Bala 2008:280).

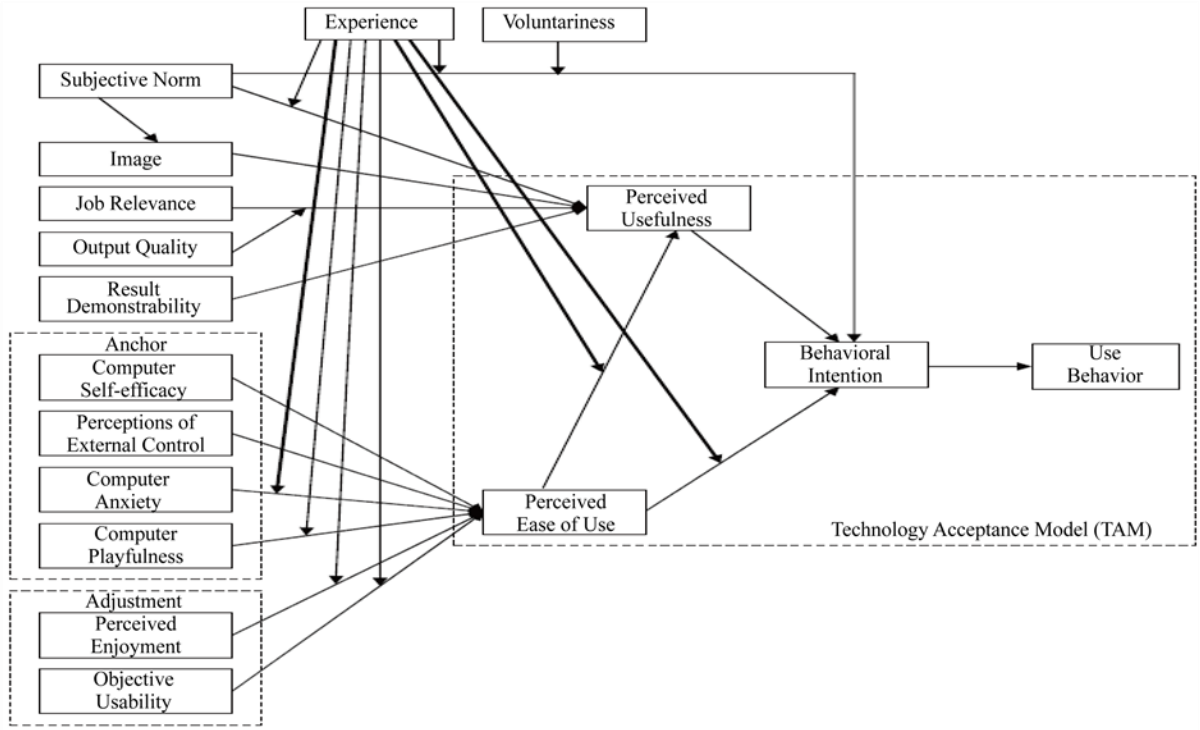

Figure 2.4 TAM3

(Source: Venkatesh & Bala 2008:280)

At the time of formulation the TAM was directed towards IT systems and applications in work environments and not in social or domestic environments (Shore et al 2018:6). However, over the years variables were added to the TAM to create extensions to the TAM, which received much research support and was extended to cover many different areas (Pierce et al 2014:131).

The TAM has been used to evaluate IT in learning environments and the impact on learning satisfaction. Lee and Lehto (2013:193) used an extension of the TAM to determine user acceptance of YouTube for procedural learning. In a study in Hungary, Nagy (2018:162) found that perceived usefulness, attitude, Internet self-efficacy and student-educator interaction influenced video usage, learning performance, and learning satisfaction.

The TAM examines individual users' behaviour with the intention to use the technology but does not analyse institutions' behaviours or reactions to assist employees. The TAM has been criticised for being limited in terms of examining organisational change or implementation strategies that would work to improve acceptance and adoption of IT (Schoville & Titler 2015:100).

2.6.1.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT is a modified extension of the TAM (Strudwick 2015:190). Extensions of the TAM incorporated additional variables to create new models that expanded on the original TAM (Pierce et al 2014:129). In 2003, Venkatesh, Morris, Davis and Davis developed the UTAUT. The UTAUT was based on previous acceptance theories and models and combines eight different models into one (Venkatesh et al 2003:425). The UTAUT model substitutes the definitions of the TAM's perceived usefulness (PU) and perceived ease of use (PEU) for performance expectancy and effort expectancy, respectively (Strudwick 2015:190).

The UTAUT identifies four key factors, namely performance expectancy, effort expectancy, social influence and facilitating conditions, and four moderators, namely age, gender, experience and voluntariness related to predicting behavioural intention to use a technology and actual technology use (see figure 2.5). Performance expectancy, effort expectancy, and social influence were found to influence behavioural intention to use a technology, while technology use behaviour was influenced by behavioural intention and facilitating conditions (Venkatesh et al 2016:329-331).

Performance expectancy refers to the degree to which an individual believes using an IT system will assist positively in job performance. Performance expectancy is the strongest predictor of intention. The moderators of gender and age will affect the influence of performance expectancy on behavioural intention. Effort expectancy refers to the degree of ease in using an IT system. The moderators of gender, age and experience will affect the influence of effort expectancy on behavioural intention. Social influence refers to the degree to which individuals perceive that important others believe that they should use the new system. The moderators of gender, age, experience and voluntariness will affect the influence of social influences on behavioural intention. Facilitating conditions refer to the degree to which individuals believe that organisation and technical infrastructure exist to support an IT system. Venkatesh et al (2003) found that facilitating conditions will not significantly influence behavioural intention, but will influence use behaviour which will be moderated by age and experience. Behavioural intention refers to a user's intention to use an IT and use behaviour refers to an individual's actual use of IT. Behavioural intention has a significant positive influence on IT usage (Venkatesh et al 2003:427-456).

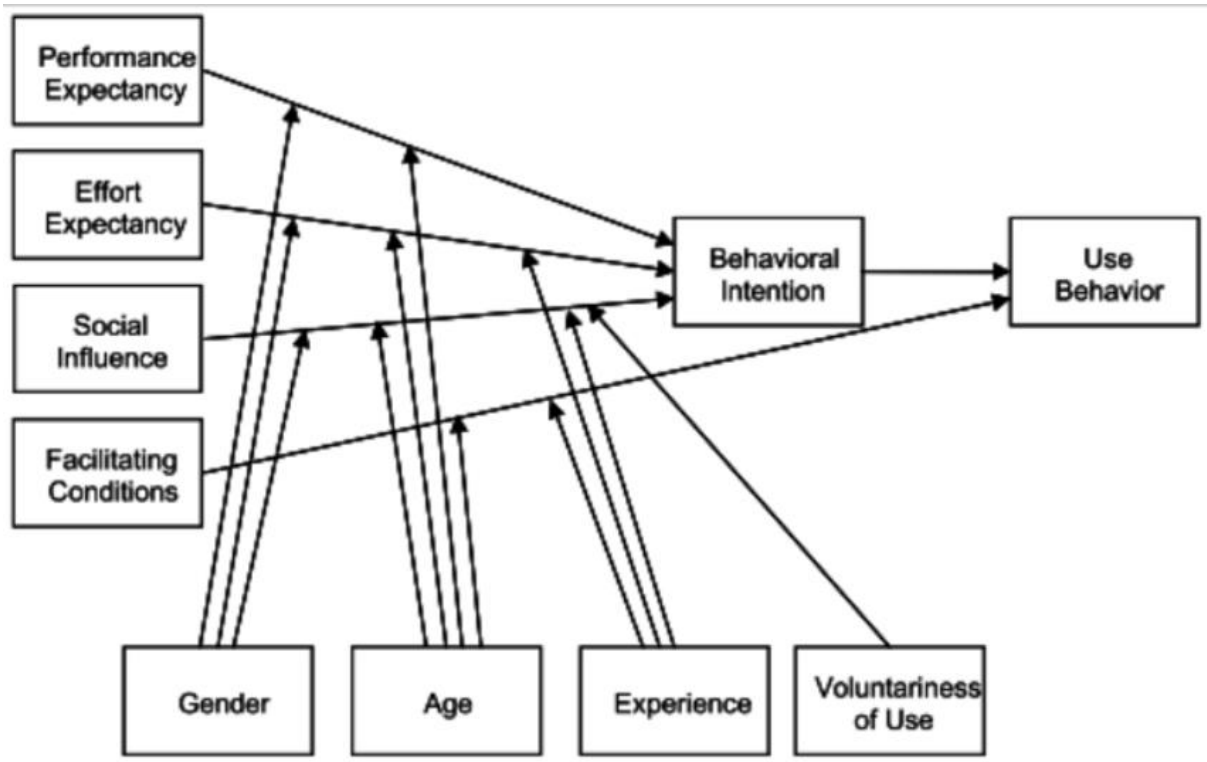

Figure 2.5 UTAUT

(Source: Venkatesh et al 2003:447)

Extended versions of the UTAUT are often used to examine IT acceptance and use in various settings (Venkatesh et al 2016:329-332). Nagy (2018:163) confirmed "the robustness and explanatory power of the TAM for the use of technology in a higher education setting". The UTAUT has been integrated with other theoretical models to study technology acceptance, use and related issues.

Strudwick (2015:190-197) conducted an integrative review of studies which used the TAM and/or UTAUT to determine IT acceptance and use among healthcare practitioners. The results revealed that several studies used the TAM and/or UTAUT to determine nursing personnel's IT acceptance. The TAM with extended variables as in the UTAUT provides a better holistic understanding of nurses' use of healthcare technology.

Laddan, Wharrad and Windle (2018:34) used the UTAUT and the TAM to develop a set of statements to explore the views of healthcare professionals on E-health in Sub-Saharan Africa. The UTAUT was used to examine the factors influencing the adoption

of HIT among healthcare practitioners in Thailand (Phichitchaisopa & Naenna 2013:413).

The researcher considered the UTAUT an appropriate framework in this study to determine student nurses' perspectives on IT in nursing education. The student nurses in the study were exposed to IT in theoretical and clinical environments and had opportunities to practise and experience IT in the course of learning. The UTAUT was used to determine factors that influenced acceptance and use of IT by the student nurses at the private NEI.

2.6.2 User attitude and preferences influencing acceptance of IT

Successful adoption and integration of IT in education requires knowledge of both students' and educators' attitudes towards and perceptions of IT (Mittal 2015:9). Samarkandi et al (2015:52) define an attitude as an "enduring view regarding a person, object, or activity that consists of a cognitive element (perceptions and beliefs) and an emotional element (positive or negative feelings)". Perceptions about the importance and benefits of IT in nursing education may encourage IT acceptance and adoption. Positive feelings associated with pleasant experiences of IT foster acceptance and use while negative emotions of anxiety, self-doubt and frustration hinder IT use and acceptance (Samarkandi et al 2015:52).

Samarkandhi et al (2015:54-55) state that IT anxiety creates fear and reluctance to learn or manipulate IT. It is related to lack of confidence in one's own ability to learn about and use computers in the academic environment. Caruth (2015:48) points out that E-learning does not guarantee learning. Students often do not have the necessary confidence, motivation, or cognitive abilities to engage in self-directed, online learning environments (Caruth 2015:48).

In a developing country, Alwan et al (2015:[6]) found that IT training incorporated into nursing education improved health professionals' knowledge and this, in turn, reduced anxiety associated with IT use. Ready access to IT encouraged them to practise and become confident thereby reducing anxiety about IT use. Caruth (2015:50) recommends the formulation of curriculums that stimulate interest in IT and promote

adequate time and effort to motivate students to become active self-directed learners fostering commitment to continuous learning.

In three hospitals in Ethiopia, Biruk et al (2014:[7]) found that IT literacy affected health professionals' acceptance of IT. Biruk et al (2014:7) therefore recommend that IT awareness be created to engage people and develop positive attitudes and readiness because users with good knowledge may more readily accept IT. In India, Mittal (2015:2) found that learners' acceptance of E-learning was influenced by IT skills, previous IT-related experiences, time input and group participation. Familiarity with use of social media and networking Apps stimulates continued use of IT in higher education environments (Hay et al 2017:9).

It is important to determine student preferences and anxieties related to IT in learning in order to develop programmes that address their needs. In a study on factors affecting E-learning preferences of university students in Turkey, Caglar and Turgut (2014:43) found that the students preferred E-learning due to financial savings and flexibility in terms of time, yet still preferred courses and exams via traditional methods. Complex multimedia-based simulations such as audio and video recordings are easily and cheaply accessible which is not always the case in real situations (Caglar & Turgut 2014:43).

2.7 CHALLENGES IMPOSED BY IT IN NURSING EDUCATION

Although IT offers many advantages, there are limitations, challenges and barriers to IT. Nurse educators acknowledge the need to transform current ways of teaching but it is not an easy, clear cut process (Gonen et al 2016:[5]). In Saudi Arabian hospitals, Khalifa (2013:338) identified human, financial, legal and regulatory, organisational, technical and professional barriers to IT.

Transformation demands investment, time and commitment. The biggest challenge to the implementation of IT in nursing education and clinical health facilities is the financial cost associated with the initial setup of infrastructure and continued support thereafter. A study at nursing colleges in South Africa revealed inadequate budgets to upgrade IT systems and IT support that did not meet the user needs (Puckree et al 2015:513). IT equipment is expensive and setting up of local area networks (LAN), wireless

connectivity (WIFI) and most recently fibre optic technologies is costly. In rural African health facilities, Sukums et al (2014:[8]) identified concerns related to the availability of IT technical support at the facilities. Ongoing assistance and updates from expert IT technicians is a necessity for effective implementation of IT. The associated financial cost frequently proves too much for restricted budgets. Lack of finances is a rude reality for many institutions, especially in rural communities, which hinder the implementation of IT. For many rural facilities, the phone remains as the primary source of communication and often the quality and type of phone system is incompatible with IT to support high-speed computers and videoconferencing (Benavides-Vaello et al 2013:117).

IT is constantly changing with newer versions of hardware and software emerging to enhance capabilities and improve ease of use (Gonen et al 2016:[7]). This means IT equipment and devices depreciate very quickly and become outdated in a short space of time. Budgets need to be created to update and/or purchase newer versions of IT. Just when individuals get accustomed to specific hardware and software, IT changes and this may result in resistance to adopting IT.

In Turkey, Caglar and Turgut (2014:43) found that lack of adequate infrastructure and deficient knowledge and skills on the part of educators hindered the use of IT in universities. Gonen et al (2016:3) emphasise that IT education and training must first be afforded to key stakeholders including nursing academics and healthcare management teams. IT development programs equate to financial costs. Challenges to the use of IT in nursing education include academics' limited knowledge on how to appropriately integrate IT into curriculums. Resistance to IT in nursing education may be attributed to inadequate understanding of the importance and contributions of IT to healthcare systems and the nursing profession (Gonen et al 2016:[3]).

The adoption and integration of IT in teaching and learning requires skill and time. Lack of proper infrastructure and staff shortages coupled with heavy workloads may hinder successful implementation of IT (Sukums et al 2014:[8]). Nurse educators must find time to surf through websites, analyse research articles and review images, audios and videos to be incorporated into lesson plans. IT skills are required for the creation of captivating presentations that hold the interest and attention of student nurses. Apps and games must be first tried and tested to ensure the level of skill required,

correctness of information and appropriateness to meet and fulfil set educational objectives.

There is an expansive amount of information available on the Internet, but not all the information is beneficial, relevant and accurate (Fujino & Kawamoto 2013:244). Nurse educators and students need to develop skills to critically analyse information independently and use only what is correct, appropriate and evidence based. Results suggest that performance may be negatively affected if IT is used inappropriately. Excessive emailing on mobile devices may impact negatively on interpersonal communication and lower performance (Fujino & Kawamoto 2013:244-249).

Healthcare personnel fail to risk assess Apps used to manage patient care. Inappropriate use of Apps in healthcare facilities result in safety issues which may prove detrimental to patient outcomes. Many individuals do not understand the risks associated with using certain Apps (Moore & Jayewardene 2014:22). Samarkandi et al (2015:50) recommends that IT enable learning environments should improve health outcomes and low performance.

A study in the Eastern Cape, South Africa, found that student nurses used social media irresponsibly without consideration of patient privacy and confidentiality (Nyangeni et al 2015:[1]). Personal information and pictures of patients were shared on social websites without the patients' consent or knowledge. The student nurses lacked awareness and accountability for their actions. Such behaviour is unethical and illegal and constitutes grounds for discipline and termination of training and employment. Nurse educators must educate student nurses on the ethical and legal responsibilities of using social media. Policies to guide the use of social media in education and clinical facilities need to be introduced. Disciplinary procedures must be in place should the code of conduct be breached (Nyangeni et al 2015:[8]).

Cyber bullying refers to the use of IT to send messages that are intimidating and threatening in nature. Student nurses may take to social media websites to complain, release pent up frustration and make negative and derogatory comments which threaten the reputation of individuals and education institutions. Such activities affect the wellbeing of students and academics and weaken the teaching and learning process (Lampley, Curia, Vottero & Hensel 2016:119).

While many NEIs and healthcare establishments provide students and nurse practitioners with IT that does not guarantee learning or improved performance. Caruth (2015:48) reported mixed views on academic achievement between online education and traditional face-to-face instruction. Chipps et al (2105:[2]) found low levels of knowledge amongst rural-based midwives in spite of access and exposure to IT. Self-study assignments may result in the exclusion of some student nurses from teaching and learning activities through lack of appropriate mobile devices and/or ability to support certain websites, Apps or games (Willemse 2015:[5]). Caglar and Turgut (2014:43) found that Turkish university students reported a lack of self-discipline and feeling socially isolated in using IT in education due to reduced interaction with fellow students and educators. However as students progressed to higher levels of education, less interaction was desired since they were familiar with IT learning environments.

While mobile technologies provide flexibility in learning thus providing student nurses with innovative student-directed learning approaches, IT must be perceived as acceptable and beneficial (Willemse 2015:[2]). Challenges associated with the use of mobile technologies include high data costs and unreliable connectivity (Zayim & Ozel 2015:456). Certain Apps may drain battery life (Willemse 2015:[6]). In Ethiopia, Biruk et al (2014:[2]) found that healthcare personnel perceived that IT disrupted work life, interfered with workflow and reduced productivity. This indicated that problem areas should be identified before the implementation of IT in order to address problems and difficulties.

2.8 RESEARCHER'S VOICE

IT is transforming the global, educational and, in particular, healthcare landscapes. The profound influence of IT on health services has demonstrated the potential to meet the needs of digital individuals, ensure better patient outcomes and patient satisfaction, reduce morbidity and mortality rates, decrease the disease burden, improve the quality and safety of diagnostic and treatment protocols, ease workloads and build confidence in practitioners. Nursing forms a major component of health services and must therefore also transition to remain applicable, effective and efficient to meet the needs of a changing environment.

Nursing education must keep abreast with the technological advancements of the world. IT must be incorporated into nursing curriculums to meet the needs of digital era students. Student nurses must be encouraged to use IT for active, engaged, self-directed and collaborative learning opportunities to improve performance, critical thinking and problem-solving abilities to direct nursing practice. Together with several advantages, there are also challenges and barriers to IT. The ability to identify and overcome difficulties and challenges early may reduce IT anxiety and resistance. IT exposure and experience in nursing education will foster positive attitudes and improve the acceptance and adoption of IT in both educational and clinical environments. NEIs have an overwhelming responsibility to ensure nurse practitioners, the health leaders of tomorrow, are supported in the development of the necessary knowledge, skills and attitudes to embrace IT.

2.9 CONCLUSION

This chapter discussed the literature reviewed on IT and its influence in nursing education and healthcare. The literature review covered the correlation between IT and behaviourist, cognitivist, constructivist, andragogy and connectivism learning theories as well as the most widely used IT acceptance models, namely the TAM and UTAUT. The discussion included user attitudes towards and perceptions of IT and barriers and challenges to IT.

Chapter 3 covers the research design and methodology.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

This chapter discusses the procedures followed in conducting the study. The research design, methodology, population, sampling technique, sample, data collection, data analysis, ethical concerns, validity and reliability of the study are described.

3.2 RESEARCH DESIGN

A research design is a detailed plan that directs the steps of the research process. The choice of research design depends on the data to be collected in order to provide answers to the research questions (Moule & Goodman 2014:171). According to Gray et al (2017:52), a research design includes a plan for data collection, measurement and analysis.

The researcher selected a quantitative, non-experimental descriptive design for the study to explain and describe student nurses' perspectives on IT in nursing education.

3.2.1 Positivist paradigm

A research paradigm represents a worldview that encompasses a set of philosophical assumptions that guides the research process (Polit & Beck 2012:736). A positivism paradigm was adopted in the study.

Positivism uses scientific methods to generate knowledge and follow strict rules, laws, truth, axioms and prediction (Gray et al 2017:25). Positivist approaches emphasise the value of testing and numerical measurements to reveal one truth and objectivity (Moule & Goodman 2014:174). Positivism assumes reality exists and can be studied even in the social world (Moule & Goodman 2014:174). The researcher was interested in an ontological approach, which examines the nature of reality (Polit & Beck 2012:11). The study lent itself to the assumptions of positivism.

Positivism uses orderly and disciplined procedures to understand phenomena and deductive processes for theory verification. The researcher is distant from the respondents and does not influence the study findings. Data is often collected from large representative samples in an attempt to generalise findings. Data is quantitative and measured by statistical analysis (Polit & Beck 2012:12-13).

The researcher followed a series of logical and orderly steps in order to gain a deeper understanding of the research problem. The researcher used deductive reasoning which moves from the general to the specific (Gray et al 2017:7). General theories are further tested through observation and the development of tests (Moule & Goodman 2014:175). The researcher acknowledged the benefits and challenges posed by IT in healthcare environments and nursing education. The researcher identified specific issues from the perspectives of the respondents at the private NEI. The researcher was objective and distant in data collection to avoid bias. Structured methods were used to collect information from a large representative sample. The data was quantitative and measured using statistical analysis.

The positivist approach was chosen for its advantages of rigour and replicability, while recognising that it is not the only approach to solve problems. The limitations of positivism include problems with measurement, and an inability to fully describe human experience due to complexities and diversities of human participants (Polit & Beck 2012:14).

Data collection instruments developed by positivist researchers include an element of subjectivity since questions may only be what the researcher considers important. Respondents may also interpret questions inconsistently. Responses may vary over time since individuals have the capacity for change and self-reflection (Saks & Allsop 2013:24).

It should be noted that despite criticism, Tappen (2016:49) points out that positivism in social sciences was an improvement on previous approaches used to generate knowledge. Knowledge based on history, tradition and theology do not test theories or make generalisations.

3.2.1.1 Quantitative research

Quantitative research is often associated with the philosophical foundation of positivism (Houser 2015:33).

Quantitative research is a systematic empirical investigation of phenomena characterised by objective measurements and statistical analysis, often involving rigorous and controlled designs (Polit & Beck 2012:739). Knowledge in quantitative research is obtained by gathering facts about phenomena and making inferences (Saks & Allsop 2013:22). Quantitative research can be used to describe, explain, predict and control phenomena being studied (Mcintosh-Scott et al 2014:29).

The research paradigm was well suited to the study because the researcher wished to collect scientific evidence to accurately describe the nature of student nurses' perspectives regarding IT in nursing education. The researcher used a structured data collection instrument and statistical analysis to ensure objective reporting of data.

3.2.1.2 Non-experimental research

A non-experimental, descriptive research design was adopted for the study. The design was appropriate to the research problem and purpose. The design allows for better understanding of phenomena in an area of limited knowledge (Gray et al 2017:28). No research had been conducted at the private NEI and little was known about the topic.

In non-experimental studies, the purpose is to merely explain and describe phenomena; there is no manipulation of variables or introduction of interventions (Brink et al 2012:112). The researcher aimed to identify and describe the respondents' perspectives on IT in nursing education. There were no applied interventions. The researcher was intrigued by and aimed to describe and understand the respondents' perspectives on the integration of IT in the nursing programmes.

3.2.1.3 Descriptive research

Descriptive research examines a situation or event that already exists (Houser 2015:38-39). Saks and Allsop (2013:6) summarise descriptive research as providing current

information on a problem. The study allowed the researcher to identify the challenges faced by student nurses regarding IT in nursing education.

Descriptive studies are concerned with gathering information from a representative sample of the population through structured data-collection instruments. According to Tappen (2016:79), simple descriptive designs collect data on the sample's characteristics, attributes, experiences and report the findings using descriptive statistics.

The researcher was interested in the perspectives of a single sample of student nurses at a private NEI. The researcher described the information collected via a structured self-administered questionnaire and used descriptive and inferential statistics to analyse the data as accurately as possible. Results from descriptive research in nursing are vital for the development of interventions that will be of benefit to the group in order to produce desirable outcomes (Houser 2015:253). The researcher based the recommendations to improve the use of IT in nursing education on the findings.

3.3 RESEARCH METHODOLOGY

Research methodology refers to the process and procedure for acquiring knowledge (McIntosh-Scott et al 2104:25). Polit and Beck (2012:741) define research methods as "the techniques used to structure a study and to gather and analyse information in a systematic fashion".

3.3.1 Research setting

A research setting refers to the place where the study is conducted (Grove et al 2015:38). Descriptive studies are often conducted in natural settings, which refer to real-life environments (Gray et al 2017:353). The study was conducted at a private NEI in the province of KZN, South Africa. The private NEI offered nursing programmes namely Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and Advanced Diploma in Medical and Surgical Nursing Science with specialisation in either Critical Care, Trauma and Emergency or Perioperative Nursing (R212) (Regulation R683; Regulation R212) (SANC 1989, 1993). The private NEI also offered short in-service certificate programmes in Critical Care, Trauma and Emergency

Nursing, Perioperative Nursing, Infection Prevention, Nursing, and Neonatal Intensive Care Nursing. The private NEI provided in-house training on basic computer and research literacy and encouraged the use of IT-facilitated activities in addition to traditional pedagogies.

3.3.2 Population

Gray et al (2017:329-330) refer to a population as a particular group of people that is the focus of the research.

The population universal included all student nurses registered for nursing programmes at the private NEI for the period 2017 and 2018. The population was composed of student nurses registered for the Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and student nurses registered for the Advanced Diploma in Medical and Surgical Nursing Science with specialisation in either Critical Care, Trauma and Emergency or Perioperative Nursing (R212) (Regulation R683; Regulation R212) (SANC 1989, 1993).

Polit and Beck (2012:744) refer to the target population as the entire population that the researcher is interested in and to which the study findings can be generalised. Gray et al (2017:694) add that the target population meets the sampling inclusion criteria in the study. Inclusion sampling criteria refer to requirements identified by the researcher that must be present in a respondent in order to be included in the sample (Gray et al 2017:680). The inclusion criteria for the study were student nurses with six or more months of experience in the nursing programmes. Exclusion criteria refer to requirements that are absent in the respondents resulting in elimination from the study, in spite of meeting the inclusion criteria (Gray et al 2017:331). Student nurses with less than six months of experience in the nursing programmes were excluded from the study.

The target population included all student nurses at the private NEI who met the study criteria of having had at least six months' experience in the nursing programmes. These student nurses had received fair exposure to and experience in IT in learning and therefore were most suitable to provide data related to the research questions. The number of student nurses that comprised the target population was two hundred and

sixty (260), of which two hundred and thirty-nine (239) were registered for the Bridging Programme and twenty-one (21) for the Advanced Diploma in Nursing.

The accessible target population in its entirety was invited to participate in the study. The accessible population is a subset of the target population and refers to the individuals who are available for the study (Polit & Beck 2012:719). The accessible population was student nurses that met the study criteria and who were present, available and willing to participate on the days of data collection.

3.3.3 Sampling

Sampling refers to the selection of respondents from a population (Grove et al 2015:37). The aim of sampling is to select a group that most closely represents the population (DePoy & Gitlin 2016:191). A representative sample allows the researcher to make accurate generalisations about the population (Hedges & Williams 2014:126). Therefore improper sampling may compromise the findings of a research study (Moule & Goodman 2014:290).

In the study, the researcher chose a non-probability sampling approach and performed convenience sampling.

3.3.3.1 Sampling approach and sampling technique

A sampling plan may involve either a probability or non-probability sampling approach while a sampling technique refers to specific methods employed within the chosen approach in order to select a sample for a study (Grove et al 2015:255-257). Sampling addresses questions related to who should be included in study, who should be excluded, and how many respondents are required to participate (Tappen 2016:117).

3.3.3.1.1 Non-probability sampling approach

In non-probability sampling, respondents are selected by non-random techniques and there is no way to estimate the chances of each individual being included in the study (Polit & Beck 2012:275). Non-probability sampling occurs when the researcher uses discretion or preference in the sample selection (Tappen 2016:122).

Non-probability sampling is often used to address the purpose of a study which could be attaining the greatest degree of representation or investigating a phenomenon in a single group (DePoy & Gitlin 2016:198). Non-probability sampling was ideal to investigate the perspectives of student nurses who had been exposed to IT in nursing education. Non-probability sampling is often used in nursing research because it is practical, requires less skills and resources, and is particularly useful in cases where there are time and financial constraints or limited accessibility to the population (Botma et al 2010:125; Polit & Beck 2012:279-278).

Limitations associated with non-probability sampling include samples that under-represent a segment of the population (Gray et al 2017:342). Generalisation beyond the sample may not be possible (DePoy & Gitlin 2016:199). Sampling bias and misleading results may occur in non-probability sampling (Botma et al 2010:125; Polit & Beck 2012:279-278).

In an attempt to overcome possible limitations to sampling, the researcher collected data from the accessible target population. A large number of respondents ensures representativeness and increases generalisation (Polit & Beck 2012:284).

Generalisation refers to the degree to which quantitative research findings can be applied to individuals other than those who participated (Polit & Beck 2012:14). While the findings of the study may be applicable to similar populations and settings, it is highly recommended that further research be conducted to verify findings (DePoy & Gitlin 2016:199).

3.3.3.1.2 Convenience sampling technique

Convenience or accidental sampling includes respondents in a study who are at the right place at the right time (Gray et al 2017:671). Convenience sampling is also referred to as “volunteer sampling” and “opportunistic sampling” (DePoy & Gitlin 2016:199). Convenience sampling is cost effective and accessible, and saves time (Grove et al 2015:264). Convenience sampling is often used to collect information in areas of limited knowledge (Gray et al 2017:343).

The respondents in the study included all student nurses from the accessible target population who met the study criteria and were present, available and willing to participate on the days of data collection. No similar study had been conducted at the private NEI consequently, convenience sampling was ideal to determine all the student nurses’ perspectives to IT in nursing education.

Limitations associated with convenience samples that may not represent the target population are addressed by trying to represent that target population as closely as possible (Gray et al 2017:342) and increasing the sample size (Grove et al 2015:258). Houser (2016:169) states that multiple biases may exist in convenience sampling. Respondents who volunteer may desire to express either extreme positive or negative perspectives towards the study.

The respondents in the study were closely matched to the target population and were thus representative of the population. All the student nurses in the accessible target population were afforded an opportunity to participate in the study. This ensured a large sample size thereby reducing limitations associated with convenience sampling.

3.3.3.2 Sample

A sample is a subset of the population included in a study (DePoy & Gitlin 2016:380). In quantitative research, the quality of the sample depends on the size of the sample and how representative the sample is of the population (Polit & Beck 2012:59). The sample size is estimated numerically through calculations of power, significance levels or confidence intervals (Tappen 2016:125). Moule and Goodman (2014:292) state that

researchers in social sciences use a professional statistician to conduct the complex calculations.

DePoy and Gitlin (2016:202) state that while it is commonly suggested to recruit as many participants as one can afford, large samples may be unnecessary. However larger samples are considered in order to achieve high levels of precision although it may equate to higher costs (Saks & Allsop 2013:178).

The researcher consulted an expert statistician to assist in determining the appropriate sample size in order to draw meaningful conclusions. The minimum sample required with a population of two hundred and sixty (260) was one hundred and fifty six (156), calculated using a margin of error of .05 and a value for alpha of .05. Ten to fifteen percent was added to this figure to accommodate for missing data items. A total sample of one hundred and seventy five (175) student nurses was suggested. In the study the researcher invited the entire accessible target population of two hundred and sixty (260) to participate. Two hundred and forty-four (244) respondents completed questionnaires. While it was more feasible to collect data from a sample instead of the entire target population, the risk existed that the sample may not have reflected the characteristics of the population. The researcher wanted all the student nurses to voice their perspectives on IT in nursing education to fully understand the implications for teaching and learning environments.

3.3.3.3 Ethical issues related to sampling

Ethics in research pertains to the integrity of the study, expected behaviours of the researcher, and protection of the rights of the respondents (DePoy & Gitlin 2016:375).

The researcher has a responsibility to protect the rights of respondents participating in a study (Gray et al 2017:162). Respondents should be selected for participation because they possess characteristics most suitable to the purpose of the study and not just because of availability (Hedges & Williams 2015:227). Moule and Goodman (2014:48) emphasise the importance of maintaining the dignity, safety and wellbeing of respondents.

All respondents should be selected and treated fairly and respectfully throughout the study. Respondents should receive equal benefits, irrespective of race, culture, age or socioeconomic status, and should be thanked for participation (Gray et al 2017:172-173).

The researcher was fair and just in selecting respondents in the study. All student nurses who met the study criteria were invited to participate in the study. The student nurses were well informed of the aim of the study, including any benefits and risks. The right to autonomy and self-determination was upheld since participation was completely voluntary. All the respondents were treated equally. Data was collected in a consistent manner from all respondents. There was no discrimination against or favouritism towards any of the respondents. The researcher upheld the rights of each respondent and expressed gratitude to the respondents for their willingness and time to participate.

3.3.4 Approval and permissions to conduct the study

3.3.4.1 Approval

The research proposal was forwarded to the Higher Degrees Committee of the Department of Health Studies at UNISA and approval and ethical clearance for the study was obtained on 6 September 2017, Reference numbers REC-012714-039 (NHERC), HSHDC/705/2017 (see Annexure A). Saks and Allsop (2013:305) state that the function of ethics committees is to engage in formal reviews and discussions to help clarify complex arguments instead of leaving decisions to individual researchers. The aim is to ensure ethical research studies and to protect the rights of respondents (Gray et al 2017:181). Approval for the study was granted and a signed ethical clearance certificate was issued by UNISA.

3.3.4.2 Permissions

The researcher sought permission from the private healthcare group. The private NEI was one of the divisions of the private healthcare group, therefore approval and consent for the study was requested from the group's Ethics and Research Committee. The specified documentation and research proposal were forwarded to the relevant persons

for review. The researcher received a letter granting permission to conduct the study (see Annexure B).

The researcher also requested permission from the campus manager at the private NEI. A brief meeting was held with the campus manager to explain the aim and objectives of the study. A formal email was forwarded to the campus manager requesting permission to conduct the study. Permission was granted by the campus manager.

The researcher provided reassurance that the results of the study would not be linked to and/or cause damage to the name or reputation of the private healthcare group or NEI. The results of the study will be shared with the group and NEI as agreed upon.

3.3.5 Data collection

Data collection refers to the systematic process of gathering information that addresses the research purpose, objectives and questions (Gray et al 2017:675). In the study, data was collected by means of a self-administered structured questionnaire.

3.3.5.1 Data collection approach and method

The chosen method of data collection was a researcher-administered and respondent-completed instrument. The researcher administers the questionnaire and the respondent completes the “pencil-and-paper” exercise (Gray et al 2017:496). The researcher chose not to use an online questionnaire to avoid any undue IT-related stress or pressure to the respondents.

3.3.5.1.1 Development and structure of the data collection instrument

The researcher developed the data-collection instrument following an extensive review of literature. The researcher ensured that items on the questionnaire fit the focus of the study. The questionnaire commenced with a clear operational definition of IT used in the context of the study so that respondents were well informed of the key concepts before attempting to complete the questionnaire. This assisted in preventing any misinterpretations and confusion. A clear instruction followed requesting respondents to

mark the most appropriate options with an X. This guided the respondents in completing the questionnaire with ease.

The self-administered questionnaire consisted of four sections, namely sections A, B, C and D. Section A, B and C contained closed fixed alternative questions and declarative statements from which respondents could choose the most appropriate options. This prevented burden on respondents since it was easier to choose from options than to write out answers, thus allowing for more questions to be answered in a fixed period of time.

Closed questions also allow for statistical analysis, making description and comparison possible (DePoy & Gitlin 2016:222). There is no need to explain or qualify responses, although it is argued that respondents may object to being forced to choose from options that do not readily reflect their opinions (Polit & Beck 2012:298).

Questionnaires allow for a large number of respondents to be reached with minimal time and expenditure (DePoy & Gitlin 2016:147). Questionnaires are used to gather information and/or characteristics about an identified population (Gray et al 2017:407). The items in section A, B and C pertained to biographical data, knowledge perspectives and behaviours, and IT advantages and challenges. Questionnaires are often used to determine opinions, attitudes, knowledge, perceived strengths and challenges to practices (Hedges & Williams 2014:118). The questionnaire was used to determine the respondents' frequency and competency of IT utilisation, including perspectives on the importance of IT and challenges posed by IT in nursing education.

Structured questionnaires consist of a formalised series of questions presented in a specific format (Moule & Goodman 2014:322). Self-administered questionnaires allow the respondents to read the questions and give their answers (Polit & Beck 2012: 265). The response sets varied from ordinal response sets, categorical responses, simple dichotomous responses, numerical rating scales to graded 5-point Likert scale options. Items relating to age and clinical years of experience involved ordinal responses where respondents were asked to indicate the appropriate year range. Categorical response sets were used for the type of nursing programme. Items related to ownership and exposure to IT used simple dichotomous responses sets. Simple dichotomous responses request respondents to choose between one of two options: yes or no

alternatives (Gray et al 2017:409). Frequency of use, competency in IT and rating of IT training used numerical rating scales. Rating scales use numerical values assigned into categories assumed to be on a continuum (Grove et al 2015:307). The respondents could indicate frequency of use as 1 = never to 5 = very often. Competency in IT was rated from 1 = not at all competent to 5 = extremely competent. Likert scales were used for rating of experiences and level of agreement/disagreement with statements related to IT perspectives, benefits and challenges. The option responses in Likert scales may be worded favourably or unfavourably and respondents indicate their agreement or disagreement (DePoy & Gitlin 2016:233). The respondents chose between poor, average and good response sets for rating of experiences. Scales related to agreement/disagreement provided option sets from strongly disagree, disagree, neutral, agree and strongly agree.

Section D of the questionnaire included an open-ended question on recommendations to improve the use of IT in nursing education. Open-ended questions require written feedback (Gray et al 2017:407). The respondents were afforded the opportunity to elaborate in their own words on measures and interventions to improve the use of IT in nursing education. Data from open-ended questions is varied and must be coded for analysis (McIntosh-Scott et al 2014:31).

Questionnaires afford respondents a greater sense of anonymity thereby ensuring more honest responses (Saks & Allsop 2013:196). Although anonymity is afforded to respondents, responses may not necessarily reflect the truth. Respondents may answer in a way that shows them in a positive light or according to perceived expectations (Polit & Beck 2012:188).

A further limitation is that respondents may misinterpret the questions. The researcher ensured that items on the questionnaire were short, clear, and unambiguous to prevent any confusion. Polit and Beck (2012:264) state that structured questionnaires take considerable time and effort to develop but are relatively easy to administer and analyse. While structured questionnaires are criticised for being superficial since they do not probe deeply (Brink et al 2012: 155-156), they are ideal when brief responses are required for numeric data analysis.

3.3.5.1.2 Review and pre-testing of the data collection instrument

The questionnaire was reviewed by an expert statistician. The statistician assessed the suitability and comprehensibility of the self-administered questionnaire to address the questions in the study. The data-collection instrument was also reviewed for statistical validity and its ability to draw meaningful statistical conclusions from the study findings.

Identified flaws and errors in the questionnaire were adjusted and rectified according to recommendations from the statistician. Repetition of items in the questionnaire was deleted. Some of the measurement scales were changed from 3- and 4-point Likert scales to 5-point numerical rating scales that measured one extreme on the left to the other extreme on the right. This ensured valid statistical analysis. A recommendation in terms of fanatical attention to detail was attended to so as to create an easy to "read and fill out" questionnaire.

Gray et al (2017:410) suggest pre-testing of questionnaires to determine the effectiveness of the data-collection technique. The data-collection instrument was pretested with five (5) student nurses on 23 October 2017. The students were addressed by the researcher in one of the lecture rooms at the private NEI. The purpose and objectives of the study and pre-test were explained to the student nurses. The student nurses were informed that participation was completely voluntary. Information leaflets were given to the students. Informed consent forms were completed by all five (5) respondents and handed in separately from the completed questionnaires. The questionnaires were filled out in a time frame of approximately forty five (45) minutes and collected immediately afterwards. The purpose of the pre-test was to detect flaws in the questionnaire and assess for clarity, unintentional repetition, ambiguity and time adequacy of the questions in the data-collection instrument.

The results of the pre-test revealed no flaws in the data-collection instrument. Items in the questionnaire were clear. There was no repetition or ambiguity. The time was adequate for completion of all items. Accordingly, no changes were made to the questionnaire.

The pre-test documents were kept separate and were not included in the data analysis. The documents were locked away in a fire proof cupboard for safety.

3.3.5.1.3 Validity and reliability of the data collection instrument

Validity and reliability of data-collection methods and instruments refer to the ability of the researcher to limit any bias in the data-collection process. Valid and reliable tools afford credibility to the data-collection instrument and the research findings (Moule & Goodman 2014:186).

The data-collection instrument must be both valid and reliable to reduce errors in measurement. Validity of an instrument refers to the extent that it accurately measures what it is supposed to measure (Gray et al 2017:370).

The data-collection instrument was assessed for face, content, and construct validity. According to Moule and Goodman (2014:187), face validity implies that the instrument appears to measure what it is intended to. The data collection instrument was developed by the researcher to address the aim and objectives of the study.

Content validity refers to the ability of the instrument to accurately measure questions in the context of the study (Polit & Beck 2012:336). Content validity can be ensured through review of the data-collection instrument by experts in the field. The data-collection instrument was evaluated for readability and language acceptability from the perspective of possible respondents. It was vital that respondents understand the items in the questionnaire.

Construct validity examines the fit between conceptual and operational definitions (Gray et al 2017:381). The researcher ensured construct validity of the instrument and its fit to the focus of the study by providing complete and adequate conceptual and operational definitions of key concepts.

Criterion-related validity refers to the measure of the instrument by comparing the findings with those collected from other methods (Moule & Goodman 2014:188). The findings of the study were compared and supported with evidence from previous studies.

Reliability of the data-collection instrument refers to the degree to which the instrument can produce consistent and stable results if repeated over time or if used by different

researchers (Brink et al 2012:169). Instrument reliability is concerned with measurement accuracy, ability to be replicated and compared (Gray et al 2017:370). Reliability is equated to measures of stability, consistency or dependability, and accuracy (Polit & Beck 2012:331). Stability refers to attainment of similar results if the same instrument is administered to the same subject but at a different time (Moule & Goodman 2016:189-190). Reliability was enhanced by using numerical values for better understanding and analysis. This reduced subjectivity and increased objectivity. Efficiency is sometimes increased by use of brief measures instead of long measurements.

A data-collection instrument becomes more reliable when items in the instrument are unambiguous and not open to misinterpretation (DePoy & Gitlin 2016:235). Validity of data-collection instruments can be threatened when the questionnaire is too long, response sets leave out important alternatives or responses, and there is inconsistent administration of the instrument. Respondents may not answer all the questions or write in their own answers to response sets. If the response rate is less than fifty percent, the representativeness of the sample becomes questionable (Gray et al 2017:410).

3.3.5.2 Data collection process

After receiving ethical clearance for the study and obtaining permission from the private healthcare group and campus manager at the private NEI to conduct the study, the researcher pre-planned specific dates for data collection at the private NEI. Data was collected on the following dates: 6, 17 and 22 November 2017 and the 11 and 15 January 2018. This allowed for data to be collected from all student groups. Fifty-nine (59) questionnaires were handed out on 6 November 2017. Fifty-seven (57) of the questionnaires were completed and returned. On 17 November 2017, forty-four (44) questionnaires were handed out and all were completed and returned. Fifty (50) questionnaires were handed out on 22 November 2017 and forty-nine (49) were completed and returned. Seventy-eight (78) questionnaires were administered on 11 January 2018, and seventy-three (73) were completed and returned. Twenty-one (21) questionnaires were administered on 15 January 2018 and all the questionnaires were completed and returned.

Consistency in data collection is achieved by ensuring that data is collected in the same manner from one respondent to the next, from one data collector to next ,and from one

setting to the next (Tappen 2016:140-143). Consistent processes were followed on all the days of data collection. On all the days of data collection, the researcher obtained permission from group lecturers to meet with the students during the afternoon lecture session so as not to disrupt teaching during the day. The researcher met with the student nurses in the groups' allocated classrooms. The researcher briefed the student nurses on the study, its purpose and objectives. The researcher addressed any issues and concerns and provided clarification, where required. Participant information leaflets were handed to the student nurses. The participant information leaflet provided the researcher's details, aim of the study and ethical considerations pertaining to the respondent. Respondents who were present, available and willing to participate in the study were asked to complete informed consent forms. The researcher expressed gratitude for the respondents' willingness to participate in the study.

The researcher introduced the respondents to the research assistants at the private NEI before exiting the classroom. The assistants aided in administering and collecting the questionnaires. The research assistants were briefed on the process to follow in administering the questionnaire so as not to influence the respondents in any way. The questionnaires were handed out by the assistants to each student, thereby minimising any undue obligation placed on the student nurses to participate in the study. Forty-five (45) minutes were afforded to each respondent to complete the questionnaire in private during which time the research assistants remained in the classroom and oversaw the process. The respondents were thanked for contributing to the study. The research assistants directed the respondents to place the signed informed consent forms and completed questionnaires in the separate boxes that were provided. Both the boxes were handed over to the researcher at the end of the data-collection session. The researcher inspected the questionnaires for completion. All questionnaires were completed thus eliminating the need to destroy and discard any. The questionnaires and informed consent forms were filed separately by the researcher and locked away in a fireproof cupboard.

3.3.5.3 Ethical considerations related to data collection

The researcher had a responsibility to uphold the scientific integrity of the study. Researcher integrity is more than just adherence to ethical principles, but includes integral conduct during all phases of the research process (Houser 2015:58).

The data collected was not fabricated or manipulated in any way. There was no misconduct or conflict of interest on the part of the researcher. Polit and Beck (2012:169) define research misconduct as falsification, fabrication and/or plagiarism during research. The researcher did not coerce any student nurse to participate in the study. The respondents completed the questionnaires voluntarily.

3.3.5.3.1 Self-determination and informed consent

Informed consent means that respondents receive the necessary information about the purpose and objectives of the study, benefits and risks, and rights as a participant (Gray et al 2017:176-178). A conscientious researcher answers respondents' questions during the consent process (Gray et al 2017:178).

The respondents' right to self-determination was upheld. Self-determination indicates respect for the respondents' autonomy to decide whether or not to participate (Gray et al 2017:162). The respondents made decisions to participate or not at their own free will. The researcher respected the respondents' decisions. The respondents in the study were student nurses and Botma et al (2010:7) emphasise that students are considered vulnerable and in a subservient position. The researcher was in a position of authority as a lecturer at the private NEI but did not exploit any relationship with the respondents. The researcher did not coerce or promise any rewards to the student nurses in exchange for participation. The respondents were reassured that participation in the study was completely voluntary.

The respondents had full disclosure regarding the research study. Polit and Beck (2012:154) refer to full disclosure as a full description of the nature of the study. A covering letter/participant information leaflet regarding the aim of the study and the researcher's details was given to the respondents. The respondents who were willing to participant in the study were asked to complete and sign the informed consent forms.

Informed consent forms are documents that inform the respondents of the purpose and requirements of the study (DePoy & Gitlin 2016:33-34), which the respondents completed on consenting to participate in the study. The completed consent forms were placed in a box separate to the completed questionnaires.

The researcher chose to remain distant in terms of interaction and administration of the questionnaire. The administration personnel at the private NEI acted as research assistants during data collection. The role of these research assistants was purely to administer the questionnaires to the respondents and collect the completed questionnaires and informed consent forms at the end of the session. In doing so, any undue obligation on the student nurses to participate in the study was minimised. The researcher ensured that the rights of the respondents were protected at all times. Students may feel obligated to participate in a study in order to maintain good relationships with lecturers and protect marks (Gray et al 2017:163). Students may not be able to decline participation due to fear of repercussions (Hedges & Williams 2014:232). The respondents were informed of the right to not participate or withdraw from the study without fear of any repercussions or discrimination.

Deception refers to misleading respondents in terms of the study's purpose and this violates the subject's right to self-determination (Gray et al 2017:163). Veracity is the principle of telling the truth and includes building trust relationships, displaying respect for autonomy and dignity (Moule & Goodman 2014:59). Respondents must be truthfully informed of the benefits and risks associated with a study.

There was no deception in the study. The principle of veracity was maintained in terms of the study's purpose, benefits and risks. The researcher respected the student nurses' right to participate, refuse participation or withdraw from the study. There were no consequences in doing so.

3.3.5.3.2 Beneficence and non-maleficence

Beneficence refers to the act of doing good while non-maleficence refers to doing no harm (Grove et al 2015:98). Respondents have a right to be protected from harm (Gray et al 2017:173). In conducting research studies, there should be a balance of benefit-

risk ratio (Gray et al 2017:174). Benefits should be maximised and risks minimised (McIntosh-Scott et al 2014:206).

The structured self-administered questionnaire provided a safe avenue for the respondents to describe their perspectives on IT in nursing education. The respondents were informed that the results from the study would be used to benefit student nurses through improved practices and contribute to better quality nursing education and better quality nursing practice.

Researchers have an obligation to maintain the integrity of study, treat respondents with respect and dignity, maintain confidentiality, and ensure safety from harm (Hedgers & Williams 2014:225). The study did not pose any physical, psychological, social or financial risks to the respondents. There was no form of reward, reimbursement, gifts or services provided to the respondents in the study. The questionnaire was administered at the private NEI and the respondents did not incur any financial costs. There was no coercion to participate.

3.3.5.3.3 Justice

Justice refers to the right to fair treatment (Gray et al 2017:172). Respondents must receive fair treatment in terms of the benefits and risks of the study (Grove et al 2015:98). Moule and Goodman (2014:59) define justice as being fair and not giving preference to respondents but also includes that the interest of respondents must come before that of the researcher.

In the study, all the student nurses who met the study criteria were afforded an opportunity to participate in the study. No preference was given to the respondents. The study provided the same benefits and risks to all the respondents.

Data was collected in a consistent manner from all the respondents. There must be fair and equal treatment of all respondents during data collection (Grove et al 2015:108). Data was collected from each respondent at the private NEI during the students' college block times. Each respondent received a participant information leaflet, informed consent form and questionnaire (see Annexures C, D and E). The researcher was available to answer any questions or provide clarification before data collection. Each

respondent was given a fair amount of time, namely forty five (45) minutes, to complete the questionnaire. Promises made to respondents must be upheld (Grove et al 2015:107). The researcher assured the respondents that the results of the study would be made available on completion and upon request.

3.3.5.3.4 Privacy, anonymity and confidentiality

Privacy refers to the right of respondents to decide what, when and how much information will be shared in a study (Grove et al 2015:105). Anonymity means that responses may not be linked to individual respondents whilst confidentiality means that respondents' private information should not be shared with others without the respondents' authorisation (Gray et al 2017:170). Confidentiality also includes safe management of data that must be protected and kept private from others (Grove et al 2015:107).

The respondents' right to privacy, anonymity and confidentiality was maintained throughout the study. The respondents completed the questionnaires in private without any distractions. No names or identifying codes appeared on the questionnaires. The informed consent forms were placed in a separate box to the questionnaires. It was thus not possible to link responses to a respondent. This ensured anonymity of responses and could have contributed to honest responses.

Personal information provided in a study must be safeguarded (Moule & Goodman 2014:60). Written data should be kept in locked cupboards and electronic data should be password protected and only shared with members of research team (Tappen 2016:199). The respondents were reassured that no unauthorised persons would have access to the data. The data collected was not used against the respondents in any way. The completed informed consent forms and questionnaires were protected and kept locked away for safety in a fireproof cupboard. All electronic documents related to data collection were password protected. The data will be destroyed after a period of time as stipulated by the Higher Degrees Committee of the Department of Health Studies at UNISA.

3.3.6 Data analysis

Data analysis refers to the organisation of data to answer the study's questions (D'Cruz & Jones citied in McIntosh-Scott 2014:217). Data analysis summarises, organises and gives meaning to data (Grove et al 2015:47). In the study data was analysed using statistical analysis. An expert statistician assisted in data analysis.

3.3.6.1 Data analysis process

The raw data was prepared for analysis. Data was managed by setting up a tracking system. The completed questionnaires were numbered from one (1) to two hundred and forty four (244). Each item in section A, B and C of the questionnaire was pre-coded to assist with capturing onto Excel. An Excel spreadsheet was formulated based on the pre-coding of items on the data collection instrument. The data from each of the completed questionnaires were captured onto the Excel spreadsheet corresponding to the allocated number. Missing data on the questionnaire was left as a blank cell on Excel. Responses to the open-ended question in section D of the questionnaire were also entered into Excel. The researcher took care to avoid errors in data input.

Data verification requires that data input be checked for accuracy and to reduce errors. The Excel spreadsheet was checked and cleaned of any obvious errors. Duplication of entries and inputs outside of the stipulated codes were double checked against the questionnaire and corrected. Strategies to improve accuracy include proof reading and checking 10% of data entry. A double entry system can be used to enter data twice and test for accuracy but it is time consuming (Moule & Goodman 2014:400-401; Tappen 2016:329). The researcher used proof reading to determine accuracy of data entry.

Microsoft Excel is often the software of choice due to its widespread availability (Evans 2013:37). Excel provides spreadsheet software for manipulation of numerical data. The numeric data can be presented in charts or graphs created in Excel (Evans 2013:45-49). The researcher used Excel and SPSS version 22 for data input and analysis.

3.3.6.2 Statistical analysis

Statistical analysis reduces large sets of data into summarised interpretable forms (DePoy & Gitlin 2016:283). Statistical analysis can take the form of descriptive and/or inferential statistics. Descriptive statistics are used to estimate parameters while inferential statistics are used to make inferences about the population (Polit & Beck 2012:379). In the study, descriptive and inferential statistics were used for analysis.

3.3.6.2.1 Descriptive statistics

Descriptive statistics were used to address the research questions in the study which was descriptive in nature. Descriptive analysis is useful for understanding quantitative research evidence and enables researchers to summarise, interpret and understand numeric information (DePoy & Gitlin 2016:285).

Descriptive statistics provide summaries of data which can be presented in tables or graphs (Botma et al 2010:148). Statistical analysis may range from simple average to complex calculations (DePoy & Gitlin 2016:285). Frequencies were represented in tables or graphs. Frequencies refer “to the number of times that a result occurs” (Brink et al 2012:180-186). Frequency tables and graphs were used for analysis of all items in the questionnaire. Descriptive statistics include numerical measures utilising mathematical calculations (Saks & Allsop 2013:217). Means and standard deviations were used, where applicable. Mean is the average of all the scores in a distribution (Gray et al 2017:523). Standard deviation specifies “how values vary about the mean of distribution”. Standard deviation is the most popular measure of dispersion (Evans 2013:65).

Limitations associated with descriptive data analysis include inadequacy of information, incorrect statistical indexes, and inability to present data in a clear and efficient manner (Polit & Beck 2012:402). A professional statistician provided guidance to ensure correct data analysis.

3.3.6.2.2 Inferential statistics

Inferential statistics refer to the process of using numerical information to draw conclusions about characteristics of a population based on sample data (Saks & Allsop 2013:225). DePoy and Gitlin (2016:297) state that the accuracy of inferences depends on how closely matched the sample is to the population. Inferential statistics may also be used to determine differences within a sample (DePoy & Gitlin 2016:284). Two hundred and forty four (244) respondents from a target population of 260 completed the questionnaire. The large number contributed to the accuracy of inferences. Inferential statistics were used to make inferences between the age groups, nursing programmes, years of clinical experience, respondents who owned IT devices and those who did not, respondents who had IT training prior to nursing and those who did not, and respondents who had internet access and those who did not.

The p-value, t-test, analysis of variance (ANOVA), chi-square test and binomial test were used in data analysis. Inferential statistics use p-values which refer to "the probability that the outcome is owing to chance – and used to communicate the significance or non-significance of the differences" (Brink et al 2012:179). The p-value is used to determine statistical significance of results. A very small p-value indicates that the probability that the result was due to error or chance is also very small. A p-value greater than 0.05 indicates the probability that the results were due to an error is very large and the researcher cannot draw conclusions (Houser 2015:356). A p-value that was greater than 0.05 indicated that the result was significant for the sample and could not be generalised to the population.

The t-test is the most common parametric statistical test. Parametric statistics are associated with data that meet specific assumptions (Gray et al 2017:567). T-test compares the means of two groups to establish if differences are significant or by chance. There are two forms of the t-test. A one sample t-test is used when samples are dependent. One sample t-test determines whether a mean score is significantly different from a scalar value (Polit & Beck 2017:385). Many items on the questionnaire had response options on a scale of 1 to 5. The scales went from one extreme on the left to the other on the right. The average scores for these items were calculated and then a one sample t-test was applied to determine whether the average score was significantly different from the 'central' score of '3'. If there was a significant difference, it was

interpreted according to the scale used; for example, significantly more/less often; significant competence/lack of competence; significant agreement/disagreement.

The independent samples t-test is used when samples are independent. The independent samples t-test is a test that compares two independent groups of cases (Brink et al 2012:191). The independent samples t-test was used to analyse differences in nursing programmes, training and access to IT.

According to Brink et al (2012:191), the chi-square test is the most widely used test in health science research. It compares sets of data in the form of frequencies. The chi-square goodness-of-fit-test refers to a univariate test, used on a categorical variable to test whether any of the response options are selected significantly more or less often than those of the others. Under the null hypothesis, it is assumed that all responses are equally selected. Univariate tests conduct analysis of a single variable in order to provide description (Botma et al 2010:148-149). The chi-square test was applied to items in the questionnaire that provided response options for the rating of exposure/experiences to IT. The ratings varied from poor to average to good.

A binomial test examines whether a significant proportion of respondents selects one of possible two responses. This can be extended when data with more than two response options are split into two distinct groups. All items in the questionnaire that contained yes or no response options were analysed using the binomial test.

For some of the scales in section B of the questionnaire, a single reliable measure for the construct was calculated. Reliability was tested using Cronbach's alpha. If the alpha was greater than 7, it indicated reliability of the measure. Cronbach's alpha coefficient is the mean of inter-item correlations. Cronbach's alpha can range from .0, interpreted as no internal reliability, to 1.0, which indicates perfect internal reliability with no measure error (Gray et al 2017:373-374). Once single measures were formed, analysis was done to determine if the measures differed significantly across the different groups. The single measure was formed by calculating the average of the response scores for the items included in the measure. The one-sample t-test was applied to test for significant competence/frequency/agreement for each of the single constructs. The ANOVA test was applied to test if the single measures differed significantly across categories of

variables from section A in the questionnaire. ANOVA was used to determine differences across the age groups and years of clinical experience.

ANOVA is an extension of the t-test and allows for the comparison of more than two means at the same time (Evans 2013:182). ANOVA is a test for several independent samples that compares two or more groups of cases in one variable (Brink et al 2012:191). ANOVA tests for differences between the groups (Gray et al 2017:572).

Limitations with inferential statistics relate to uncertainty with generalisation to a population that has not been fully measured and possibility of errors (Polit & Beck 2012:402).

Chapter 4 discusses the data analysis fully.

3.3.6.3 Validity of data analysis

Validity of data analysis can be ensured by choosing the most appropriate data collection and analysis methods for the study. The sample must match the population as closely as possible in order to draw valid statistical conclusions. The correct sample size is required for generalisations and correct interpretations (Evans 2013:125).

The study sample was closely matched to the population and the number of respondents exceeded the suggested sample size thereby enhancing generalisations and interpretations. The data-collection instrument, namely the self-administered structured questionnaire, was most appropriate to address the purpose and objectives of the study and allowed for statistical analysis of data.

Data collected from a study should not be manipulated or used to fit a different purpose. If used for a different purpose, results may be incorrect and misinform decision making. The researcher has an obligation to report data honestly with no distortions. Justifications for omitted cases in the study must be provided (Moule & Goodman 2014:402-403). There was no manipulation or distortion of data. The researcher committed to analysing and reporting data truthfully.

3.4 VALIDITY AND RELIABILITY OF THE STUDY

Validity and reliability are closely related concepts which aim to ensure quality of the research study. Valid empirical knowledge requires sound ethical research (Grove et al 2015:95). According to Grove et al (2015: 213), biases in descriptive research can be avoided by proper conceptual and operational definitions, correct sample selection and size, valid and reliable instruments and data-collection procedures that may partially control the environment.

Validity refers to the truthfulness of a research study. The chosen research design and methodology must address the research questions in order to produce trustworthy results (Gray et al 2017:42-43).

Internal validity refers to the ability of research design to accurately answer the research questions and external validity refers to the capacity to generalise the study findings and develop inferences from the sample to the study population (DePoy & Gitlin 2016:122-124). The quantitative, non-experimental descriptive design was appropriate to address the questions of the study. Two hundred and forty four (244) respondents from a target population of two hundred and sixty (260) completed the questionnaires making generalisation of the findings and inferences statistically conclusive.

Reliability of the research study refers to consistency of measure (Gray et al 2017:370). The study was well planned. Steps in the research process were clearly detailed, making it possible to repeat the study under similar circumstances to reveal similar results. According to Tappen (2016:151-152), reliability of a study can be improved by training data collectors to be competent and responsible, ensuring similar settings when collecting data, and reducing environmental distractions. The researcher ensured that data was collected in a consistent manner and that the research assistants were briefed regarding the process to follow during data collection.

3.4.1 Rigor in quantitative research

Rigor in quantitative research refers to a high degree of accuracy, consistency with attention to all measurable aspects of the study. The chosen research design and methodology must be well thought out to address the research questions in order to

produce dependable results. There must be logical consistency between all steps of the research process (Gray et al 2017:42-43).

Rigor in the study was addressed by the selection of an appropriate research design to answer the research questions. An appropriate target population was selected by specifying the study criteria of having six and more months of experience thus ensuring that the respondents were most suitable to answer the study questions. Data was collected from a large number of respondents thereby contributing to valid and reliable analysis. Data was recorded precisely, using Excel spreadsheets and SPSS. Data was measured accurately, using statistical analysis with the assistance of an expert statistician. The researcher followed a sequential approach throughout the study.

3.5 CONCLUSION

This chapter described the research design and methodology. A quantitative, non-experimental descriptive design was followed in the study. Data was collected from student nurses at a private NEI via a self-administered structured questionnaire. Descriptive and inferential statistics were used to analyse the data. Measures to ensure validity and reliability of the study, including ethical considerations, were discussed.

Chapter 4 discusses the data analysis and interpretation and results.

CHAPTER 4

ANALYSIS, PRESENTATION AND DESCRIPTION OF THE RESEARCH FINDINGS

4.1 INTRODUCTION

This chapter discusses the data analysis and interpretation, and the findings with reference to the literature reviewed. The aim of the study was to explain and describe the perspectives of student nurses at a selected private NEI on the use of IT in nursing education. The findings were used to recommend strategies to improve the use of IT in nursing education.

4.2 DATA MANAGEMENT AND ANALYSIS

Data analysis summarises, organises and gives meaning to data (Grove et al 2015:47).

In the study the researcher captured the data, using Excel. Data was managed by setting up a tracking system. An Excel spreadsheet was formulated for data analysis. Each hardcopy questionnaire was marked and filed to match the data input into the Excel spreadsheet. Responses on the questionnaires were codified to make capturing easier. The data from all the questionnaires were input into Excel. Missing data on questionnaires were left as blank cells on the Excel spreadsheet. Responses to the open-ended question in Section D of the questionnaire were also entered into Excel. The researcher used proof reading to determine the accuracy of data entry. The Excel spreadsheet was checked and cleaned of any errors.

A statistician assisted in data analysis. Data was analysed using SPSS, version 22. Statistical analysis reduces large sets of data into summarised interpretable forms (DePoy & Gitlin 2016:283). Descriptive and inferential statistics were used in the data analysis. Means, standard deviations and frequencies were used. Tables, pie and bar graphs were used for visual presentation.

Inferential statistics may also be used to determine differences within a sample (DePoy & Gitlin 2016:284). Inferential statistics were used to make inferences between the age groups, nursing programmes, years of clinical experience and groups with IT training and Internet access. The p-value, chi-square test, ANOVA test, binomial test, and t-tests were used in the data analysis.

4.3 RESEACH FINDINGS

The findings are presented and discussed according to the sections of the questionnaire.

4.3.1 Respondents' biographical profile

4.3.1.1 Age

The respondents' age categories were analysed using frequency distribution. Frequencies refer "to the number of times that a result occurs" (Brink et al 2012:180-186). Table 4.1 presents the respondents' age categories.

Table 4.1 Frequency distribution of respondents' age categories (N=244)

Age groups	Frequency	Percent
18-30	134	54.9
31-40	104	42.6
41-50	6	2.5
TOTAL	**244**	**100.0**

Table 4.1 shows that of the respondents, 54.9% (n=134) were 18-30 years old; 42.6% (n=104) were 31-40 years old, and 2.5% (n=6) were 41-50 years old. The majority of the respondents belonged to the Millennials or Net Generation, which was the era of technological advances including the availability of smartphones. They were probably in a position to better understand the importance of IT in nursing education and possessed skills to utilise IT effectively in their learning. Johnson and Romanello cited in Bruce and Klopper (2017:181) found that these generations were often familiar with IT and Hay et al (2017:9) found that familiarity with IT stimulated continued use of IT in higher education environments.

Of the respondents, 2.5% (n=6) belonged to Generation X. This generation did not grow up in technological environments and IT exposure and experience often occurred through work environments (Haeger & Linghamb 2014:321). These older respondents may probably learn to use IT at a slower pace to their younger counterparts due to reduced familiarity.

4.3.1.2 Registered nursing programmes

Frequency distribution was used to analyse the number of respondents registered per nursing programme. Figure 4.1 depicts the distribution.

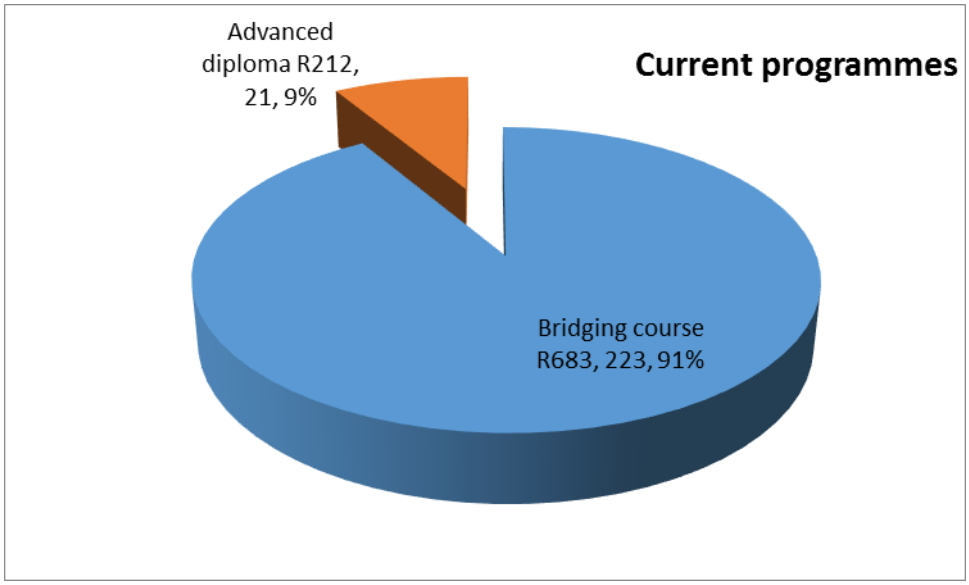

Figure 4.1 Respondents registered for nursing programmes (N=244)

Figure 4.1 shows that of the respondents, 91% (n=223) were registered for the Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and 9% (n=21) were general nurses pursuing the post-basic programmes for Advanced Diploma in Medical and Surgical Nursing Science with specialisation in either Critical Care, Trauma and Emergency, or Perioperative Nursing (R212) (Regulation R683; Regulation R212) (SANC 1989, 1993).

Nursing forms the backbone of healthcare in South Africa. Consequently, nursing education and training should prepare students in such a manner that they are able to cope with technological advances aimed at improving patient outcomes. Nurse practitioners require IT literacy to use high-technology medical devices and EHR

(Murphy et al 2017:1). Effective utilisation of CDSS requires practitioners to navigate through the IT App (Sukums et al 2014:[1]). The fact that the institution under study incorporated IT training in the nursing programmes augurs well for the profession because on completion of training, these nurse practitioners should be able to cope with the demands of the fourth industrial revolution particularly in healthcare.

4.3.1.3 Respondents' years of clinical experience

Frequency distribution was used to analyse the respondents' years of clinical experience (see table 4.2).

Table 4.2 Respondents' years of clinical experience (N=244)

Years of clinical experience	Frequency	Percent
0-5	153	62.7
6-10	77	31.6
11-15	10	4.1
16-20	3	1.2
>20	1	0.4
TOTAL	**244**	**100.0**

Table 4.2 shows that of the respondents, 62.7% (n=153) had between 0-5 years of clinical experience; 31.6% (n=77) had 6-10 years of clinical experience; 4.1% (n=10) had 11-15 years of clinical experience, and 1.6% (n=4) had 16 and more years of clinical experience. It was inferred that the respondents with lesser years of clinical experience were younger and digital natives with the implication that they were exposed to IT in clinical environments at early stages of their careers. The respondents with more years of clinical experience especially the 1.6% (n=4) were considered older and accustomed to traditional nursing practices with minimal IT integration in healthcare systems with the implication that they may struggle to fully accept and utilise IT in nursing education. Moore and Jayewardene (2014:20) found that younger healthcare practitioners were more inclined to use IT in clinical practice.

4.3.1.4 Qualification and training in IT

The respondents were asked about prior IT education and training. Frequency distribution was first applied for analysis. Thereafter the binomial test was applied to

determine whether a significant proportion of the respondents selected either of the two response options, namely “yes or no”.

The p-value was used to determine the statistical significance of the results. A very small p-value indicates that the probability that the result was due to error or chance is also very small. A p-value greater than 0.05 indicates the probability that the results were due to an error is very large and the researcher cannot draw conclusions (Houser 2015:356). Table 4.3 presents the respondents’ binomial results of IT qualification and training.

Table 4.3 Binomial results of respondents’ IT qualification and training (N=244)

	Frequency (%) Yes	**Frequency (%) No**	**Total**	**p-value**
Do you possess a formal IT qualification, e.g. a credited certificate in IT?	28 (11)	216 (89)	244	< .0005
Have you undertaken any training in IT before registering for nursing?	94 (39)	150 (61)	244	< .0005

Table 4.3 illustrates that of the respondents, 89% (n=216) did not possess a formal IT qualification (p<.0005) while 61% (n=150) also indicated no prior IT training before registering for the nursing programmes (p<.0005). The lack of IT education and training was reflective of the South African schooling system that did not support IT exposure and teaching across all schools. While private schools often provided IT courses as part of the curriculum, many public schools did not have the necessary infrastructure and resources to offer IT. IT education and training outside of the schooling system was often associated with high cost implications and this often contributed to the lack of IT education and training before enrolment in higher education institutions. The respondents therefore faced the challenge of learning and using IT in addition to the discipline of nursing. There was pressure to learn IT fast in order to achieve programme objectives and success.

4.3.1.5 Ownership of IT devices and IT access, including the Internet

Frequency distribution was used for the initial analysis of ownership of IT devices and IT access. Some respondents did not answer these items and the missing data was excluded from the binomial test analysis. The binomial test was applied to analyse data only from respondents who answered the question

4.3.1.5.1 Ownership of IT devices

Table 4.4 Respondents' binomial results of ownership of IT devices (N=244)

	Frequency (%) Yes	Frequency (%) No	Total (n)	p-value
Do you own a computer?	185 (82)	40 (18)	225	< .0005
Do you own a smartphone?	229 (97)	6 (3)	235	< .0005
Do you own a tablet?	108 (55)	90 (45)	198	.227

Table 4.4 indicates that of the respondents, 97% (n=229) owned smartphones (p<.0005); 82% (n=185) owned computers (p<.0005), and 55% (n=108) owned tablets. The results indicated that the majority of the respondents owned at least one type of IT device. Readily available access to IT devices meant that the respondents could practise and use IT at any time to enhance learning. Hay et al (2017:13) found that Australian undergraduate nursing students used at least one IT device: a computer, smartphone or tablet. In their study, Zayim and Ozel (2015:456) reported that most of the nursing students owned mobile phones, smartphones and laptops. The researcher noted that even though South Africa is a developing country, the respondents' IT ownership compared favourably with that of developed countries like Australia and Turkey. The results suggested an awareness and desire on the part of the respondents to keep pace with technological evolution trends.

4.3.1.5.2 Access to IT

Table 4.5 reflects the binomial results of the respondents' access to IT.

Table 4.5 Binomial results of respondents' IT access (N=244)

	Frequency (%) Yes	Frequency (%) No	Total (n)	p-value
Do you have access to the Internet?	230 (95)	13 (5)	243	< .0005
Do you have access to IT on the go?	154 (75)	55 (26)	209	< .0005
Do you have access to IT at home?	165 (80)	42 (20)	207	< .0005
Do you have access to IT at campus?	218 (96)	8 (4)	226	< .0005
Do you have access to IT at the hospital?	176 (82)	39 (18)	215	< .0005

Table 4.5 shows that of the respondents, 95% (n=230) had access to the Internet (p<.0005). The Internet is an indispensable tool for learning and readily available access means that learning is not confined to brick-and-mortar classrooms but enhanced through virtual environments. In this study, the majority of the respondents had access to the Internet and therefore numerous learning opportunities. The results concurred with Akman et al's (2014:422) finding that Turkish nursing students accessed the Internet especially for study purposes. Chipps et al (2015:[6]) reported that mobile phones improved access to the Internet for many learners in rural areas of South Africa where IT access and network connections were often a challenge.

In this study, the majority of the respondents had access to IT. Of the respondents, 96% (n=218) had access at the campus (p<.0005); 82% (n=176) had access at clinical facilities (p<.0005); 80% (n=165) had access at home (p<.0005), and 75% (n=154) had access wherever they went (p<.0005). Johnston (2013:262) maintains that the digital era individual has a desire to connect and be connected at all times. The respondents therefore had the ability to learn at a time and place most convenient to them. Moreover, the respondents could access support through the Intranet, medical databases and support Apps whilst in the clinical environments thus strengthening confidence in practice. Samarkandi et al (2015:65-66) found that having access to a computer at home and school helped to reduce IT anxiety in Saudi Arabian nursing

students. The results also revealed that experience on the Internet improved IT confidence and learning.

4.3.2 Frequency of use and competency in IT

Items related to the frequency of use and competency in IT included response options on a scale from 1 to 5. The scale measured one extreme on the left to the other extreme on the right. The average scores for these items were calculated and then a one-sample t-test was applied. The one-sample t-test was used to determine whether the average score was significantly different from the 'central' score of '3'. If there was a significant difference, it was interpreted according to the scale used; for example, significantly more or less often; significant competence or lack of competence, and significant agreement or disagreement.

The mean (M) refers to the average of all the scores in a distribution (Gray et al 2017:523). Standard deviation (SD) specifies "how values vary about the mean of distribution (Evans 2013:65). The t-value represents the total number of respondents who answered the item in the questionnaire and the p-value (p) indicates the significance of the results.

4.3.2.1 Respondents' frequency of use and competency in general IT

This section describes the respondents' frequency of use and competency in general IT utilisation.

4.3.2.1.1 Respondents' frequency of use of general IT

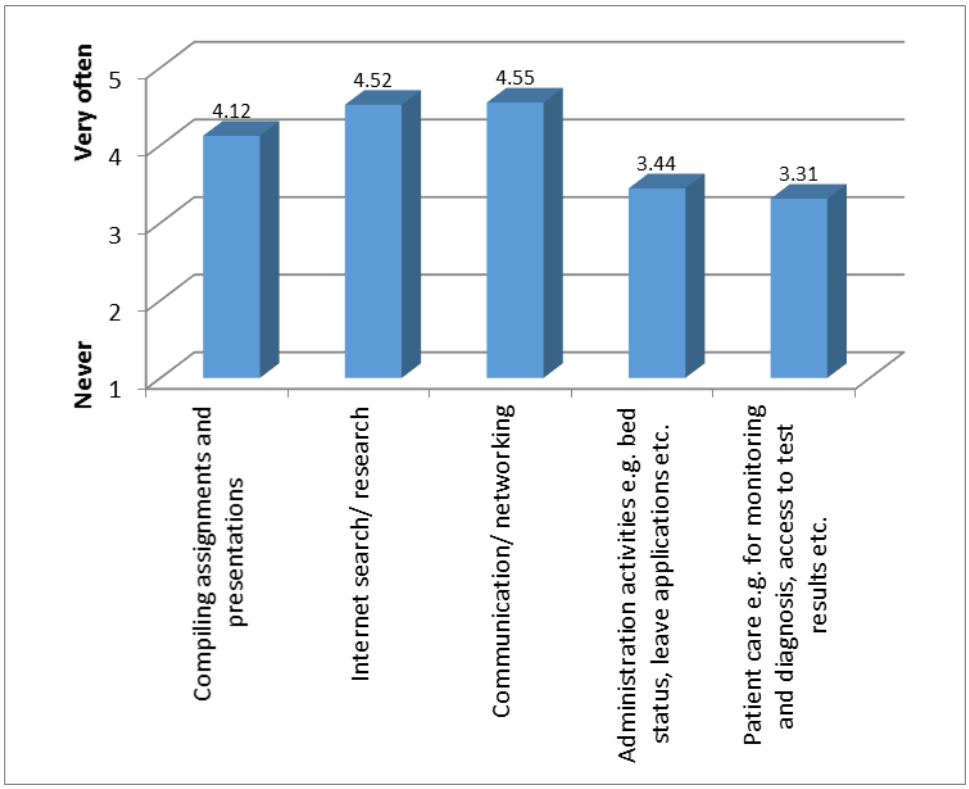

Figure 4.2 Respondents' frequency of use of general IT (N=244)

Figure 4.2 depicts that the respondents reported that IT was used significantly frequently for communicating and networking (M=4.55, SD=.869), t (241)=27.747, p<.0005, followed by internet searches and/or research (M=4.52, SD=.889), t (241)=26.615, p<.0005 and lastly for compiling assignments and presentations (M=4.12, SD=1.167), t (239)=14.879, p<.0005. The pressure of programme requirements at the institution in the study may have acted as a motivator compelling the use of IT in nursing education. The results were similar to Zayim and Ozel's (2015:458-460) finding that more than half of the nursing students used IT for information searches on the Internet and for social networking.

The study found that the respondents used IT significantly frequently for administrative activities, such as bed status, leave applications etc (M=3.44, SD=1.419), t (238) =4.833, p<.0005, and patient care, such as for monitoring and diagnosis, access to test results etc (M=3.31, SD=1.428), t (238)=3.353, p=.001. Health institutions in South Africa are incorporating IT into medical care practices (Britnell 2013:158) and general IT skills are often required to use specially developed IT systems for work-related

purposes. The results concurred with Dean's (2013:8) finding in Stockport, Greater Manchester, that nursing personnel used IT for daily allocation rosters, patient bookings through automated appointments, and forecasting workload to determine staffing requirements.

4.3.2.1.2 Respondents' competency in general IT utilisation

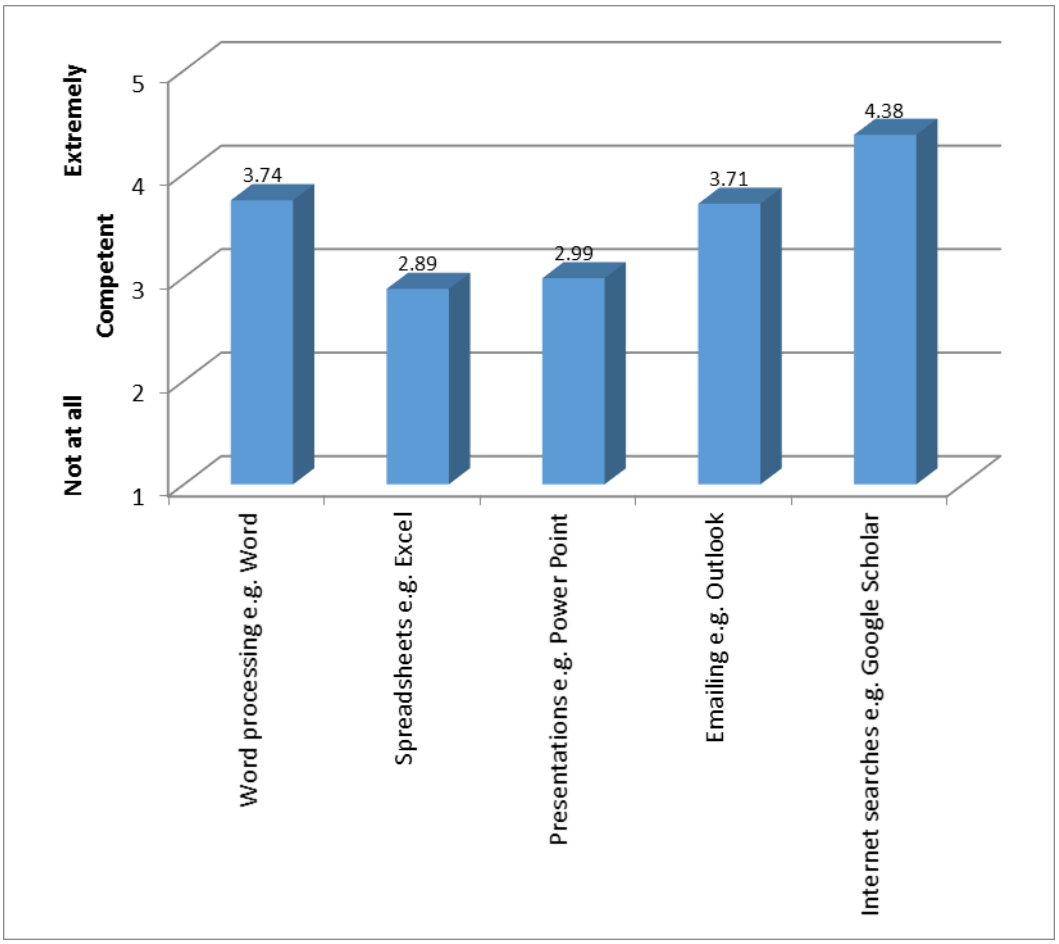

Figure 4.3 Respondents' competency in general IT utilisation (N=244)

Figure 4.3 illustrates that the respondents reported significant competence in using IT for Internet searches, e.g., Google Scholar (M=4.38, SD=.954), t (243)=22.540, p<.0005; word processing, e.g., Word (M=3.74, SD=1.203), t (242) = 9.652, p<.0005, and emailing, e.g., Outlook (M=3.71, SD=1.320), t (242)=8.406, p<.0005. The respondents indicated little or a lack of competence (M<3) in working on presentations, e.g., Power Point (M=2.99, SD=1.391), t (243)=-0.092, p=.927, and spreadsheets, e.g., Excel (M=2.89, SD=1.279), t (241)=-1.357, p=.176.

The results may have been related to the limited use of Power Point and Excel in the nursing programmes in comparison to Internet searches and Word. These results were similar to Gonen et al's (2016:[6]) finding that Israeli bachelor degree nursing students reported most knowledge in Word and Internet searches with less than 25% indicating limited or no competency in Excel and other software.

4.3.2.2 Respondents' frequency of use and competency in IT utilisation for medical purposes/learning

The respondents' frequency of use and competency in IT utilisation for medical purposes and learning were analysed.

4.3.2.2.1 Respondents' frequency of IT utilisation for medical purposes/learning

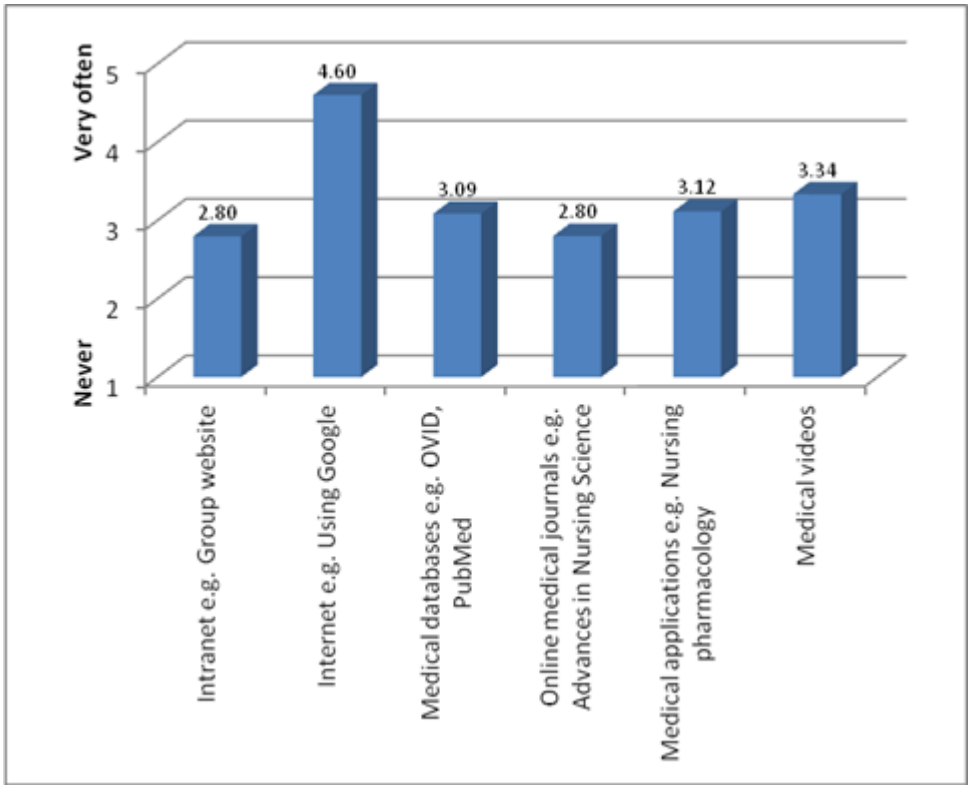

Figure 4.4 Respondents' frequency of IT utilisation for medical purposes/learning (N=244)

Figure 4.4 shows significant frequency in the respondents use of the Internet, e.g., Google (M=4.60, SD=.792), t (243)=31.604, p<.0005, and medical videos (M=3.34, SD=1.231), t (243)=4.263, p<.0005. The respondents' use of the Internet and its search

engines, such as Google, provided access to a multitude of information and communication sources, which is pivotal to enhance learning and nursing practice. The respondents' use of medical videos provided an additional dimension to learning with the potential to strengthen theoretical and clinical integration. The respondents could watch medical videos for better understanding of medical procedures which may not be readily available in clinical institutions. Nagy (2018:173) found that the use of videos in educational landscapes had a significant impact on students' learning performance and satisfaction. Students found the use of videos useful for revision and preparation for practice (Holland et al cited in Forbes, Oprescu, Downer, Phillips, McTier, Lord, Barr, Alla, Bright, Dayton, Simbag & Visser 2016:55).

The results indicate that the respondents reported frequent use of medical Apps e.g., nursing pharmacology (M=3.12, SD=1.287), t (242)=1.396, p=.164, followed by medical databases, e.g. OVID and PubMed (M=3.09, SD=1.076), t (241)=1.254, p=.211. Although the respondents used medical Apps and databases, there is concern over the validity and reliability of some of the Apps. In the UK, Moore and Jayewardene (2014:20-21) found that medical formularies, textbooks and CDSS were the most commonly used Apps, but the Apps were not usually risk assessed. Nurses in particular requested official endorsement to use specific Apps due to concerns about quality, safety and efficiency of use.

The respondents reported significant infrequent use (M<3) of the Intranet, e.g., group website (M=2.80, SD=1.225), t (242)=-2.566, p=.011, and online medical journals, e.g., Advances in Nursing Science (M=2.80, SD=1.183), t (242)=-2.603, p=.010. Hay et al (2017:8) found that nursing students often used evidence- based databases, drug guides, E-books, and various Apps in undergraduate nursing programmes. It was concerning that the respondents utilised these significant information sources infrequently since updated policies, procedures and quality improvement initiatives were available on the Intranet to standardise and guide nursing practices across all institutions in the healthcare group. According to Bruce and Klopper (2017:123), adult students decide what and when to learn according to needs and relevance of subject matter and this could possibly explain the results of the study. The respondents' infrequent use of online medical journals may have been related to financial implications associated with online medical journals and/or a lack of awareness.

4.3.2.2.2 Respondents' competency in IT utilisation for medical purposes/learning

The respondents were asked to indicate their competency in using IT for medical purposes and learning (see figure 4.5).

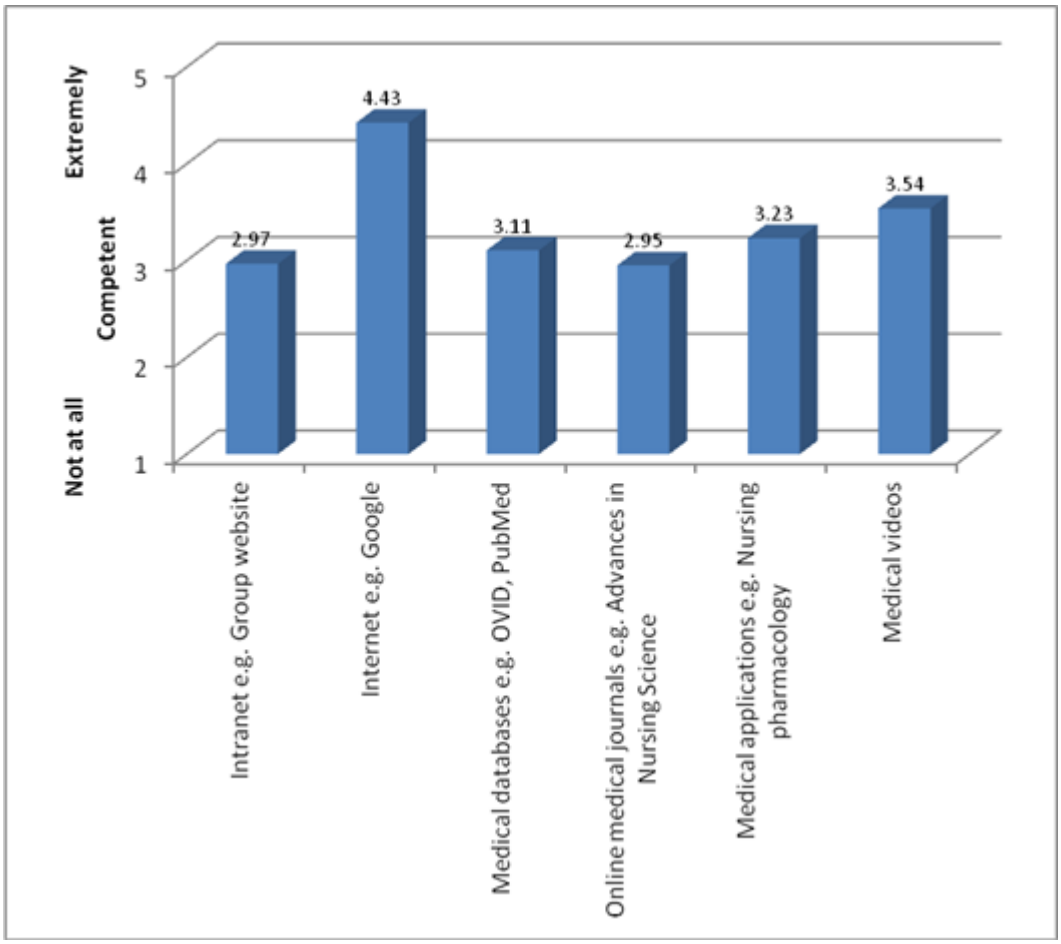

Figure 4.5 Respondents' competency in IT utilisation for medical purposes/learning (N=244)

Figure 4.5 shows that the respondents' reported significant competence in using the Internet, e.g., Google (M=4.43, SD=.952), t (239)=23.187, p<.0005; medical videos (M=3.54, SD=1.315), t (242)=6.391, p<.0005, and medical Apps, e.g., nursing pharmacology (M=3.23, SD=1.287), t (241)=2.798, p=.006. The respondents reported competence in using medical databases, such as OVID, PubMed (M=3.11, SD=1.208), t (242)=1.381, p=.169. Learning through electronic media provides a stimulating, enhanced experience to traditional learning approaches (Clark et al 2017:94).

The respondents reported a lack of competence in using the Intranet, e.g., group website (M=2.97, SD=1.253), t (242)=-.410, p=.682 and online medical journals, e.g.,

Advances in Nursing Science (M=2.95, SD=1.265), t (242)=-.608, p=.543. The respondents' lack of competence could have been due to infrequent use of the Intranet and online medical journals coupled with differences in navigation. In addition, the group's Intranet had been reviewed and updated. Several changes were implemented on the website and this could have contributed to the respondents' lack of competence as a result of unfamiliarity. Nagy (2018:174) found that students' IT self-efficiency impacted on IT usage and should be cultivated for better learning performance and learning satisfaction.

4.3.2.3 Respondents' frequency in downloading of information/documents

Frequency distribution and the one-sample t-test were used to analyse the respondents' frequency of downloading of information/documents. The respondents were asked to rate the frequency of downloading of information/documents, using a numerical rating scale where 1 was equal to never and 5 equal to very often.

Table 4.6 Respondents' frequency distribution of downloading of information/ documents (N=244)

Rating scale	Frequency	Percent
1=Never	6	2.5
2	19	7.8
3	54	22.1
4	62	25.4
5=Very often	103	42.2
TOTAL	**244**	**100.0**

Table 4.6 indicates that of the respondents, 42.2% (n=103) selected option 5: very often; 25.4% (n=62) selected option 4; 22.1% (n=54) selected option 3; 7.8% (n=19) selected option 2, and 2.5% (n=6) selected option 1: never.

The one-sample t-test revealed that the respondents reported downloading of information/documents on the Internet significantly frequently (M=3.97, SD=1.086), t (243)=13.966, p<.0005. The frequency of downloading of information/documents may have been influenced by the desire or need to do so. Supplemental information was often required and used for presentations, assignments, research projects and

assessments. Copyright clauses and plagiarism are important aspects to consider before downloading and using information/documents.

4.3.2.4 Respondents' frequency of utilisation of social networks for study and/or work purposes

The respondents were asked to indicate their most frequently used social networks for study and/or work purposes (see figure 4.6).

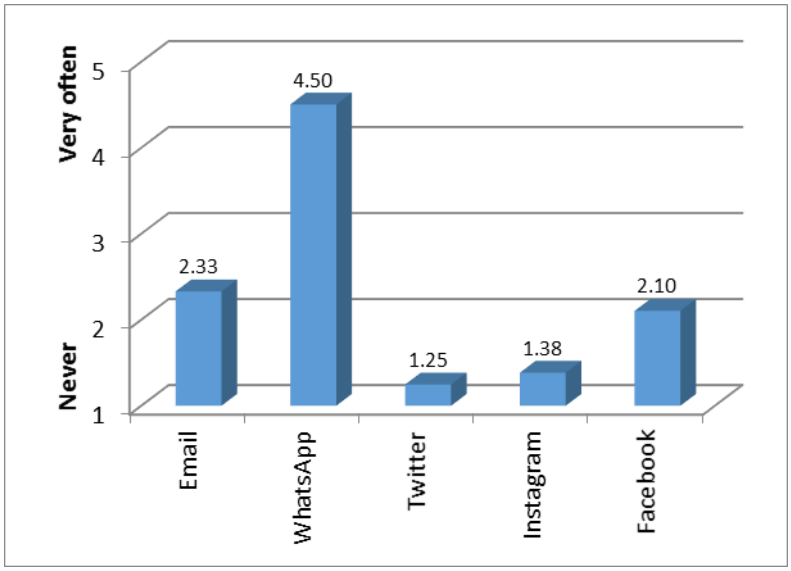

Figure 4.6 Respondents' frequency of utilisation of social networks for study and/or work purposes (N=244)

Figure 4.6 illustrates that the respondents reported using WhatsApp most frequently, followed by infrequent use of email, Facebook, Instagram, and Twitter. Hay et al (2017:14) found that student nurses used several social media sites and Apps for educational purposes in nursing programmes.

The respondents reported using WhatsApp significantly frequently (M=4.50, SD=.962), t (243)=24.417, p<.0005 for study- and/or work-related issues. WhatsApp provides a quick, easy and reliable means of communication whilst allowing for images and video clips to be shared between contacts at reasonably low cost. This might have explained the respondents' preference for WhatsApp compared to other social networks. The results concurred with Willemse and Bozalek's (2015:[4-5]) finding at a higher education institution in the Western Cape, South Africa, that WhatsApp was the most

frequently used social App for communicating with lecturers and peers, and sharing instructional videos. WhatsApp was user friendly and the most affordable compared to email and Facebook.

The respondents reported significant infrequent use of email (M=2.33, SD=1.378), t (241)=-7.558, p<.0005 and Facebook (M=2.10, SD=1.552), t (241)=-8.989, p<.0005 for study- and/or work-related purposes. Johnson and Romanello cited in Bruce and Klopper (2017:181-182) found that the Net generation students preferred short and instantaneous communication and used instant messaging Apps more often than emails. The results were in contrast to that of other studies. In the Eastern Cape, South Africa, Nyangeni et al (2015:[3]) found that nursing students preferred Facebook, followed by WhatsApp, Twitter and YouTube. Nursing students used social media to network in personal, educational and clinical environments. However, Chipps et al (2015:[4]) found that rural-based midwives in South Africa seldom used social networks, such as Facebook, for educational or work-related matters. The participants reported that they almost never used Twitter (M=1.25, SD=.747), t (242)=-36.564, p<.0005 and Instagram (M=1.38, SD=.980), t (241)=-25.658, p<.0005 for study and/or work purposes. These social media sites were often best known for sharing of personal rather than educational or work content. In a study in Australia, Hay et al (2017:13) found that less than 25% of the undergraduate nursing students used Twitter.

4.3.2.5 Respondents' frequency of utilisation of E-learning platforms for medical purposes/learning

The respondents were asked to indicate their use of E-learning platforms for work and study purposes (see figure 4.7).

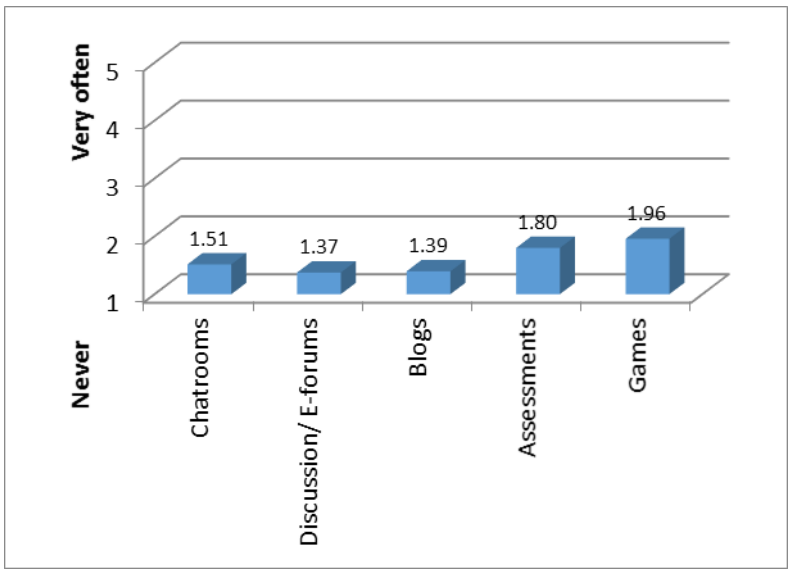

Figure 4.7 Respondents' frequency of utilisation of E-learning platforms for medical purposes/learning (N=244)

Figure 4.7 indicates that the respondents reported significantly infrequent use of games (M=1.96, SD=1.365), t (237)=-11.777, p<.0005; assessments (M=1.80, SD=1.206), t (238)=-15.389, p<.0005; chatrooms (M=1.51, SD=1.104), t (242)=-20.986, p<.0005; blogs (M=1.39, SD=.930), t (240)=-26.807, p<.0005, and discussion/E-forums (M=1.37, SD=.886), t (240)=-28.501, p<.0005 for medical purposes/learning. The respondents' infrequent use of E-learning platforms may have been due to lack of awareness and exposure, and an associated sense of discomfort, including large data usage and high cost implications. Chipps et al (2015:[5]) found that blogs and internet chats were used infrequently by advanced midwifery nursing students at the University of KwaZulu-Natal. In their study, Epstein and Ray (2014:237) reported that students did not perceive in-class blogging as positive. Students were afraid of being judged and preferred anonymous posts. De-Marcos, Dominguez, Saenz-de-Navarrete and Pages (2014:90) found low participation rates in gamification and social networking on e-learning among students. Games are traditionally often associated with play and leisure consequently games may be viewed negatively and student nurses may be discouraged from gamification in nursing education.

4.3.3 IT exposure, training and support

Items related to the respondents' IT exposure, training and support were analysed using frequency distribution, the binomial test, and chi-square goodness-of-fit test.

4.3.3.1 Interactive video conferencing

4.3.3.1.1 Respondents' participation in interactive video conferencing

Of the respondents, 50% (n=122) reported having been part of an interactive video conference via the Smartboard. The NEI in the study held various video conferencing sessions via the Smartboard. Student nurses were invited to attend but numbers were often restricted due to venue capacity. This might explain the 50% exposure rate.

4.3.3.1.2 Respondents' rating of experience of interactive video conferencing

Table 4.7 lists the respondents' rating of their experience of interactive video conferencing via Smartboard.

Table 4.7 Respondents' frequency rating of experience of interactive video conferencing via Smartboard (n=122)

Rating	Frequency	Percent
Poor	13	10.7
Average	72	59
Good	37	30.3
TOTAL	**122**	**100**

Table 4.7 indicates that of the respondents who had participated in interactive video conferencing, 59% (n=72) rated the experience average; 30.3% (n=37) rated the experience good, and 10.7% (n=13) rated the experience poor.

The chi-square goodness-of-fit test compares sets of data in the form of frequencies. The chi-square goodness-of-fit test was applied to test whether any option was selected significantly more than others. In the null hypothesis, it is assumed that all responses are equally selected (Botma et al 2010:148-149). The chi-square goodness-of-fit test revealed that of the respondents, 59% (n=72) rated the interactive video conference experience average, $\chi 2\ (2)=43.295$, $p<.0005$. It should be noted that the quality of an interactive video conference is often dependent on the capability of the devices, visual and audio clarity, good uninterrupted connections, number of participating persons, and adherence to rules of conduct. Video conferencing offers a virtual learning space which may appeal to digital era students. Video conferencing transforms traditional nursing

pedagogies to more interactive and engaging learning methodologies (Clark et al 2017:94).

4.3.3.2 Simulation devices and/or manikins

This section describes the respondents' exposure to and rating of simulation devices and/or manikins.

4.3.3.2.1 Respondents' exposure to simulation devices and/or manikins

Of the respondents, 71% (n=173) reported having been exposed to simulation devices and/or manikins. Simulations and manikins provide opportunities for student nurses to develop clinical decision-making skills in a "safe" environment. IT affords students the opportunity to enact difficult situations to trial responses and test solutions that may not be possible in clinical practice (Johnson, Hickey, Scopa-Goldman, Andrews, Boerem, Covec & Larson 2014:10).

4.3.3.2.2 Respondents' rating of exposure to simulation devices and/or manikins

The respondents were asked to rate their exposure to simulation devices and/or manikins (see table 4.8).

Table 4.8 Respondents' frequency rating of exposure to simulation devices and/or manikins (n=173)

Rating	Frequency	Percent
Poor	1	0.6
Average	71	41
Good	101	58.4
TOTAL	**173**	**100.0**

Table 4.8 indicates that of the respondents who were exposed to simulation devices and/or manikins, 58.4% (n=101) rated the experience good; 41% (n=71) rated it average, and 0.6% (n=1) rated it poor.

The chi goodness-of-fit test revealed that a significant 99.4% (n=172) of the 173 respondents that were exposed to simulation and/or manikins rated the experience as at least average, $\chi 2$ (2)=91.329, p<.0005. 41% (n=71) rated the experience as average while the remaining 58.4% (n=102) rated the experience as good. Simulators and/or manikins must be functional and of good quality in order to create useful positive experiences that facilitate learning in nursing education.

4.3.3.3 In-house IT training

The respondents were asked to rate the quality of the in-house training by choosing poor, average or good. The respondents rated the in-house training good (M=3.38, SD=1.156), t (242)=5.161, p<.0005. It was difficult to make direct comparisons to findings from other studies since the content of the IT training programmes may have differed. In-house training is often used to best prepare personnel for specific IT use to meet job requirements. Ricks, Benjamin and Williams (2015:[4-6]) found that many registered nurses in primary healthcare facilities received IT training in order to use mobile computing devices enabling them to access information necessary for patient diagnosis, treatment and education. In contrast, nursing students rated the short computer course offered at a Turkish university as insufficient in the nursing programme (Akman et al 2014:422-423).

4.3.3.4 Support in IT

The respondents were asked whether they received ongoing support in IT (see table 4.9).

Table 4.9 Respondents' binomial results of ongoing support in IT (N=244)

	Frequency (%) YES	**Frequency (%) NO**	**Total**	**p-value**
Do you receive ongoing support in IT throughout your course?	142 (58)	102 (42)	244	.012

Table 4.9 indicates that of the respondents, 58% (n=142) indicated having received ongoing support in IT throughout the nursing course while 42% (n=102) felt

unsupported. This was of concern in the light of the fact that continuous IT support was available to the respondents. Continuous IT support is pivotal to reduce frustration and IT anxiety. Samarkandi et al (2015:54-55) emphasise that IT anxiety creates fear and resistance to learn and use IT. Continuous support and refresher courses may improve IT competency. In their study conducted at healthcare facilities in Ethiopia, Alwan et al (2015:[3]) found that 75.5% of the participants had received basic IT training previously yet less than 20% demonstrated good IT knowledge and less than 30% demonstrated good IT utilisation.

4.3.3.5 Encouragement to use IT and training on IT-enabled equipment in the nursing programmes

Frequency distribution and one-sample t-test were used to analyse the respondents' agreement or disagreement regarding encouragement to use IT and the provision of training on IT-enabled equipment in the nursing programmes.

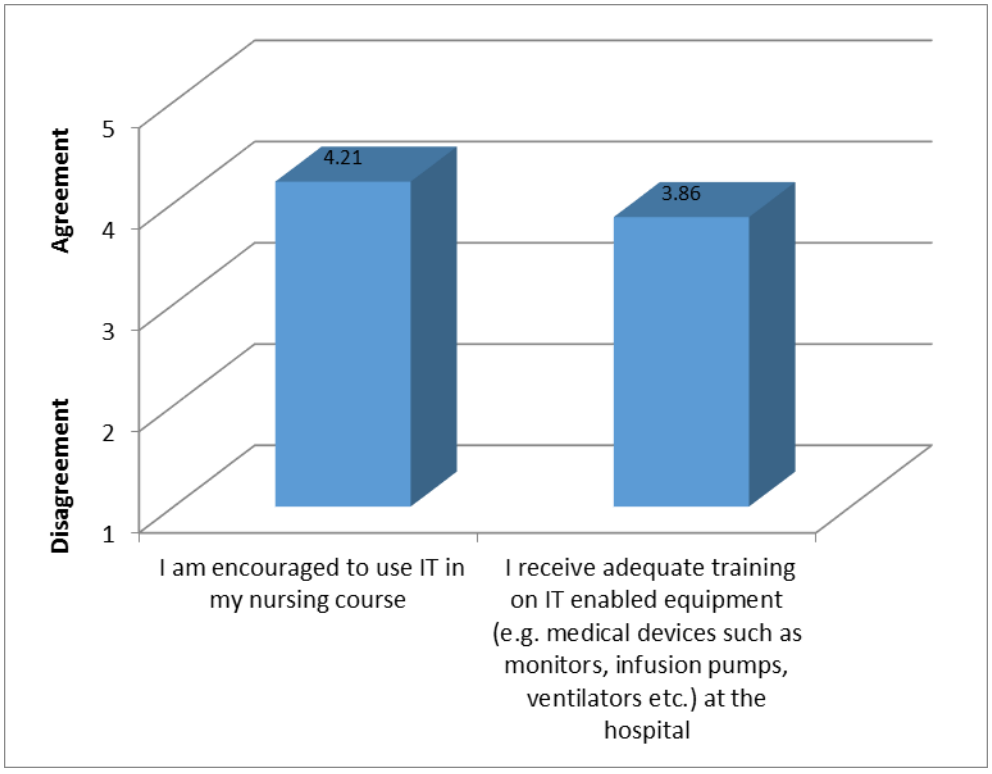

Figure 4.8 Respondents' encouragement and training to use IT (N=244)

Figure 4.8 illustrates that the respondents indicated significant agreement that they were encouraged to use IT in the nursing programmes, (M=4.21, SD=0.837), t (243)=22.556, p<.0005. Compulsory IT-related activities have been found to motivate utilisation of IT in nursing education. Alwan et al (2015:[6]) found that IT-based tasks in education ensured higher levels of IT utilisation among Ethiopian healthcare practitioners.

The respondents reported significant agreement that they received adequate training on IT-enabled equipment (e.g., medical devices, such as monitors, infusion pumps, and ventilators) at the hospital (M=3.86, SD=1.089), t (243)=12.291, p<.0005. Adequate training on IT-enabled equipment in clinical facilities is vital since accurate and safe nursing interventions include effective and efficient utilisation of medical equipment. Samarkandi et al (2015:67) found that student nurses who were encouraged to use IT in education and training were better prepared for IT use in clinical environments, including continuous professional development.

4.3.4 Perspectives on IT in nursing education

Frequency distribution and one-sample t-test were used to analyse the respondents' statements on IT in nursing education.

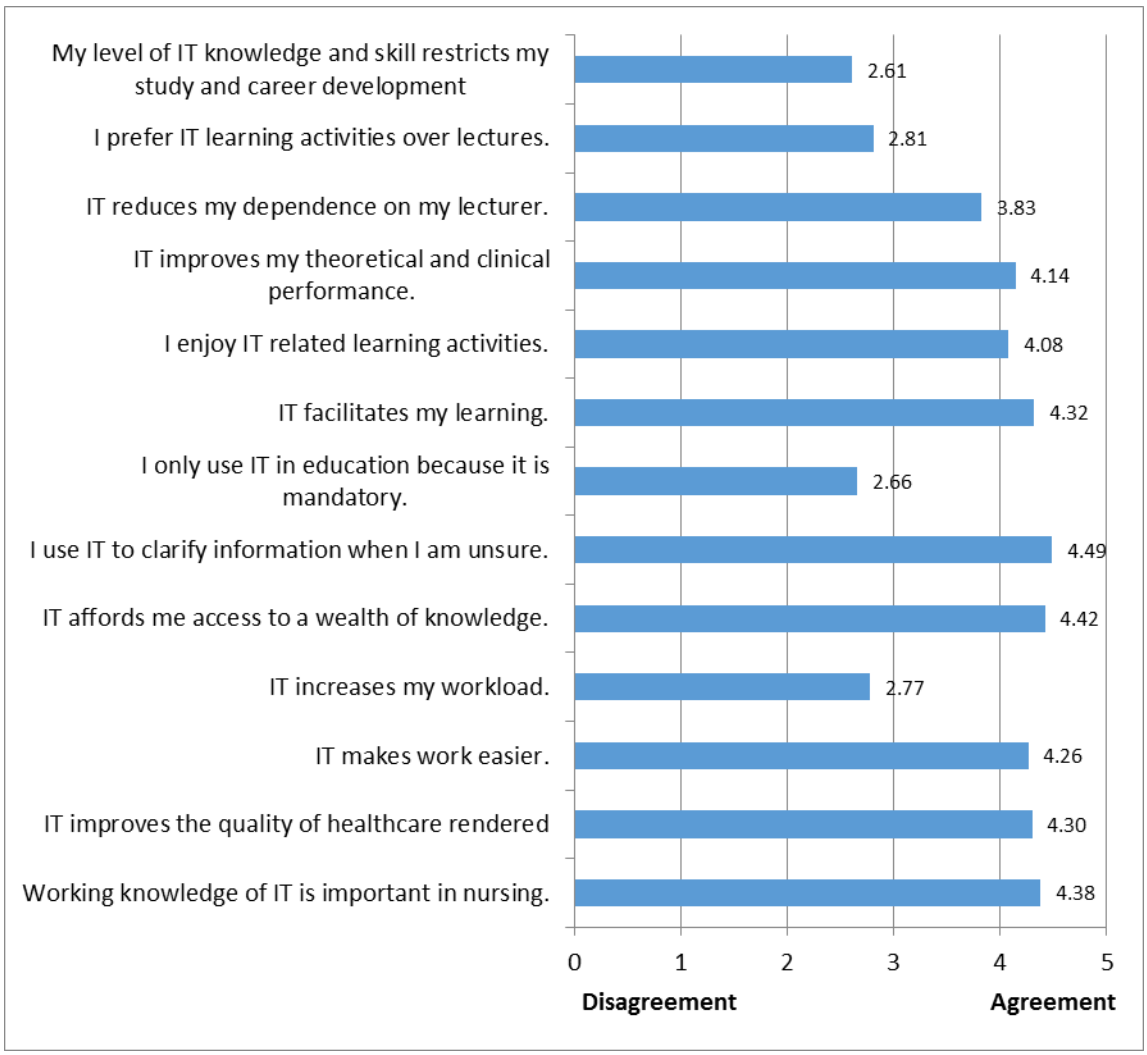

Figure 4.9 Respondents' perspectives on IT in nursing education (N=244)

Figure 4.9 illustrates that the respondents agreed with the following statements:

- Working knowledge of IT is important in nursing.
- IT improves the quality of healthcare rendered.
- IT makes work easier.
- IT affords me access to a wealth of knowledge.
- I use IT to clarify information when I am unsure.
- IT facilitates my learning.
- I enjoy IT-related activities.
- IT improves my theoretical and clinical performance.
- IT reduces my dependence on the lecturer.

The respondents indicated significant agreement that working knowledge of IT was important in nursing (M=4.38, SD=.815), t (243)=26.401, p<.0005. The nursing profession is not immune to IT and the respondents demonstrated awareness that IT knowledge and skills were important for job execution. The results were similar to other studies. In a study in the United States of America (USA) on nursing faculty and student experiences with information literacy, Carter-Templeton, Patterson and Mackey (2014:213) found that nursing students felt that IT literacy in nursing was important for application to clinical environments. Akman et al (2014:423) found that Turkish nursing students agreed that IT knowledge and skills were important in nursing.

The respondents indicated significant agreement that IT improved the quality of healthcare rendered (M=4.30, SD=.851), t (242)=22.833, p<.0005. The results concurred with other studies. Seahloli (2016:83) found that healthcare practitioners in both public and private facilities in South Africa believed that IT had the ability to improve healthcare processes. The ultimate objective of initiation and integration of any system in healthcare should impact positively on healthcare service delivery. Awareness of the impact of IT in the healthcare landscape may contribute to increased acceptance and utilisation.

The respondents indicated significant agreement that IT made work easier (M=4.26, SD=.905), t (243)=21.777, p<.0005. In a study on the attitudes of nursing staff towards computerisation in two hospitals in Nairobi, Kenya, Kipturgo et al (2014:[6-7]) found that participants agreed that IT made work easier and more efficient. In their study in the USA, Whitt et al (2017:47) found that undergraduate nursing students felt that IT, such as EHR, improved patient care, productivity and job satisfaction. It is important that healthcare practitioners experience the benefits of IT in terms of contributing to effective and efficient processes, and this may enhance adoption of IT in healthcare landscapes.

The respondents indicated significant agreement that IT afforded access to a wealth of knowledge (M=4.42, SD=.764), t (242)=28.975, p<.0005. The respondents demonstrated awareness of the multiple information sources available on the “World Wide Web” (www) such as text, audio, images, animation and videos to enhance learning, including theoretical and clinical practice in health sciences. In a study on the experiences of registered nurses in accessing information via mobile computing devices, the participants reported that access to information increased knowledge,

assisted in accurate diagnosis, reduced unnecessary referrals and provided motivation for sustained use of IT (Ricks et al 2015:[4-5]).

The respondents indicated significant agreement that IT was used to clarify information when unsure, (M=4.49, SD=0.794), t (242)=29.154, p<.0005. The ability of IT to clarify information was demonstrated in several studies. Willemse and Bozalek (2015:[4-7]) found that nursing students used IT to guide clinical practice by asking lecturers questions and seeking clarity about matters discussed. Mgutshini (2013:[5]) found that an online class of nursing students often replayed recordings until they understood the content. The ability to clarify information is critical to ensure safer, quality practices and better patient outcomes. In this study, the respondents demonstrated awareness of this avenue.

The respondents indicated significant agreement that IT facilitated learning, (M=4.32, SD=.822), t (240)=24.852, p<.0005. IT has been used in various educational disciplines to augment teaching and learning. George and DeCristofaro (2016:414) found that IT better engaged nursing students through active learning methodologies and enhanced the retention of learning content. IT improved self-directedness and responsibility to learn and culminated in student success (Caruth 2015:54).

The respondents indicated significant agreement that student nurses enjoyed IT-related learning activities, (M=4.08, SD=.911), t (243)=18.498, p<.0005. The results of the study were similar to findings of other studies. Rockinson-Szapkiw, Courduff, Carter and Bennett (2013:264-265) found that nursing students expressed a liking for IT-facilitated learning activities. Mgutshini (2013:[5]) found that an online class of nursing students experienced greater overall learning enjoyment and social interaction compared to campus-based nursing students.

The respondents indicated significant agreement that IT improved theoretical and clinical performance (M=4.14, SD=.907), t (243)=19.689, p<.0005. Willemse (2015:[6]) found that the use of WhatsApp improved the integration of theory and clinical practice of health assessment competency in a primary healthcare module in South Africa. Mgutshini (2013:[4]) found that the online class of nursing students had higher averages than the campus based class when identical assessments were undertaken. Awareness

of the ability of IT to improve performance may encourage student nurses to use IT as an added measure for course success.

The respondents indicated significant agreement that IT reduced dependence on the lecturer (M=3.83, SD=1.092), t (242)=11.804, p<.0005. Access to information sources via IT means that student nurses can obtain multiple opinions and dimensions in learning with the ability to connect with professionals all over the world (Olele 2014:119). Caglar and Turgut (2014:48) found that the need for face-to-face interaction between student and lecturer grew less once students became familiar with university environments and IT systems.

Figure 4.9 illustrates the respondents' disagreement with the following statements:

- IT increases my workload.
- I only use IT in education because it is mandatory.
- I prefer IT-related activities over lectures.
- My level of IT knowledge and skills restricts my study and career development.

The respondents reported significant disagreement that IT increased workload (M=2.77, SD=1.205), t (243)=-2.923, p=.004. Sukums et al (2014:[8]) found that healthcare practitioners believed that IT would simplify work and assist in record keeping. Rajagopal (2013:88) found that IT actually decreased the workload of personnel in healthcare facilities.

The respondents indicated significant disagreement that IT was only used in education because it was mandatory (M=2.66, SD=1.178), t (241)=-4.476, p<.0005. The majority of the respondents belonged to the Millennials and iGeneration who often prefer learning through smart devices and web-enabled technologies (Johnson & Romanello cited in Bruce & Klopper 2017:181). This could have possibly explained the respondents' disagreement to the statement that IT was only used in education because it was mandatory.

The respondents indicated significant disagreement that they preferred IT learning activities over lectures (M=2.81, SD=1.203), t (240)=-2.464, p=.014. The results concurred with Caglar and Turgut's (2014:47) finding that while students experienced much of the advantages of E-learning platforms, many still preferred to have courses and examinations in the traditional way. Therefore, blended learning approaches may be more suitable to enhance student satisfaction.

The respondents indicated significant disagreement that their level of IT knowledge and skills restricted their study and career development, (M=2.61, SD=1.119), t (239)=-5.423, p<.0005. The respondents' perspectives could have been influenced by the fact that the level of competency was self-reported and they believed that their level of IT knowledge and skills were sufficient for study and career progression. In addition, the job requirements and job descriptions in nursing did not request IT knowledge and skills. IT knowledge and skills related to the job could be acquired through on-the-job training and experience.

4.3.5 Challenges in using IT in nursing education

Frequency distribution and one-sample t-test were used to analyse the respondents' responses to challenges in using IT in nursing education (see figure 4.10).

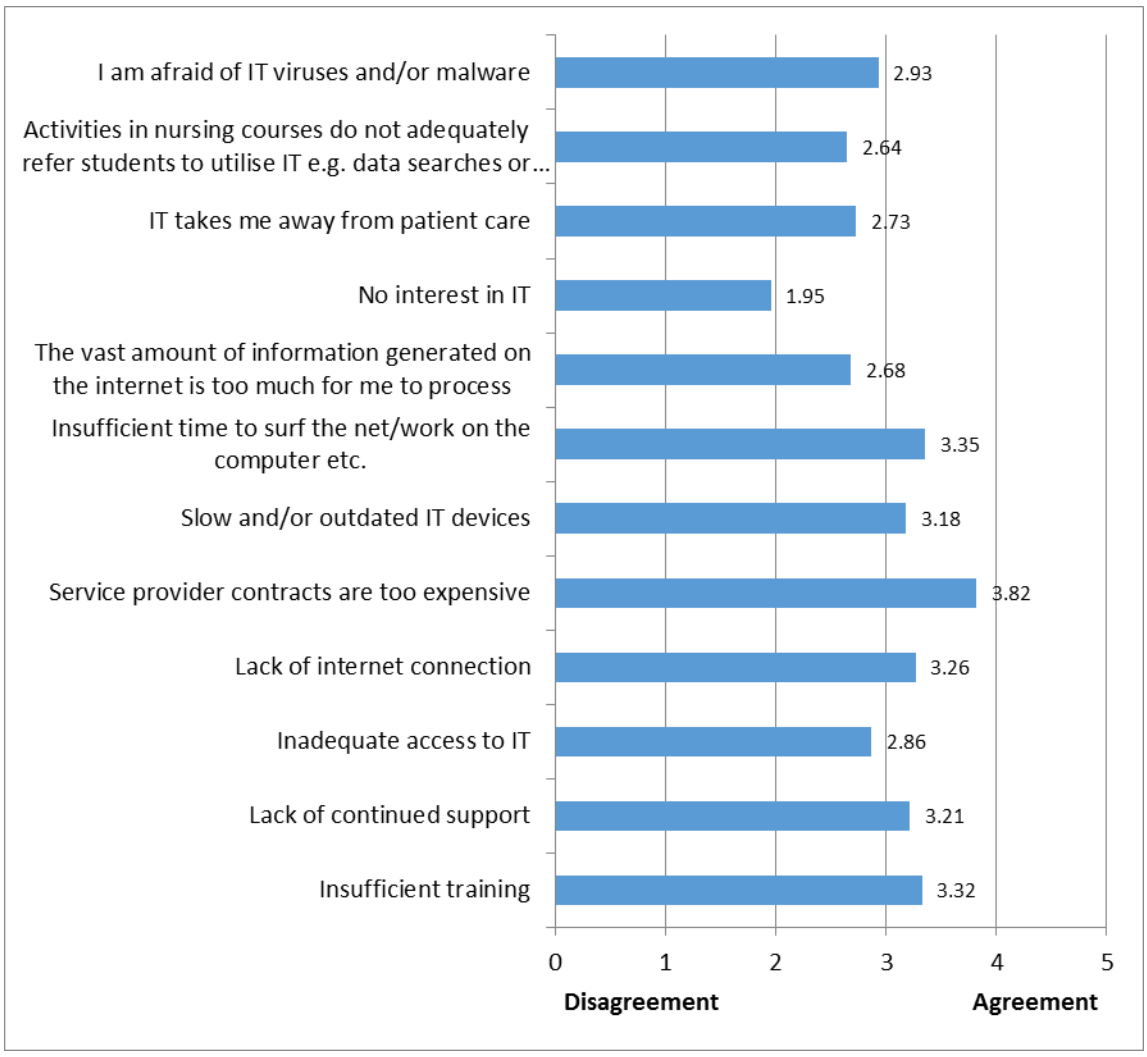

Figure 4.10 Respondents' challenges in using IT in nursing education (N=244)

Figure 4.10 illustrates the respondents' agreement with the following challenges:

- Insufficient training
- Lack of continued support
- Lack of internet connection
- Service provider contracts were too expensive
- Slow and/or outdated IT devices
- Insufficient time to surf the net/work on the computer etc.

The respondents indicated significant agreement that insufficient training was a challenge in utilising IT (M=3.32, SD=1.127), t (240)=4.459, p<.0005. Insufficient training amounts to a lack of IT knowledge and skills necessary for study and work execution. Israeli hospital nurses reported that a lack of knowledge of IT posed a

challenge in using IT in clinical environments. IT was seen as a threat due to unfamiliarity (Gonen et al 2016:[5]).

The respondents indicated significant agreement that there was a lack of continued support in IT (M=3.21, SD=1.166), t (242)=2.862, p=.005. A lack of support in IT may contribute to increased frustration culminating in resistance to IT. Seahloli (2016:63) found that medical personnel in public and private healthcare institutions in South Africa struggled with IT due to long time lapses between training and IT implementation.

The respondents indicated significant agreement that there was of a lack of Internet connection (M=3.26, SD=1.277), t (241)=3.221, p=.001. Good Internet connections are key to information accessibility for learning, communication and clinical support in nursing education. Willemse and Bozalek (2015:[4-8]) found that a lack of Internet connection prevented students at a higher education institution in the Western Cape, South Africa, from using social media to support learning. Lack of access, slow connections and multiple periods of downtime due to load shedding were challenges to the implementation of IT in South African healthcare facilities (Seahloli 2013:63). IT without proper connectivity is as good as a car without wheels.

The respondents reported significant agreement that service provider contracts were too expensive (M=3.82, SD=1.226), t (241)=10.385, p<.0005. Learning via IT requires that students have access to the Internet and this requires the purchase of data. One of the challenges to the implementation of IT in nursing education in the country is that data purchases and contracts are expensive and consumers are limited in choice between only a few service providers. Student nurses are often on constrained budgets and an inability to afford adequate data packages restrict learning via IT. Zayim and Ozel (2015:456) found that financial costs related to communication were a challenge in using IT at a state university in Turkey. Bruce and Klopper (2017:363-364) identified costly expenses related to IT and connectivity as drawbacks to E-learning.

The respondents indicated significant agreement that slow and/or outdated IT devices posed a challenge to utilising IT (M=3.18, SD=1.217), t (238)=2.232, p=.027. This concurred a study which found that some models of IT devices did not facilitate downloading of social media Apps such as WhatsApp and Facebook hence nursing students did not benefit from the IT support offered via these platforms (Willemse &

Bozalek 2015:[4]). The advancement of technology is so fast paced that hardware often needs to be replaced to support the latest technologies and software requires frequent updates for optimal functioning. This again may not be feasible on a student budget.

The respondents indicated significant agreement with insufficient time to surf the net/work on the computer etc (M=3.35, SD=1.218), t (239)=4.451, p<.0005. In the USA, Carter-Templeton et al (2014:213) found that student nurses reported lack of time as the most commonly occurring barrier to accessing online information. In a study comparing gamification and social networking on e-learning, De-Marcos et al (2014:90) found that students complained of insufficient time to complete the allocated IT exercises.

Figure 4.10 indicates the respondents' disagreement with the following challenges:

- The vast amount of information on the internet was too much to process.
- No interest in IT
- IT takes me away from patient care.
- Activities in nursing courses did not adequately refer students to utilise IT, e.g. data searches or referral to websites etc.
- I am afraid of viruses and/or malware.

The respondents indicated significant disagreement that the vast amount of information generated on the Internet was too much to process (M=2.68, SD=1.073), t (242)=-4.604, p<.0005. Students must be able to sift through extensive amounts of information using only what is accurate and relevant (Fujino & Kawamoto 2013:248-249). The skill of being able to differentiate between valid and reliable information is pivotal to ensure accurate and safe practice. The researcher found it of concern that respondents disagreed with the statement that there was too much information. This raised the question of whether Wikipedia or first information sources were used with no other comparisons.

The respondents indicated significant disagreement that there was no interest in IT (M=1.95, SD=0.945), t (240)=-17.171, p<.0005. This was to be expected given that the majority of the respondents were young and part of the Net generation fascinated by IT. Seahloli (2016:83) found that South African healthcare personnel were keen on IT and

preferred to move to IT systems in practice. The move to paperless processes was welcomed.

The respondents indicated significant disagreement that IT took nurses away from patient care (M=2.73, SD=1.237), t (239)=-3.443, p=.001. This concurred with other studies. Moore and Jayewardene (2014:2) found that nurses disagreed that IT wasted time and interfered with patient care. Kipturgo et al (2014:[4]) found that nurses disagreed that IT increased workload and took nurses away from quality patient care. Nurses pledge that patient care will always be first and foremost. Anything that interferes with the ability to uphold that oath, including IT, may not be accepted and used in practice. This holds true particularly for the older generation nurses where the emphasis in nursing was related to hands on care of the patient and not on nursing machines.

The respondents indicated significant disagreement that activities in nursing courses did not adequately refer students to use IT, e.g., data searches or referral to websites etc (M=2.64, SD=1.103), t (241)=-5.010, p<.0005. Adequate exposure to and experience in IT in nursing education is pivotal to develop IT competency. Gonen et al (2016:[7]) maintain that it is the nurse educator's responsibility to include IT in the nursing curriculum in order to reduce challenges and anxieties associated with IT use in educational and clinical environments.

The respondents indicated significant disagreement that there was inadequate access to IT (M=2.86, SD=1.205), t (240)=-1.764, p=.079. Every effort was made to provide access to IT at the NEI and clinical facilities. While the ideal is to have an adequate number of devices to cater for the number of student nurses, it is often not realistic or feasible. However, the students were encouraged to bring their own IT devices for use at campus. The private healthcare group discouraged the use of personal devices in clinical institutions for various reasons. The greatest concerns were related to privacy and infection control practices.

The respondents indicated significant disagreement that there was fear of IT viruses and/or malware (M=2.93, SD=1.290), t (239)=-851, p=.396. This was of concern in the light of the fact that many computers did not have an installed antivirus program or the installed program was not updated regularly. The computers allowed the connection of

external drives which posed a threat of carrying viruses from one device to another. In contrast, Seahloli (2016:63) identified that lack of antivirus systems posed a challenge to the successful implementation of IT in South African healthcare facilities. This result indicated that the respondents lacked awareness of IT threats and safety issues. The lack of awareness meant an ability to compromise not only personal IT devices but also institutional devices.

4.3.6 Overall use, competency and attitude to IT

Five constructs, namely general IT competency, IT use for medical purposes/learning, IT competency for medical purposes/learning, online use of E-learning platforms, and attitude were extracted from some of the items in section B of the questionnaire. Table 4.10 depicts the identified constructs from items in the questionnaire, including the reliability of measure.

Table 4.10 Reliability of constructs (N=244)

Construct	Items included from questionnaire	Cronbach's alpha
General IT competency	2.1–2.5	.853
Use of IT for medical purposes/learning	3.1–3.6	.757
IT competency for medical purposes	4.1–4.6	.864
Online use of E-learning platforms	7.1–7.5	.808
Attitude	14.1–14.3; 14.5–14.6; 1 4.8–14.10	.914

A single reliable measure for the construct was obtained. Reliability of the constructs was tested using Cronbach's alpha. Reliability of the measure was indicated with an alpha greater than 0.7. Once reliability was determined, a single measure was formed by calculating the average of the response scores for the items included in the measure. Analysis was done to determine whether these measures differed significantly across age groups, nursing programmes, clinical experience, IT training and Internet access. The one-sample t-test was used to test for significant competence/frequency/agreement for each of the single constructs. The rating/Likert scales in the questionnaire were used to interpret the results.

The general IT competency construct included five items in the questionnaire which pertained to the rating of IT competency in using Word, spreadsheets, presentations, email and Internet searches. The reliability statistic with Cronbach's alpha for these items was .853. Analysis revealed that the respondents were significantly competent in general IT (M=3.5410, SD=.98619), t (243)=8.569, p<.0005.

The construct of IT use for medical purposes/learning included six items in the questionnaire that were related to the frequency of use of the Intranet, Internet, medical databases, online medical journals, medical applications, and medical videos. Cronbach's alpha for this construct was measured at .757. Analysis revealed that IT was used significantly frequently for medical purposes/learning (M=3.2917, SD=0.76598), t (243)=5.948, p<.0005.

The construct for IT competency for medical purposes/learning was extracted from six items in the questionnaire measuring competency levels in using the Intranet, Internet, medical databases, online medical journals, medical applications and medical videos. Cronbach's alpha reliability of measure was .864. Analysis indicated that the respondents were significantly competent in the use of IT for medical purposes/learning (M=3.3646, SD=.94497), t (242)=6.015, p<.0005.

The construct online use of E-learning platforms included five items in the questionnaire. The items pertained to the respondents' frequency of participation in online medical chatrooms, discussions/E-forums, blogs, assessments and games. Cronbach's alpha measured .808 for these items. Analysis revealed that the online use of E-learning platforms was significantly infrequent (M=1.6156, SD=0.85801), t (242)=-25.151, p<.0005. Chatrooms, discussions/E-forums, blogs, assessments and games were all used infrequently by the respondents.

The attitude construct included eight items. The items were related to the respondents' agreement or disagreement with various statements regarding IT in nursing education. The statements were related to the importance of IT knowledge for nursing, IT improving quality of nursing care and IT making work easier, IT providing access to a wealth of knowledge and clarification of information, IT facilitated learning, providing

enjoyment in learning activities and improving theoretical and clinical performance. Cronbach's alpha was measured at .914 for the attitude construct.

The items in the questionnaire associated with the attitude construct focused on measuring the level of positive attitude towards using IT. The test was to determine whether there was significant agreement or disagreement that IT was important to use. Agreement with the various statements, for example that IT was good to use, improved quality of nursing care, and made work easier, translated into a positive attitude towards using IT. The results showed that there was a significantly positive attitude towards using IT ($M=4.2964$, $SD=0.66557$), $t\ (243)=30.426$, $p<.0005$. The assumed attitude scale of 1–5 taken from the items in the questionnaire represented 1 as being equal to a very negative attitude towards using IT and 5 being equal to a very positive attitude.

The results concurred with other studies. Turkish nursing students displayed positive views regarding IT for learning, communicating and accessing educational information and obtaining examination results (Zayim & Ozel 2015:462). Seahloli (2016:84) found that patients and administrative and healthcare personnel in public and private facilities in South Africa were positive about IT in the healthcare landscape. In contrast to the results, a study conducted in Israel found that the participants had neither a positive nor a negative attitude to IT (Gonen et al 2016:[6]).

4.3.7 Comparisons between respondents' age groups, nursing programmes, clinical experience, IT training and Internet access

The single measures of the constructs were tested to determine whether there were significant differences across categories of variables from section A of the questionnaire namely age, nursing programmes, clinical experience, IT training and Internet access.

4.3.7.1 Comparison between respondents' age groups

The ANOVA test was applied to test for differences across the age groups. ANOVA is a test for several independent samples that compares two or more groups of cases in one variable (Brink et al 2012:19).

Significant differences were found for general IT competency, use of IT for medical purposes/learning, and competency in IT for medical purposes/learning constructs across the age categories. The ANOVA test scores were higher for the 18-30 age group. Therefore the average competency for the 18-30 age group was higher than for other age groups. The results were expected and in line with the assumption that digital age students are familiar and comfortable with and competent in IT (Bruce & Klopper 2017:181). Johnston (2013:261) found that there were differences in IT perceptions and usage between the different generations of university students in South African.

The level of competency in general IT application differed significantly across the age groups, $F(2,241)=17.471$, $p<.0005$. Higher competency was found in the 18-30 age group compared to those above 30 years of age. The results suggest that the younger respondents, who very often used IT to a greater extent, would report higher levels of IT competency. Chipps et al (2015:[6]) found that older nursing students reported low levels of IT competency and difficulty in using IT.

IT use for medical purposes/learning differed significantly across age, $F(2,241)=4.290$, $p=.015$. IT was utilised more frequently by the respondents in the 18-30 age group compared to those above 30 years of age. Familiarity and IT literacy among the younger respondents may have contributed to the sustained use of IT beyond social environments. The results were similar to a study which found that Ethiopian healthcare practitioners between the ages of 25 and 35 years were three times more likely to use IT than other age groups (Alwan et al 2015:4)

The level of competency for medical purposes/learning differed significantly across age, $F(2,240)=11.563$, $p<.0005$. Higher competency was found in the 18-30 age group when compared to those above 30 years. The younger respondents' frequency of IT use could have contributed to higher levels of competency for medical purposes/learning.

There were no significant differences between the age groups in terms of online use of E-learning platforms and attitude to IT.

4.3.7.2 Comparison between respondents' nursing programmes

The independent sample t-test was applied to make comparisons between the nursing programmes. The independent samples t-test compares two independent groups of cases (Brink et al 2012:19; Gray et al 2017:567-568).

There was a significant difference in IT use for medical purposes/learning across the nursing programmes, t (242)=-2.113, p=.036. The respondents registered for the Advanced Diploma in Nursing (R212) (M=3.627) used IT significantly more than the respondents doing the Bridging Programme (R683) (M=3.260). The difference may have been related to programme requirements and areas of clinical specialisation. The Advanced Diploma in Nursing is a higher post-basic qualification with more extensive IT-related activities in both educational and clinical environments compared to the Bridging Programme. Alwan et al (2015:[4]) found that health practitioners with higher levels of education were more likely to use IT compared to those with lower levels of education.

There were no significant differences between the nursing programmes in terms of general IT competence, IT competence for medical purposes/learning, online use of E-learning platforms, and attitude to IT.

4.3.7.3 Comparison of respondents' years of clinical experience

The ANOVA test was applied to test for differences across the respondents' years of clinical experience. Analysis revealed no significant differences for any of the constructs across the years of clinical experience. The respondents' years of clinical experience did not impact on general IT competency, use of IT for medical purposes/learning, IT competency for medical purposes/learning, online use of E-learning platforms or attitude to IT. In contrast to the study's findings, Sukums et al (2014:[5]) found that younger rural African healthcare workers with five or less years of experience reported more basic computer knowledge than the older generations with more years of clinical experience.

4.3.7.4 Comparison of respondents with and without IT training

The independent sample t-test was used for analysis. There were no significant differences in respondents who had an IT qualification compared to those who did not in any of the five constructs.

There were significant differences, however, between respondents who had undertaken IT training prior to registering for the nursing programmes and those who had not in terms of general IT competency, t (220.479)=4.587, p<.0005. The respondents who had undertaken IT training before having registered for the nursing programmes (M=3.88) showed higher competency in general IT compared to those who had not (M=3.32). The results of the study indicate the value of IT training on competency levels.

There was significant difference in IT use for medical purposes/learning, t (242)=2.054, p=.041. IT was used more frequently for medical purposes/learning by the respondents who had undertaken IT training before registering for nursing (M=3.41) in comparison to the respondents who had not (M=3.21). The results suggest that the respondents who had acquired IT knowledge and skills were therefore more confident to use IT for medical purposes/learning. Alwan et al (2015:[4]) found that healthcare professionals with previous IT training were more likely to use IT compared to ones who did not.

There was significant difference in IT competency for medical purposes/learning, t (241)=2.147, p=.033. The respondents who had undertaken IT training prior to nursing showed higher IT competency for medical purposes/learning (M=3.52) than the respondents who had not (M=3.26). The results would suggest that prior experience in IT would enhance IT literacy and competency for medical purposes/learning.

There were no significant differences between the respondents who had undertaken IT training prior to nursing and those who had not in terms of online use of E-learning platforms.

Attitude was positive for both groups of respondents in terms of those who had undertaken IT training prior to nursing and those who had not, t (242)=2.761, p=.006. However, attitude was significantly more positive for the respondents who had undertaken IT training prior to nursing (M=4.44) than for those who had not (M=4.20).

The results suggest that IT experience not only contributes to improved frequency of use and competency in IT but also contributes to positive attitudes.

4.3.7.5 Comparison between respondents with and without access to the Internet

The independent sample t-test was used for analysis to determine differences between the respondents who had access to the internet and those who did not.

There was significant difference in the general IT competency t (241)=3.671, p<.0005. Competency in general IT application was significantly higher in the respondents who had access to the Internet (M=3.58) compared to those who did not (M=2.58).

There was significant difference in the frequency of IT use for medical purposes/learning, t (241)=2.935, p=.004. IT use for medical purposes/learning occurred significantly more frequently among the respondents who had access to the Internet (M=3.31) than those who did not (M=2.69).

There was significant difference in IT competency for medical purposes/learning, t (240)=3.507, p=.001. IT competency for medical purposes/learning was significantly higher in the respondents who had access to the Internet (M=3.40) than those who did not (M=2.48).

The results suggest that access to the Internet created opportunities to enhance IT utilisation and competencies. The results concur with Alwan et al's (2015:[5]) finding that public healthcare practitioners with less IT access demonstrated lower levels of IT knowledge and utilisation.

There were no significant differences between the respondents who had access to the Internet and those who did not in terms of online use of E-learning platforms and attitude to IT.

4.3.8 Respondents' recommendations to improve use of IT in nursing education

Section D of the questionnaire asked the respondents to make recommendations to improve the use of IT in nursing education. It was an open-ended question which the respondents could answer in their own words on measures and interventions to improve the use of IT. The responses from each question were entered onto the formulated Excel spread sheet. The researcher analysed the responses. Responses that were similar were grouped together to form themes. Three main themes emerged from the analysis.

4.3.8.1 Recommendations related to IT education, training and support in nursing programmes

Majority of the respondents' recommendations were related to IT education, training and support. The respondents suggested the inclusion of an IT module as part of the nursing programmes' curriculum. Some stated that competency assessments should be conducted on the IT module. Nursing students in Turkey recommended that an informatics module form part of the nursing curriculum (Akman et al 2014:422-423). In Nigeria, Toyo (2017:10) recommended the inclusion of IT training in the curriculum to improve IT operational skills.

The respondents recommended more in-service and upgrade programs in IT. Some of the respondents suggested better IT training with greater integration into lessons. This is in keeping with the assumptions of adult students who want to apply new knowledge (Bruce & Klopper 2017:123) and integration of IT into lessons would facilitate hands on experience. Upgrade programs are recommended to enhance knowledge and skills to keep pace with the emergence of new technologies to which nurse practitioners may be exposed. Chand et al (2015:3508) maintain that education and clinical institutions have a responsibility to provide IT training that keeps pace with technological innovations and global trends.

The respondents requested continuous support in IT with the presence of specialised IT support personnel to assist whenever necessary. Challenges related to troubleshooting may arouse frustration in the IT user and contribute to resistance. Dedicated, specialised IT personnel who are readily available to assist in times of need may

provide a sense of relief, support and encouragement thereby reducing IT anxiety. Healthcare practitioners in public and private facilities in South Africa also recommended that continuous support to IT be provided to enhance the adoption of IT in clinical environments (Seahloli 2016:54-55).

4.3.8.2 Respondents' recommendations related to IT access and connectivity

In regard to IT access and connectivity, the respondents recommended the presence of more computers and updated devices. Toyo (2017:10) states that sufficient networked computers should be made available to nursing students to facilitate learning. Some respondents suggested that tablets and/or laptops be pre-loaded with study material and e-books. This is in keeping with the assumptions of the digital era student who often prefers IT gadgets, such as laptops, tablets and smartphones, to printed material (Johnson & Romanello cited in Bruce & Klopper 2017:181-182). While this was a valid recommendation, it must be noted that there are cost implications in the provision of IT and therefore may not be feasible for all students.

The respondents also recommended free WiFi access at both campus and hospitals. While there was free WiFi at the private NEI, many of the respondents indicated that connectivity was often slow. Hence there were numerous suggestions for better connectivity. The quality of connectivity is often dependent on the service provider, physical location and number of users on the network at a given time. Too many users working off the same network may contribute to slow connections, arousing frustration. A study conducted by Puckree et al (2015:518) found that nursing academics at selected NEIs in South Africa also had limited access, training and support in IT and this greatly impacted on the use of IT in pedagogical activities.

4.3.8.3 Recommendations related to IT training and integration at clinical facilities

The respondents recommended that all personnel and not just students have access to IT in clinical facilities. The respondents suggested training programs for the personnel at hospital. Hospital personnel also require IT literacy for job execution. These health practitioners are often older with limited knowledge and skills in IT, making IT training essential to ensure safe quality practices. In a study with nurses at a Japanese

university hospital, Fujino and Kawamoto (2013:248) emphasised that IT education should not be limited only to students and newly qualified nurses, but include experienced nurses as well in order to improve quality of care and reduce resistance that might arise through a gap in IT education between younger and older generations.

The respondents also recommended that IT be used to search for information and direct medical practices at the hospital. Some respondents recommended that IT be fully integrated into the clinical environments through the use of smart devices and electronic patient records. Chand et al (2015:3505) found that nurse administrators strongly agreed that EHR improved patient safety and satisfaction, provided complete records, and lowered legal risks.

4.4 CONCLUSION

This chapter discussed the data analysis and interpretation, and presented the research findings. The respondents' perspectives on IT in nursing education, IT use, competency and attitude were compared across the different age groups, nursing programmes, years of clinical experience, and groups with IT training and Internet access. The findings were discussed with reference to the literature review.

Chapter 5 summarises the findings, briefly presents the conclusions and limitations, and makes recommendations for practice and further study.

CHAPTER 5

SUMMARY OF RESEARCH FINDINGS, CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

5.1 INTRODUCTION

This chapter briefly describes the findings, conclusions, and limitations of the study and makes recommendations for practice and further study.

5.2 RESEARCH DESIGN AND METHODOLOGY

A quantitative, non-experimental descriptive design was followed in the study to explain and describe student nurses' perspectives to IT in nursing education. The researcher adopted a positivism paradigm with an ontological approach to understand the nature of reality. Positivism follows a scientific approach, using orderly and logical processes in the study (Gray et al 2017:7).

The study was conducted at a private NEI in the province of KZN, South Africa where programme requirements stipulated the use of IT. The target population included student nurses from the Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and Advanced Diploma in Medical and Surgical Nursing Science with specialization in either Critical Care, Trauma and Emergency or Perioperative Nursing (R212) (Regulation R683; Regulation R212) (SANC 1989, 1993). The inclusion criteria for the study were student nurses with six or more months of experience in the nursing programmes. The respondents were selected by means of non-probability, convenience sampling. Data was collected by means of a structured self-administered questionnaire developed by the researcher. Data was obtained from a target population of two hundred and forty four (244) nursing students who were present, available and willing to participate.

Data was measured objectively using statistical analysis. Statistical analysis summarises large amounts of data into interpretable forms (DePoy & Gitlin 2016:283).

The researcher used descriptive statistics to describe the respondents' biographical data, frequency and competency of IT use, and their perspectives on the advantages and challenges posed by IT in nursing education. Inferences and comparisons were made between the age groups, nursing programmes, years of clinical experience, IT training, and Internet access by means of inferential statistics.

The researcher upheld all the ethical considerations throughout the study, by obtaining approval and permission to conduct the study and respecting the respondents' rights to autonomy, privacy, confidentiality and anonymity, justice and beneficence. Selecting the most appropriate research design and methodology and providing concise details of all the steps ensured the validity and reliability of the study.

5.3 SUMMARY AND INTEPRETATION OF RESEARCH FINDINGS

This section summarises the findings on the respondents' biographical profile; ownership of IT devices and IT access including the Internet; frequency of use and competency in general IT; IT use and competency for medical purposes/learning; use of social networks and E-learning platforms for study and/or work purposes; IT exposure, training and support; perspectives on IT in nursing education; challenges in using IT in nursing education; comparisons between age groups, nursing programmes, clinical experience, IT training and internet access, and their recommendations.

5.3.1 Respondents' biographical profile

Of the respondents, 54.9% (n=134) were 18-30 years; 42.6% (n=104) were 31-40 years and 2.5% (n=6) were 41-50 years. Most of the respondents were young adults from the Millennials or Net Generation and accustomed to IT in all spheres of life (Haeger & Linghamb 2014:321). According to the UTAUT model, the younger the age, the stronger the effect on performance expectancy (Venkatesh et al 2003:447). It is assumed that these younger generations would appreciate, accept and adopt IT more readily in nursing education.

Of the respondents, 91.4% (n=223) were registered for the Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683), and 8.6% (n=21) were general nurses registered for the Advanced Diploma in Medical and Surgical

Nursing Science with specialisation in either Critical Care, Trauma and Emergency or Perioperative Nursing (R212). Both programmes exposed the respondents to IT to ensure that these nurse practitioners were equipped to function in the technological advancing educational and clinical landscapes.

Of the respondents, 62.7% (n=153) had 0-5 years of clinical experience; 31.6% (n=77) had 6-10 years of clinical experience; 4.1% (n=10) had 11-15 years of clinical experience, and 1.6% (n=4) had 16 and more years of clinical experience. It was inferred that the respondents with fewer years of clinical experience were younger and exposed to IT early, while those with more years of clinical experience were older and accustomed to traditional nursing practices and therefore would require more support to adjust to IT in the profession. According to the UTAUT model, the older user with little IT experience is most concerned about effort expectancy in using IT (Venkatesh et al 2003:447).

Of the respondents, 89% (n=216) did not have a formal IT qualification and 61% (n=150) also indicated having no prior IT training before registering for the nursing programmes. A lack of IT exposure and experience added to the challenge of higher education and could limit full educational and professional potential, especially for students who do not and cannot adjust quickly.

5.3.2 Ownership of IT devices and IT access including the Internet

Of the respondents, 97% (n=229) owned smartphones; 82% (n=185) owned computers and 55% (n=108) owned tablets. Of the respondents, 95% (n=230) had access to the Internet ($p < .0005$). Regarding access to IT in study, work and home environments, 96% (n=218) had access at campus; 82% (n=176) had access at clinical facilities; 80% (n=165) had access at home, and 75% (n=154) had access wherever they went. The desire to keep up with the digital trend was evident by the high percentages of ownership and access to IT including the Internet at almost all times, thereby facilitating a constant state of connection and the ability to learn at a time and place most suitable to the respondents.

5.3.3 Frequency of use and competency in general IT

The respondents reported that they used IT frequently for communicating and networking, Internet searches and/or research, compiling assignments and presentations, administrative activities, such as bed status, leave application etc, and patient care, such as for monitoring and diagnosis, access to test results etc. The educational and clinical health environments require that nurse practitioners use IT to communicate, study and work. This pressure may have motivated the respondents' use of IT in nursing education. According to the UTAUT model, the impact of social influence in mandatory contexts becomes significant over time and with sustained IT use indicating that the IT user responds to social gains and changes behavioural intention to ensure compliance (Venkatesh et al 2003:452).

The respondents reported competence in using IT for Internet searches, e.g., Google Scholar; word processing, e.g. Word, and emailing, e.g. Outlook. The respondents reported little or lack of competence in working on presentations, e.g. Power Point, and spreadsheets, e.g., Excel. The respondents did not work extensively on presentations and spreadsheets compared to the Internet, word and email in the nursing programmes. Their varying degrees of experience may have contributed to their levels competence.

5.3.4 Frequency of IT use and competency for medical purposes/learning

The respondents reported frequent use of the Internet, e.g., Google and medical videos, medical applications, e.g., nursing pharmacology, and medical databases, e.g., OVID. This suggested that they could access various information and communication sources to supplement learning. However, the respondents indicated infrequent use of the Intranet, e.g., group's website and online medical journals, e.g., Advances in Nursing Science. The researcher found this of concern since updated policies, procedures and quality initiatives to ensure standardisation and quality of care were often only available online via the group's website.

The respondents reported competence in using the Internet, e.g., Google, medical videos, medical Apps, e.g., nursing pharmacology, and medical databases, e.g., OVID. George and DeCristofaro (2016:414) found that Apps engaged undergraduate nursing students and assisted with memory and the development of patient interview skills. The

respondents reported little or no competence in using the Intranet, e.g. group's website, and online medical journals, e.g., Advances in Nursing Science. The infrequent use of the Intranet and online medical journals coupled with differences in navigation and cost implications could have explained the reported lack of competence. According to the UTAUT model, facilitating conditions including the removal of barriers to IT use is significant in both voluntary and mandatory contexts (Venkatesh et al 2003:453).

The respondents reported downloading of information/documents from the Internet significantly frequently. These information sources can supplement learning provided that the content is reliable and valid.

5.3.5 Frequency of use of social networks and E-learning platforms for study and/or work purposes

The respondents reported using WhatsApp most frequently, followed by infrequent use of email, Facebook, Instagram and Twitter for study and/or work purposes. WhatsApp is often preferred due to its ease of use, conversational type of communication and affordability. Johnson and Romanello cited in Bruce and Klopper (2017:181-182) found that the Net generation students preferred short and instantaneous communication and used instant messaging Apps more often than emails. Facebook, Twitter and Instagram were often viewed as Apps for recreational purposes and not often used for study or work purposes. Manca and Ranieri (2013:504) found that while many students appreciated the learning experience associated with social networks such as Facebook, many remained resistant to its full usage as a formal learning tool.

The respondents reported infrequent use of games, online assessments, chatrooms and discussion/E-forums for medical purposes/learning. While there are many advantages to using these platforms in learning, a lack of awareness, exposure, interest, time constraints, fears related to being judged and financial implications can deter use of these E-learning platforms. Lampley et al (2016:119) noted that cyber bulling affected the wellbeing of students. In their study, Epstein and Ray (2014:237) found that many students did not feel motivated to participate in E-learning platforms such as blogs since this did not form part of an assessment. According to the UTAUT model, normative pressure in terms of reward and punishment is strong during early

stages of IT use whilst increased experience provides an instrumental basis for IT use (Venkatesh et al 2003:453).

5.3.6 IT exposure, training and support

Of the respondents, 50% (n=122) reported having been part of an interactive videoconference via the Smartboard. Of these respondents, 59% (n=72) rated the interactive video conference experience as average. Synchronous virtual classrooms promote student interaction, develop a learning community, and provide accessibility to students at various locations (Martin & Parker 2014:192). Challenges related to venue capacity, equipment capabilities, connectivity and number of participating persons may interfere with the quality of the sessions.

Of the respondents, 71% (n=173) reported having been exposed to simulation devices and/or manikins. Of the respondents who were exposed to simulation and/or manikins, 99.4% (n=172) rated the experience as at least average; 41% (n=71) rated the experience as average, and 58.4% (n=102) rated the experience as good. High, medium and low fidelity simulators engage students and foster the development of multiple skills including psychomotor and clinical decision-making skills (Bruce & Klopper 2017:326).

The respondents reported the in-house IT training received in preparation for study and work requirements as good. Of the respondents, 58% (n=142) indicated having received ongoing support in IT throughout the nursing course. Nevertheless, the respondents recommended more and better IT training with continued IT support.

The respondents agreed that they were encouraged to use IT in the nursing programmes and received adequate training in IT-enabled equipment, e.g., medical devices such as monitors, infusion pumps and ventilators at the hospital. Training on the proper use, calibration, trouble shooting and care of medical devices is imperative to ensure quality, safe and cost-effective practices. The provision of opportunities to use IT may reduce IT anxiety. Biruk et al (2014:[7]) state that IT literacy impacts on acceptance of IT in healthcare landscapes.

5.3.7 Respondents' perspectives on IT in nursing education

According to the UTAUT model, performance expectancy which was derived from perceived usefulness, extrinsic motivation, job fit, relative advantage and outcomes expectations, is the strongest predictor of behavioural intention to use IT and remains significant in voluntary and mandatory settings (Venkatesh et al 2003:447).

The respondents agreed that working knowledge of IT was important in nursing and that IT improved the quality of healthcare rendered. The respondents demonstrated awareness that IT impacted on healthcare landscapes and that IT knowledge and skills were necessary for job execution. According to Gonen et al (2016:[3]), IT resistance may be as a result of lack of awareness and understanding of the importance of IT in nursing. Therefore awareness of the importance and benefits of IT in the nursing profession may contribute to IT acceptance and adoption.

The respondents strongly agreed that IT made work easier, afforded access to a wealth of knowledge, and was used to clarify information when unsure. IT streamlines administrative processes, eliminates duplication, saves time and reduces workload (Rajopaul 2013:81-88). The invention of the World Wide Web gives the public easy access to various types of media from text, audio, images, animation and video streaming (Hardy 2013:45-46) to augment information sources and learning. However, the ability to critically analyse and discriminate accuracy and reliability of data is imperative to ensure quality and safe information.

The respondents agreed that IT facilitated learning, improved theoretical and clinical performance, reduced dependence on the lecturer, and that they enjoyed IT-related learning activities. Chipps et al (2015:[4]) found that IT in the form of mobile technologies supported learning through enhanced information searches and discussions with lecturers and peers. Rockinson-Szapkiw et al (2013:265) emphasise the positive impact of IT on learning ability and performance indicating that students who use e-textbooks display higher levels of affective and psychomotor learning. IT provides multiple perspectives on content, including experiences from subject experts from all over the world (Woolfolk cited in Keating 2015:74-75). This is monumental in the light of brain drain challenges affecting educational and clinical disciplines.

The respondents disagreed that IT increased workload, was only used in education because it was mandatory, IT learning activities were preferred to lectures, and that their level of IT knowledge and skills restricted study and career development. The fact that the majority of the respondents were young and reported frequent IT use and IT competency may have contributed to disagreement to the statements. Manca and Ranieri (2013:487-504) found that students had a traditional view of learning, acknowledging specific spaces and times for learning and specific spaces and times for recreation. Blended approaches encompassing traditional and E-learning platforms may be preferred.

5.3.8 Challenges to using IT in nursing education

The respondents agreed that insufficient training was a challenge in using IT, there was lack of continued IT support, and there was insufficient time to surf the net/work on the computer. These challenges impact on knowledge, skills and attitude to IT which, in turn, may deter the use of IT in nursing education. Chand et al (2015:3505) found that one of the challenges to IT in healthcare was that nurses had different IT literacy skills.

The respondents agreed that there was a lack of internet connection, service provider contracts were too expensive, and slow and/or outdated IT devices were an obstacle to using IT. Seahloli (2016:63) found that in addition to inadequate connectivity, IT devices were not serviced regularly and faults were not attended to timeously in public healthcare facilities in South Africa. Data bundles were expensive and consumers had limited bargaining power since there were only a few network providers in the country. IT devices depreciate quickly, become obsolete and/or inundated. Restricted budgets may limit the purchase of newer faster IT models on the market.

The respondents disagreed that the vast amount of information generated on the Internet was too much to process; IT took nurses away from patient care; there was no interest in IT; there was inadequate access to IT; nursing courses did not adequately refer students to use IT, e.g., data searches or referral to websites, and there was fear of IT viruses and/or malware.

5.3.9 Overall use, competency and attitude to IT

The respondents were competent in general IT; used IT frequently for medical purposes/learning; were competent in the use of IT for medical purposes/learning, and had positive attitudes towards IT. Knowledge of attitudes to IT is beneficial in order to facilitate the acceptance and adoption of IT in education (Mittal 2015:9). The UTAUT model theorises that self-efficiency, anxiety and attitude do not directly influence behavioural intention to use IT, however these become significant in the absence of performance expectancy and effort expectancy constructs (Venkatesh et al 2003:468). Yet some studies using the UTAUT model found that attitude does influence behavioural intention to use IT (Dwivedi, Rana, Jeyaraj, Clement & Williams 2017; Zainab, Kiran, Karim & Sukmawati 2018:29). Kohnke, Cole and Bush (2014:39) found that positive attitudes exerted a positive influence on IT usage. In this study, the respondents' overall online use of E-learning platforms, such as chatrooms, discussions/E-forums, blogs, assessments and games, was significantly infrequent.

5.3.10 Comparisons between respondents' age groups, nursing programmes, clinical experience, IT training and Internet access

Significant differences were found for the respondents' general IT competency, use of IT for medical purposes/learning and competency in IT for medical purposes/learning across the age categories. The average use and competency for the 18-30 age group were higher than for other age groups. Younger generation age groups are familiar with IT in personal, educational and work environments (Haeger & Linghamb 2014:321). Familiarity and experience with IT equates to increased usage and competence in IT.

There were striking differences in IT use for medical purposes/learning across the nursing programmes. The respondents registered for the Advanced Diploma in Nursing (R212) used IT significantly more than the respondents doing the Bridging Programme (R683). Educational and operational requirements in speciality nursing meant that the Advanced Diploma respondents had greater IT exposure and use in practice.

The respondents' years of clinical experience did not impact on their general IT competency, use of IT for medical purposes/learning, IT competency for medical purposes/learning, online use of E-learning platforms or attitude to IT.

There were no notable differences between respondents who had an IT qualification compared to those who had not. There were pronounced differences, however, between respondents who had undertaken IT training prior to registering for the nursing programmes and those who had not. The respondents who had undertaken IT training before registering for the nursing programmes showed higher competency in general IT, used IT more frequently for medical purposes/learning, had higher competency in IT use for medical purposes/learning, and indicated a more positive attitude to IT.

There were remarkable differences between respondents who had access to the Internet and those who did not. General IT competency, IT use for medical purposes/learning, and competency in IT use for medical purposes/learning were higher for the respondents who had access to the Internet compared to those who did not.

5.3.11 Respondents' recommendations

The respondents recommended more intensive IT education and training in nursing programmes with refresher courses and continued IT support. The respondents also recommended that IT training be extended to all healthcare personnel in clinical facilities. IT education and training in nursing equips student nurses to gain essential knowledge and skills, thereby reducing IT anxiety and building confidence (Alwan et al 2015:[6]).

The respondents recommended the availability of more computers and updated devices with better and faster Internet connectivity. IT resistance may be reduced by eliminating and/or alleviating frustration related to IT.

The respondents recommended that IT be integrated more in clinical environments through the use of smart devices and EHR. Continuous exposure to and experience in IT will improve practice, reduce fears and build confidence thus facilitating acceptance and adoption of IT (Alwan et al 2015:[6]).

5.4 CONCLUSIONS

The study explained and described the respondents' perspectives on the use of IT in nursing education. The respondents acknowledged that IT is an important component in learning and is relevant and beneficial to the profession. The findings highlight the challenges posed by IT. The respondents recommended strategies to improve the use of IT in nursing education.

5.5 RECOMMENDATIONS

The findings of the study indicated that while there are numerous advantages to IT in nursing education, IT challenges are a reality for student nurses. The identified gaps must be closed to ensure that IT is accepted, adopted and used effectively and efficiently in nursing education. Based on the findings of the study, the researcher makes the following recommendations to support the use of IT in nursing education and for further research.

5.5.1 Recommendations for policy makers

Policy makers should develop and introduce policies that stipulate the extent of IT use in educational and clinical facilities.

5.5.2 Recommendations for nursing education institutions (NEIs)

Nursing education institutions should:

- Incorporate an IT specific module into nursing programme curriculums.
- Conduct regular formal assessments to ensure IT competency.
- Provide IT education, training and continued support by suitably qualified specialists.
- Provide in-service and upgrade programmes frequently to help student nurses cope with transitioning technologies.
- Develop and introduce clear disciplinary procedures in terms of privacy and reputational violations, copyright infringements and plagiarism.

- Provide updated IT devices and technologies, including fast reliable connectivity, at educational and clinical facilities.

5.5.3 Recommendations for nurse academics

Nurse academics should:

- Incorporate IT-related activities into lesson plans to enhance exposure to and experience in IT.
- Incorporate clearly thought out IT activities, specify learning objectives and provide adequate time to achieve set objectives.
- Be role models displaying positive attitudes to IT and leading by example indicating acceptance and adoption of IT in nursing education.
- Review and trial specific medical websites, Apps and games in order to make recommendations for use to student nurses.
- Reiterate the risks and safety concerns related to IT in nursing education, emphasising safe IT practices.
- Have regular meetings with student nurses to discuss IT challenges in order to provide support in overcoming difficulties.

5.5.4 Recommendations for healthcare institutions

Healthcare institutions should:

- Integrate IT into the clinical environments thereby increasing awareness of, exposure to and experience of IT.
- Provide IT training for all healthcare personnel to ensure optimal use of IT for improved patient outcomes and enhanced productivity.
- Make onsite IT support readily available to assist IT users with any challenges.

5.5.5 Recommendations for further nursing research

The researcher recommends that further studies be conducted on the following topics:

- A qualitative exploration of student nurses' perspectives on IT in nursing education
- An investigation into student nurses' actual frequency of IT use and IT competency
- An investigation into the influence of frequency of IT use and IT competency on student nurses' theoretical and clinical performance
- A comparison of the influence of IT in public and private NEIs' including other nursing programmes

5.6 CONTRIBUTIONS OF THE STUDY

The study contributes to a transitioning nursing educational landscape that aims to remain relevant in the fourth industrial revolution. The findings reflected insights into the respondent student nurses' perspectives on IT in nursing education, IT benefits, and challenges, and their recommendations. The respondents' perspectives have an important bearing on the acceptance and adoption of IT in nursing education. The researcher provides recommendations to assist nurse academics to better plan and support learning that meets the needs of digital era student nurses. This will contribute significantly to the education and training of nurse practitioners who will be able to function competently in IT-enhanced healthcare environments

5.7 LIMITATIONS OF THE STUDY

The limitations of positivism include an inability to fully describe human experience due to the complexities and diversities of human participants (Polit & Beck 2012:14). The quantitative research paradigm adopted in the study may not have explained the full depth of student nurses' perspectives on IT in nursing education

The respondents were taken from a single private NEI and reflected their perspectives, therefore the research findings cannot be generalised to other private or public NEIs. Student nurses at other NEIs may not have the same exposure, training or working experiences of IT in nursing education.

The data collected in the study were the respondents' self-reported perspectives and therefore could include an element of bias and/or exaggeration. The researcher made

inferences based on the data provided by the respondents and did not objectively measure the frequency of IT use nor test their levels of IT competency.

5.8 CONCLUDING REMARKS

The study explained and described the perspectives of student nurses at a private NEI on IT in nursing education, including challenges they faced. Recommendations have been made to improve the use of IT in nursing education. Bruce and Klopper (2017:306-310) state that healthcare practitioners find themselves in E-health environments and nurse educators have a responsibility to be at the forefront of emerging technologies to ensure that student nurses are best prepared for an IT rich world.

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ANNEXURES

ANNEXURE A
ETHICAL CLEARANCE CERTIFICATE

UNISA university of south africa

RESEARCH ETHICS COMMITTEE: DEPARTMENT OF HEALTH STUDIES

REC-012714-039 (NHERC)

6 September 2017

HSHDC/705/2017

Dear Ms F Singh

Ms F Singh
Student 4561-871-2

Decision: Ethics Approval

Supervisor: Dr TE Masango
Qualification: D Litt et Phil
Joint Supervisor: -

Name: Ms F Singh

Proposal: Information technology in nursing education: perspectives of student nurses

Qualification: **MPCHS94**

Thank you for the application for research ethics approval from the Research Ethics Committee: Department of Health Studies, for the above mentioned research. Final approval is granted from 6 September 2017 to 6 September 2019.

The application was reviewed in compliance with the Unisa Policy on Research Ethics by the Research Ethics Committee: Department of Health Studies on 6 September 2017.

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*

2) *Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the Research Ethics Review Committee, Department of Health Studies. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.*

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PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
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3) *The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.*

4) *[Stipulate any reporting requirements if applicable].*

Note:
The reference numbers [top middle and right corner of this communiqué] should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants, as well as with the Research Ethics Committee: Department of Health Studies.

Kind regards,

Prof JE Maritz
CHAIRPERSON
maritje@unisa.ac.za

Prof MM Moleki
ACADEMIC CHAIRPERSON
molekmm@unisa.ac.za

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ANNEXURE B

LETTER OF APPROVAL FROM PRIVATE HEALTHCARE GROUP

RESEARCH OPERATIONS COMMITTEE FINAL APPROVAL OF RESEARCH

Approval number: UNIV-2017-0047

Ms Fiona Singh

E mail: fiona.singh@netcare.co.za

Dear Ms Singh

RE: INFORMATION TECHNOLOGY IN NURSING EDUCATION: PERSPECTIVE OF STUDENT NURSES

The above-mentioned research was reviewed by the Research Operations Committee's delegated members and it is with pleasure that we inform you that your application to conduct this research at Private Nursing Education Institution, has been approved, subject to the following:

i) Research may now commence with this FINAL APPROVAL from the Committee.

ii) All information regarding the Company will be treated as legally privileged and confidential.

iii) The Company's name will not be mentioned without written consent from the Committee.

iv) All legal requirements with regards to participants' rights and confidentiality will be complied with.

v) The Company must be furnished with a STATUS REPORT on the progress of the study at least annually on 30th September irrespective of the date of approval from the Committee as well as a FINAL REPORT with reference to intention to publish and probable journals for publication, on completion of the study.

vi) A copy of the research report will be provided to the Committee once it is finally approved by the relevant primary party or tertiary institution, or once complete or if discontinued for any reason whatsoever prior to the expected completion date..

vii) The Company has the right to implement any recommendations from the research.

viii) The Company reserves the right to withdraw the approval for research at any time during the process, should the research prove to be detrimental to the subjects/ Company or should the researcher not comply with the conditions of approval.

ix) APPROVAL IS VALID FOR A PERIOD OF 36 MONTHS FROM DATE OF THIS LETTER OR COMPLETION OR DISCONTINUATION OF THE STUDY, WHICHEVER IS THE FIRST.

We wish you success in your research.

Yours faithfully

22/10/17

Prof Dion du Plessis
Full member: Research Operations Committee & Medical Practitioner evaluating research applications as per Management and Governance Policy

Shannon Nell
Chairperson: Research Operations Committee
Date: 25/10/2017

This letter has been anonymised to ensure confidentiality in the research report. The original letter is available with author of research

ANNEXURE C
PARTICIPATION INFORMATION LEAFLET

PARTICIPATION INFORMATION LEAFLET AND INFORMED CONSENT

INFORMATION LEAFLET

For student nurses

Title of the study

Information technology in nursing education: Perspectives of student nurses.

Researchers name: Fiona Singh

Student number : 4561 871 2

Telephone number: (031) 581 8200

Email address : fiona.singh@netcare.co.za

Supervisor : Dr TE Masango

Telephone number: (012) 429 3386

Email address : masante@unisa.ac.za

Chair of the University of South Africa, Department of Health Sciences, Research Ethics Committee : Prof JE Maritz

Telephone number : 082 788 8703

Email address : maritje@unisa.ac.za

1. Introduction

You are invited to participate in the above mentioned study. This information leaflet is intended to assist you on deciding whether to participate or not. This leaflet informs you of the details of the study so that you fully understand what is involved. If you have any questions, which are not explained in this leaflet, do not hesitate to contact the researcher.

2. What is the aim of the study?

The purpose of this study is to explain and describe the perspectives of student nurses towards information technology (IT) in nursing education.

3. What is expected of you during this study?

You will be requested to sign an informed consent form indicating your willingness to participate in the study. You will be given a questionnaire which will take approximately forty five minutes to complete. The questions require a simple cross over options that you would consider most appropriate. Your name will not be written on the questionnaire to ensure that your responses will remain private and confidential. You will place your signed consent forms and completed questionnaire into the separate boxes that will be provided. The documents will be analysed and kept safely for a period of time as stipulated by the University of South Africa (UNISA).

4. Does the study pose any risks or discomfort to you?

The study will not pose any risks to you. There is no threat of physical, emotional or social discomfort.

5. What are the benefits of the study?

The study will provide a safe avenue for you to describe your perspectives to IT in nursing education. The results of the study will give nurse educators insights to the strengths and challenges posed by IT on you as a student nurse. A better understanding will amount to changes in the nursing programs to better support and integrate IT into your learning. The study will also recommend solutions to identified challenges. The ultimate goal is to create the most positive IT experiences for you as a student nurse. This will equate to better quality nursing education and better quality nursing practice.

6. What are your rights as a participant?

Participation in the study is completely voluntary. The decision is entirely yours. You have the right to refuse to participate. There will be no penalties, judgement or discrimination against you. Your right to anonymity, privacy and confidentiality will be respected at all times. It will not be possible to link your response to you. The findings of the study will be available to you on completion and upon your request.

9. What about compensation for participation.

As mentioned above, participation is voluntary. There is no compensation for participation. There will also be no costs to you since the questionnaire will be given and collected at campus during your college blocks.

7. Has the study received ethical approval?

Ethical approval for the study has been obtained from the Higher Degrees Committee of the Department of Health Studies and the Research and Ethics Committee at UNISA. Permission to conduct the study has been received from the relevant private healthcare group's Ethics and Research Committee including the campus manager at the private nursing education institution.

8. Who should you contact for further information or queries?

Should you have any questions regarding this study, please do not hesitate to contact the researcher, supervisor or chairperson on the contact details indicated on the first page of this information leaflet.

ANNEXURE D
INFORMED CONSENT

INFORMED CONSENT TO PARTICPATE IN THE STUDY

Title of study

Information technology in nursing education: Perspectives of student nurses.

Declaration

I…… (Full names and surname) hereby consent to participate in the above mentioned study.

I confirm that I have been informed of the study's aim, processes and benefits and risks including my rights as a participant. I acknowledge that I may withdraw my consent and participation without any prejudice.

I have read and fully understand the contents of the participant information leaflet. I declare that my participation is of my own free will.

……..... ……

Signature of participant **Date**

ANNEXURE E

QUESTIONNAIRE

Dear Respondent

Information technology (IT) in the context of this study and questionnaire refers to all hardware and software including communication systems used in nursing and nursing education. IT hardware refers to all high tech or computerised devices and /or equipment that are used in rendering or teaching nursing care. IT hardware includes computers, Smart Boards, smart phones, tablets, mannequins and simulators. IT software includes the internet, computer programs such as Microsoft Outlook, Word, Power Point Presentations and Excel. IT communication technologies include social media and network technologies such as Facebook, WhatsApp, Twitter, Instagram, LinkedIn, WeChat, YouTube and the like.

This questionnaire consists of 4 sections.

Please mark the most appropriate options with a X

Section A

A1.Indicate your age bracket

18 - 30	**31 - 40**	**41 - 50**	**50+**

A2. What course are you currently undertaking?

Bridging course leading to registration as general nurse (R683)	**Advanced diploma in medical and surgical nursing (R212)**

A3. How many years of clinical experience do you have?

0 - 5	**6 - 10**	**11 - 15**	**16-20**	**> 20**

A4. Do you possess a formal IT qualification e.g. a credited certificate in IT?

Yes	No

A5. Have you undertaken any training in IT before registering for nursing?

Yes	No

A6. Indicate whether or not you own the following IT devices:

IT Device	Yes	No
6.1 Computer		
6.2 Tablet		
6.3 Smartphone		

A7. Do you have access to the internet?

Yes	No

A8. Indicate whether or not you have access to IT...

	Yes	No
8.1 On the go		
8.2 At home		
8.3 On campus		
8.4 At the hospital		

Section B

B1. Indicate how often (from 1 = never to 5 = very often) you utilise IT for the following:

	Never 1	2	3	4	Very Often 5
1.1 Compiling assignments and presentations					
1.2 Internet search/ research					
1.3 Communication/ networking					
1.4 Administration activities e.g. bed status, leave applications etc.					
1.5 Patient care e.g. for monitoring and diagnosis, access to test results etc.					

B2. Rate your level of competency (from 1 = not at all competent to 5 = extremely competent) with regard to the following:

	Not at all Competent 1	**2**	**3**	**4**	**Extremely Competent 5**
2.1 Word processing e.g. Word					
2.2 Spreadsheets e.g. Excel					
2.3 Presentations e.g. Power Point					
2.4 Emailing e.g. Outlook					
2.5 Internet searches e.g. Google Scholar					

B3. Indicate how often (from 1 = never to 5 = very often) you use the following

	Never 1	**2**	**3**	**4**	**Very Often 5**
3.1 Intranet e.g. group website					
3.2 Internet e.g. Using Google					
3.3 Medical databases e.g. OVID, PubMed					
3.4 Online medical journals e.g. Advances in Nursing Science					
3.5 Medical applications e.g. Nursing pharmacology					
3.6 Medical videos					

B4. Rate your level of competence (from 1 = not at all competent to 5 = very competent) in utilising the following:

	Not at all Competent 1	**2**	**3**	**4**	**Extremely Competent 5**
4.1 Intranet e.g. group website					
4.2 Internet e.g. Google					
4.3 Medical databases e.g. OVID, PubMed					
4.4 Online medical journals e.g. Advances in Nursing Science					
4.5 Medical applications e.g. Nursing pharmacology					
4.6 Medical videos					

B5. How often do you download information/documents off the internet?

Never 1	2	3	4	Very often 5

B6. Indicate how often (from 1 = never to 5 = very often) you discuss study or work related issues via the following platforms:

	Never 1	2	3	4	Very Often 5
6.1 Email					
6.2 WhatsApp					
6.3 Twitter					
6.4 Instagram					
6.5 Facebook					

B7. Indicate how often (from 1 = never to 5 = very often) you participate in online medical…

	Never 1	2	3	4	Very Often 5
7.1 Chatrooms					
7.2 Discussion/ E-forums					
7.3 Blogs					
7.4 Assessments					
7.5 Games					

B8. Have you ever been part of an interactive video conference via the Smart Board?

Yes	No

B8.1 If yes, how would you rate the experience?

Poor	Average	Good

B9. Have you been exposed to simulation devices and/or manikins?

Yes	No

B9.1 If yes, how would you rate your experience?

Poor	Average	Good

B10. Rate (from 1 = very poor to 5 = very good) the in-house IT training you receive/d in preparing you for your study and work requirements

Very poor 1	2	3	4	Very good 5

B11. Do you receive ongoing support in IT throughout your course?

Yes	No

B12. Indicate your agreement that you are encouraged to use IT in your nursing course

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

B13. Indicate your agreement that you receive adequate training on IT enabled equipment (e.g. medical devices such as monitors, infusion pumps, ventilators etc.) at the hospital

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

B14. Indicate to what extent you agree with the following:

	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
14.1 Working knowledge of IT is important in nursing.					
14.2 IT improves the quality of healthcare rendered					
14.3 IT makes work easier.					
14.4 IT increases my workload.					
14.5 IT affords me access to a wealth of knowledge.					
14.6 I use IT to clarify information when I am unsure.					
14.7 I only use IT in education because it is mandatory.					
14.8 IT facilitates my learning.					
14.9 I enjoy IT related learning activities.					
14.10 IT improves my theoretical and clinical performance.					
14.11 IT reduces my dependence on my lecturer.					
14.12 I prefer IT learning activities over lectures.					
14.13 My level of IT knowledge and skill restricts my study and career development					

Section C

C1. Indicate your agreement that the following are challenges you have encountered in using IT

Challenges	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1.1 Insufficient training					
1.2 Lack of continued support					
1.3 Inadequate access to IT					
1.4 Lack of internet connection					
1.5 Service provider contracts are too expensive					
1.6 Slow and/or outdated IT devices					
1.7 Insufficient time to surf the net/work on the computer etc.					
1.8 The vast amount of information generated on the internet is too much for me to process					
1.9 No interest in IT					
1.10 IT takes me away from patient care					
1.11 Activities in nursing courses do not adequately refer students to utilise IT e.g. data searches or referral to websites etc.					
1.12 I am afraid of IT viruses and/or malware					

Section D

D1. What strategies would you recommend to improve the use of IT in nursing education?

……

……

……

Thank you for your participation.

ANNEXURE F
LETTER OF THE STATISTICIAN

Gill Hendry B.Sc. (Hons), M.Sc. (Wits), PhD (UKZN)
Mathematical and Statistical Services

Cell: 083 300 9896
email : hendryfam@telkomsa.net

12 November 2018

Re: Assistance with statistical aspects of the study

Please be advised that I have assisted Fiona Singh (Student number 45618712), who is presently studying for a Masters of Arts in Health Studies at UNISA, with the questionnaire validation and data analysis for her study.

Yours sincerely

Gill Hendry (Dr)

ANNEXURE G
LANGUAGE EDITING CERTIFICATE

Cell/Mobile: 073-782-3923

53 Glover Avenue
Doringkloof
0157 Centurion

8 November 2018

TO WHOM IT MAY CONCERN

I hereby certify that I have edited Fiona Singh's master's dissertation, **Information technology in nursing education: perspectives of student nurses**, for language and content.

IM Cooper

Iauma M Cooper
192-290-4

ANNEXURE H

TURNITIN ORIGINALITY REPORT

Final dissertation

by Fiona Singh

Submission date: 15-Nov-2018 05:24PM (UTC+0200)
Submission ID: 1039615701
File name: Fiona_singh_Final_15_Nov_2018.doc (3.35M)
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INFORMATION TECHNOLOGY IN NURSING EDUCATION: PERSPECTIVES OF STUDENT NURSES

by

FIONA SINGH

submitted in accordance with the requirements

for the degree of

MASTER OF ARTS

in the subject

HEALTH STUDIES

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: Prof TE Masango

November 2018

Final dissertation

ORIGINALITY REPORT

23%	19%	7%	12%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	uir.unisa.ac.za Internet Source	7%
2	scholar.sun.ac.za Internet Source	<1%
3	Submitted to Mancosa Student Paper	<1%
4	Submitted to University of South Africa Student Paper	<1%
5	Submitted to University of KwaZulu-Natal Student Paper	<1%
6	Submitted to Grand Canyon University Student Paper	<1%
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