

**NURSING INFORMATICS COMPETENCIES IN THE NURSING STUDENTS  
IN A UNIVERSITY IN THE WESTERN CAPE**

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**A mini- thesis submitted in fulfillment of the requirements for Masters  
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## **ABSTRACT**

**Background:** The increasing use of technology and informatics in the provision of nursing care encourages the consideration of whether final year undergraduate nursing students are prepared for the use of informatics in clinical care and what the current state of knowledge, skills and attitudes on nursing informatics is.

**Purpose of the study:** The overall aim was to investigate the perceived relevance, competencies in nursing informatics and attitudes towards nursing informatics of the final year undergraduate nursing students at a selected University in the Western Cape.

**Methodology:** A quantitative research approach using a descriptive survey design was used in the study. Self-administered questionnaires were used to investigate final year undergraduate nursing student's perceived relevance of informatics skills for nursing, the perceived level of nursing informatics competence, and attitudes towards nursing informatics. Nursing students currently enrolled in the fourth year in their undergraduate bachelor nursing degree programme were the target population for this study (n=198). Frequencies of the perceived relevance of computers literacy skills, informatics literacy and information management skills for nursing, and competencies in computers skills, informatics literacy and information management skills and attitudes towards informatics were calculated and presented.

**Results:** The findings suggested that even though only 28% (n=28) and 4% (n=4) of nursing students has attended computer and informatics classes respectively, 99% (n=99) confirmed that they perceive nursing informatics as relevant in nursing education and nursing practice. Computer literacy skills (4.23 sd 0.8) were rated more relevant

than information management skills (4.0 sd 1.0), while informatics literacy skills were rated lowest (3.9 sd 1.0). In terms of perceived competence, competency in computer literacy skills (4.2 sd 0.9) were rated significantly higher than information management skills (3.2 sd 1.0), while informatics literacy skills were again rated lowest (3.0 sd 1.0). More positive attitudes than negative attitudes towards computers in nursing were reported by the respondents.

**Recommendations:** To improve student nurses' perceptions of the relevance, competency, and attitudes towards computerisation in health care.

**Conclusion:** This study showed that computer literacy skills, informatics literacy skills and information management skills were perceived as relevant to nursing with some perceived competency in these skills and positive attitudes towards computerisation in health care.

## KEYWORDS

- Nursing informatics
- Computer literacy skills
- Informatics literacy skills
- Information technology
- Nursing informatics competencies
- Information Management Skills
- Nursing students

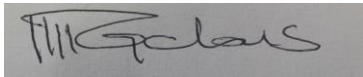
## LIST OF ABBREVIATIONS

AAN	American Academy of Nurses
AMIA	American Medical Informatics Association
ANA	American Nursing Association
EHS	Electronic Health System
ICT	Information Communication Technology
IOM	The Institute Medicine
IT	Information Technology
JCAHO	Joint Commission of Accreditation of Healthcare Organisation
NI	Nursing Informatics
NICAT	Nursing Informatics Competency Assessment Tool
NAC	Nurses Attitudes towards Computerisation
NLN	National League for Nursing
PITAC	The Presidential Information Technology Advisory Committee
SANICS	The Self-Assessment of the Nursing Informatics Competence Scale
TIGER	Technology Informatics Guiding Educational Reform
UWC	University of the Western Cape

## DECLARATION

I Jakobina Foibe Agabus, declare that the research entitled "*Nursing Informatics competencies in the nursing students in a university in the Western Cape*" is my own work, that is not been submitted before for any degree or examination in any university, and that all the sources used or quoted has been indicated and acknowledged as complete references.

Jakobina Foibe Agabus

A rectangular box containing a handwritten signature in black ink. The signature appears to be 'Jakobina Foibe Agabus' written in a cursive style.

Date: 11 December 2020

## **DEDICATION**

This Master's thesis is dedicated to:

My guardian Doctor Hanna Neshuku, my now late mother Elizabeth Petrus for their support and prayers while I was away studying,

The nursing students of the University of the Western Cape, may nursing informatics improve our nursing practice.

## **ACKNOWLEDGEMENTS**

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I owe gratitude to the University of the Western Cape School of Nursing's staff, the research committee for giving me this platform to perform this task. Furthermore, my respect goes to the University of the Western Cape final year undergraduate nursing students who participated in the questionnaire; it is because of students that the data were collected and, I could not have completed my study successfully without you. Your opinions are valued.

Finally, I should not forget to convey my sincere gratitude to Ms. Oluwanifesimi Rita Ologun the assistant researcher who assisted with the data collection.



I hope this study will open doors to success and nursing student informatics challenges will be understood, taken in consideration and the solution to be brought forward.

Contents	
ABSTRACT.....	i
KEYWORDS.....	iii
LIST OF ABBREVIATIONS.....	iv
DECLARATION.....	v
DEDICATION.....	vi
ACKNOWLEDGEMENTS.....	vii
CHAPTER ONE: INTRODUCTION TO THE STUDY.....	1
1.1 Background of the study.....	1
1.2 Problem Statement.....	5
1.3 Significance of the Study.....	7
1.4 Study Aim and Objectives.....	7
1.4.1 Aim.....	7
1.4.2 Objectives.....	8
1.5 Conceptual and operational definition of terms.....	8
1.6 Organisation of the Thesis.....	9
1.7 Summary Chapter One.....	10
CHAPTER 2: LITERATURE REVIEW.....	11
2.1 Introduction.....	11
2.2 History of informatics in nursing.....	11
2.3 Health informatics and nursing informatics' integration into health care.....	12
2.4 Impact of nursing informatics on nursing practice and the health care system.....	14
2.5 Impact of nursing informatics on nursing education.....	16
2.6 Nursing Informatics competencies.....	17
2.7 Enhancing students' informatics competencies and attitudes towards informatics use.....	24

2.8 Adopted instruments used to measure nursing informatics competencies .....	26
2.9 Summary Chapter Two.....	28
CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY .....	29
3.1 Introduction .....	29
3.2 Research setting .....	29
3.3 Research approach and design.....	29
3.3.1 Study population and study sample .....	30
3.3.2 Description of the instrument of the study.....	30
3.3.2.1 Instrument validity.....	32
3.3.3.2 Instrument reliability .....	33
3.3.3.3 Pre-test of the instrument .....	34
3.4 Data collection process .....	35
3.5 Data analysis.....	37
3.6 Ethical issues .....	38
3.6.1 Permission .....	38
3.6.2 Procedures and mechanisms for protecting human rights .....	39
3.6.3 Respect of persons .....	39
3.6.4 Principle of justice .....	39
3.6.5 Principle of beneficence .....	39
3.7 Summary Chapter Three .....	40
CHAPTER 4: RESULTS.....	41
4.1 Introduction .....	41
4.2 Sample realisation.....	41
4.3 Demographic information .....	42
4.4: Computer and informatics training attended.....	42

4.5 Perceived relevance of nursing informatics skills .....	43
4.5.1 Perceived relevance of computer literacy skills for nursing practice .....	43
4.6 Perceived levels of competence in computer literacy skills, informatics skills and information management skills for nursing students .....	54
CHAPTER 5: DISCUSSION OF RESULTS .....	69
5.1 Introduction .....	69
5.2 Perceived relevance of computer literacy skills, informatics literacy skills and information management skills for nursing practice.....	70
5.2.1 Relevance of computer literacy skills .....	70
5.2.2 Relevance of information management skills .....	73
5.2.3 Relevance of informatics literacy.....	74
5.3 Perceived competence of computer literacy skills, informatics literacy skills and information management skills for nursing students .....	75
5.3.1 Perceived competence in computer literacy skills .....	75
5.3.2 Perceived competence in information management skills.....	76
5.3.3 Perceived competence in informatics literacy skills.....	78
5.4 Attitudes towards computerisation in health care for the nursing students.....	79
5.4.1 Positive attitudes towards computerisation in health care .....	80
5.4.2 Negative attitudes towards computerisation in health care .....	81
CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS .....	83
6.1 Introduction .....	83
6.2 Key findings.....	83
6.3 Recommendations .....	85
REFERENCES.....	90
APPENDICES .....	102

Appendix 1: Ethical clearance .....	102
Appendix 2: Permission to collect data from the Registrar .....	103
Appendix 3: Permission to conduct data from the Head of Department .....	104
Appendix 4: Permission to use the tool .....	105
Appendix 5: Information document.....	106
Appendix 6: Consent form.....	114
Appendix 7: Questionnaire .....	115
Appendix 8: Turnitin Score .....	123
Appendix 9: Letter from Editor.....	124

## LIST OF TABLES

Table 1: Definition of terms .....	8
Table 2: The two level of nursing informatics competencies (Staggers., et al. 2002). ....	22
Table 3: Content validity .....	33
Table 4: Demographic information .....	42
Table 5: Computer and informatics training.....	43
Table 6: Mean level of agreement of perceived relevance of computer literacy skills for effective nursing care .....	44
Table 7: Level of agreement of perceived relevance of computer literacy skills for effective nursing care .....	45
Table 8: Mean level of agreement of perceived relevance of informatics literacy skills for effective nursing care .....	47
Table 9: Level of agreement of perceived relevance of informatics literacy skills for effective nursing care .....	48
Table 10: Mean level of agreement of perceived relevance of information management skills for effective nursing care .....	50
Table 11: Level of agreement of perceived relevance of information management skills for effective nursing care .....	51
Table 12: Average nursing informatics domain relevance scores .....	53
Table 13: Relevancy of nursing informatics skills with >75% of respondents rating these as very or extremely relevant .....	53
Table 14: Mean level of perceived competence of computer literacy skills for effective nursing care .....	55
Table 15: Level of perceived competence of computer literacy skills for effective nursing care .....	56
Table 16: Mean level of perceived competence of informatics literacy skills for effective nursing care .....	58
Table 17: Level of perceived competence of informatics literacy skills for effective nursing care .....	59

Table 18: Mean level of perceived competence of information management skills for effective nursing care .....	61
Table 19: Level of perceived competence of information management skills for effective nursing care .....	62
Table 20: Average nursing informatics domain competence scores .....	64
Table 21: Positive Attitudes towards computerisation in health care for undergraduate nursing students .....	66
Table 22: Negative Attitudes towards computerisation in health care for undergraduate nursing students .....	67

## **CHAPTER ONE: INTRODUCTION TO THE STUDY**

### **1.1 Background of the study**

Nursing informatics is defined by Staggers and Thompson (2002) as a specialty that integrates nursing science, computer science and information science to manage information, communicate data and knowledge in nursing practice. This specialty has been adapted, as many technologies are, to provide and promote health care as well as improve communication and management by nurses. Competency in nursing informatics is therefore essential for health service delivery (Hussey & Kennedy, 2016). The assessment of informatics competencies provides guidance as to what should be taught at different educational levels and the training, in specific skills, that is needed for students to improve their informatics competence (Fehr, 2014).

Nursing informatics includes the use of information technologies such as Electronic Health Systems (EHS), telemedicine, eHealth, mHealth and electronic patient monitoring systems in all public and private health care settings and is especially useful in rural health care to provide a functional health information system (Ball et al., 2011 ; Mars, 2013; Chipps, Ramlall & Mars, 2012; eHealth strategy South Africa, 2019). Other information technology includes information communication systems such as mobile care (m-care) which is a patient friendly messaging system whereby patients access care by receiving consultation and appointment reminders via a short message service and can also report their own health-related issues. Wireless technology tools such as;



wireless ECG machines, wireless vital monitoring systems are nurse-friendly and compatible with nursing care and can be used by nurses while they are walking around providing care (Brown, Yen, Rojas & Schnall, 2013; eHealth strategy South Africa, 2012).

A lack of knowledge and skills about nursing informatics (NI) is identified as one of the concerns affecting the safety and quality of care rendered (Kinnunen, Rajalathi, Cummings, & Borycki, 2017). In contrast with the past, the use of health information technology is now a necessity in nursing practice with telehealth (virtual doctor or nurse visits); digital systems in health care institutions such as teleradiology, tele-ultrasound (antenatal services) and teleophthalmology used to render convenient access for health care purposes and for efficient and effective care provision (Ball et al., 2011). Today's healthcare environment with its technological advancements, necessitates competency in nursing informatics as a requirement for employment in many government and private health institutions and organisations (Choi, 2012). Even though many graduating nursing students may have some knowledge of information technology (IT) and some experience with computers, they may not understand the relevance of informatics in nursing and the required competencies in informatics used in hospitals to ensure safe patient care (Sharie, Juanita & Bernard, 2012). As stated by Westra and Delaney (2008): "*Are the nursing students of the selected university trained and prepared enough to be able to render care with a strong underlying basis of informatics skills and attitudes?*" (Westra & Delaney, 2008).

Findings in an older study by McNeil, Elfrink and Pierce (2004) on preparing student nurses, faculty and clinicians for 21<sup>st</sup> century informatics practice, identified that the most frequently taught aspects of informatics in most nursing schools was the ethical use of patient information systems. This was seen as important to ensure that guidelines regulating computer practices in nursing, telemedicine and information communicating systems are adhered to. In addition, organisations such as the Institute of Medicine recommended that all health care professionals should be trained to work in interdisciplinary teams that delivers patient centered care, daily, by using informatics (Edwards & O'Connor, 2011). The Presidential Information Technology Advisory Committee (PITAC) in America has set up standardised terminology that all health professionals should be familiar with in the provision of health care augmented by technology (Moeller & Vakilzadian, 2012). Other associations such as the American Nursing Association (ANA), the National League for Nursing (NLN) and Technology Informatics Guiding Educational Reform (TIGER) have developed core nursing informatics competencies that have since been adopted by many institutions of higher education (Choi, 2012). However, in recent studies, the emphasis is more on integrating informatics into the nursing education curricula for all health care professionals, intersecting nursing with computers and information science, advancing informatics trends to improve health care quality and exploring the health care professional's attitudes towards nursing informatics (Niyomkar,2012; Akman, Erdemir, & Tekindal, 2014).

The use of informatics plays a major role in nursing and health care delivery. Nursing informatics can help the nurse with patient care decision making processes, the administration of health care and the educational preparation of students (Murphy, 2010; Staggers, Gassert, & Curran, 2002). To ensure that nursing informatics is applied in everyday nursing practice, authors have, since as early as 2002, been recommending the importance of starting to train students in nursing informatics disciplines (Abdrbo, 2008; Sukums, et al., 2014). In the nursing informatics research field, various studies in the United State of America, Canada and Sweden have emphasized the promotion of care through informatics education for evidence-based practice on nursing informatics competencies (Choi, 2012; Chenot & Daniel, 2010). To investigate the current state of nursing informatics, researchers have concentrated on surveying the knowledge, skills and attitudes of students and staff in nursing informatics, as well as the development of instruments to measure nurse's competency in, and attitudes towards nursing informatics (McNeil et al., 2005; Staggers et al., 2002).

Few studies on the use of informatics in nursing and informatics competencies of nurses have been done in Africa. In Nigeria, nursing informatics is a new specialty (Daniel & Oyetunde, 2013), whilst in countries such as Kenya, Uganda, Swaziland and South Africa, telemedicine and eHealth have commonly been used from as early as 1984 (House, Keough, & Hilman, 1987; Longenecker, Campbell, Ladry, Pardue, & Daigle, 2012; International Telecommunication Union (ITU), 2013). A study done in South Africa by Bhebe and Harpe (2013) noted that the Western Cape Government declared that: "*Information Communication Technology (ICT) will play an important role*

*in health and anticipates that by the year 2030, health workers will be ‘techno savvy’ and that ICT will be as an essential tool like the pen and paper of yesteryear.”* The authors (Ibid) further explained that ICT will enhance the integration of a patient’s data and facilitate continuity of patient care across facilities in the system, and over the course of a patient’s life (Bhebe & Harpe, 2013).

Nursing informatics researchers have shown that information technology and information systems in nursing education and nursing practice has brought an improvement in patient care and thereby escalating responsibilities of nurses, nurse educators and students (Chenot & Daniel, 2010; Hunter, McGonigle, & Hebda, 2013). Against this background, this study aims to investigate how undergraduate students at a selected university in the Western Cape, South Africa perceive the relevance of computers and informatics skills for nursing, their perceived competence in nursing informatics, and attitudes towards informatics use.

## **1.2 Problem Statement**

Health and nursing care delivery and nursing education are changing due to the exponential growth of technology and the need for the integration of nursing informatics into nursing care (Staggers et al, 2002; eHealth strategy South Africa, 2012). Various studies have shown that health care worker competence in the use of informatics in health care, education and at different levels of health care systems can improve the quality of care rendered (Daniel & Oyetunde, 2013; Technology Informatics Guiding

Educational Reform [TIGER], 2012). While literature shows that the integration of nursing informatics into health care systems should start in nursing schools, inadequate emphasis is placed on nursing informatics in nursing schools and nursing curricula (Sukums et al., 2014).

Inadequate competencies in nursing informatics and insufficient training on current technology and informatics by nursing schools and the training hospitals may compromise the delivery of health care and education (Staggers et al., 2002; eHealth strategy South Africa, 2012). Therefore, it is important for nursing informatics to form part of nursing schools and training hospitals' curriculum to improve health care delivery as is the case in several developed countries (Elder & Koehn, 2009).

No formal nursing informatics training exists in the Western Cape nursing curriculum (UWC Faculty of Community and Health Sciences Calendar, Part 8), with some orientation and training to computers and learning management systems where relevant. The UWC School of Nursing Annual Report of 2015/16 highlighted the necessity for computer and informatics skills and highlighted the influence of attitudes towards use of informatics and informatics competencies. The focus of this study was therefor to investigate the perceived relevance and competencies of nursing students in nursing information and to describe the attitudes towards computerisation and nursing informatics.

### **1.3 Significance of the Study**

This was the first study in a nursing school at a university in South Africa that has focused on determining how undergraduate nursing students perceived the relevance of computers and informatics skills for nursing, their perceived nursing informatics competence, and their attitudes towards nursing informatics use. The study's findings will be presented to the School and will contribute to the educational preparation of students. The study might encourage the School to make the nursing informatics content, and the assessments provided throughout the programme, visible in the nursing curriculum. Lastly, the study and its findings might encourage researchers, interested in this field, to further develop a competency model or a set of nursing informatics competencies for nursing education.

### **1.4 Study Aim and Objectives**

#### **1.4.1 Aim**

The overall aim was to investigate the perceived relevance, competence, and attitudes towards nursing informatics of final year undergraduate nursing students at a selected university in the Western Cape.

#### 1.4.2 Objectives

- 1) To describe the perceived relevance of computer and informatics skills for nursing of undergraduate final year nursing students at a selected university in the Western Cape.
- 2) To describe the perceived levels of competence in computer and informatics skills for nursing of the undergraduate nursing students at a selected university in the Western Cape.
- 3) To describe attitudes towards computerization in health care for the undergraduate nursing students at a selected university in the Western Cape

#### 1.5 Conceptual and operational definition of terms

**Table 1: Definition of terms**

<b>Terms</b>	<b>Definition</b>
<b>Computer literacy skills</b>	<p>Computer literacy skills include the psychomotor skills to use computer tools, as well as knowledge of basic hardware and software functionality; these are all required for effective bedside nursing (Schleyer, Burch &amp; Schoessler, 2011).</p> <p><u>Operational definition:</u> In this study, computer literacy skill is the ability to perform related computer functions such as navigating of computer operating systems, use of software to create presentations and use of computer external devices (Nursing Informatics competency Assessment Tool item number 6 to 15).</p>
<b>Informatics literacy skills</b>	<p>Informatics literacy skills are the nurses' abilities to recognize the need for information and to retrieve, evaluate, and use information for patient care appropriately (Schleyer, Burch &amp; Schoessler, 2011).</p> <p><u>Operational definition:</u> In this study, informatics literacy skills is the use of other related technologies such as Electronic Health Records and electronic dispensing systems to document, dispense, review and monitor nursing data during nursing care (Nursing Informatics Competency Assessment Tool item 16 to 28).</p>

Terms	Definition
<b>Information management skills</b>	<p>Information management skill is applying the data to support clinical decisions, documentation, ensuring data integrity, confidentiality, and security. Information management skills is the knowledge to articulate the value of information systems in improving patient safety, quality, and outcome (Schleyer, Burch &amp; Schoessler, 2011).</p> <p><u>Operational definition:</u> In this study, information management skills is the ability to find stored electronic data, share these data with other colleagues, use these data to improve nursing practice and manage the systems to protect the patients data (Nursing Informatics Competency Assessment Tool item 29 to 35).</p>
<b>Nursing informatics Competency/Competence</b>	<p>An acceptable level of knowledge, skills and ability to complete specific informatics task (Hunter, McGonigle &amp; Hebda, 2013)</p> <p><u>Operational definition:</u> In this study, nursing informatics competency is defined as an ability to successfully use computers and informatics for information processing and management of data to improve nursing practice. Competence refers to capacity to perform skill where competency fore to individual's actuals performance.</p>
<b>Nursing students</b>	<p><u>Operational definition:</u> In this study, nursing students includes only undergraduate final year nursing students currently enrolled in the undergraduate Bachelor of Nursing degree at a selected school of nursing at a university in the Western Cape.</p>

## 1.6 Organisation of the Thesis

**Chapter One:** Introduces the research project, gives a brief background, and describes the problem statement. Significance of the study and the aim of the research and the research objectives are also included in this chapter.

**Chapter Two:** Reviews the theoretical and empirical literature related to the research topic.

**Chapter Three:** Describes, outlines, and justifies the methodology adopted during the research process.

**Chapter Four:** Presents the results of the research as findings.



**Chapter Five:** Describes and discusses the findings and links them to the literature review and gives recommendations for future action.

**Chapter six:** Includes the conclusions, limitations, and recommendations of the study.

### **1.7 Summary Chapter One**

This first chapter introduced to the reader an overview of nursing informatics and its importance in nursing education and nursing care. The problem statement of the study, the rationale for the research, the significance of the study and the key aim and objectives were set out along with the operational definitions of key concepts and an outline of the thesis.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Introduction**

This Chapter presents a review of studies done on health and nursing informatics. The review focuses on a brief history of informatics in nursing, how various authors have theorized about nursing informatics, its effects and impact on nursing practice, the health care system and nursing education. Emphasis is placed on the importance of assessing nurses' informatics competency, to improve and standardize informatics' use in health care. The review also includes literature on enhancing nurses' skills in various informatics competencies and improving attitudes towards using informatics. Discussions on the findings on informatics studies done on the various instruments developed and adopted to measure nurse's informatics knowledge and attitudes, are also included.

### **2.2 History of informatics in nursing**

Informatics was described by the French, around the 1970's, as "informatique, the computer milieu" which simply means the use of computers for processing of data and information (Saba, 2011). In the 1980's, Schole and Barber (1983) coined the term "nursing informatics" which is the use of computers and other information technology for nursing processes, care and education. As technology developed, so did nursing informatics and it was recognised and approved by the American Nurses Association as a specialty in 1992 (Saba & McCormick, 2001). Today the emphasis is more on the

integration of computer science, information technology and nursing science to support nursing practice.

### **2.3 Health informatics and nursing informatics' integration into health care**

The broader field of health informatics, according to Kotch and Hagslund (2009), deals with the development and implementation of information and communication technology-based methods such as processing, representation, communications, and management of data in health care. This field also includes information and knowledge for medicine, health care provided, prevention and the evaluation of health care provided (Hersh, Margolis, Quiros, & Otero, 2010).

Extensive studies have been done on nursing education and informatics reforms since its inception 30 years ago (Schole and Barbe, 1983). Grave and Corcoran (1989) in their 90's study on "The study of nursing informatics" defines nursing informatics as a specialty within the field of health information technology that is growing globally and includes the use of information technology to improve nursing practices. Thus, nursing informatics is an integration of computer science, information science and nursing science which supports nursing practice (Staggers et al., 2002). The use of pen and paper was common in nursing, until nursing informatics evolved (McNeil et al., 2005). However, the current focus is on information technology and computer models that are integrated in a patient centered environment (Bhebe & Harpe, 2013).

Adebanjo and Olubiyi's (2008) study on the Nigerian nursing educational reforms has shown that the health system is responsive to innovation and the constantly changing educational systems. Though there are many challenges, the country's health system is, in conjunction with the advent of telemedicine, e-learning and distance learning, to expand diversity, and improve the emergence of better-informed consumers, and increase complexity of care in a more complex environment than what was obtainable in the past (Adebanjo & Olubiyi, 2008). Adebanjo and Olubiyi (2008), emphasized that the 21<sup>st</sup> century has also become more complex and challenging and consequently needs an educated nursing workforce who are better prepared for the expanding role of the nurse, the accelerating changes in health care delivery, and the ever-increasing need for community-based care. Thus, after the colonial inheritance of Nigeria, organised nursing education has passed through stages of development and practicing nurses were trained to become technical nurses that are able to use the advanced technologies available, to meet the worldwide nursing informatics competency working standards (Adebanjo & Olubiyi, 2008).

The McNeil et al. (2004) study on preparing the student nurse, faculty and clinician for 21<sup>st</sup> century informatics practices has similarly documented that, like other continents such as Europe, Asia, Antarctica and Australia (Daniel & Oyetunde, 2013). The Americans are also facing a crisis as it seeks newer ways to improve the health quality and safety of its continent. Madsen, Cummings and Borycki's (2015) study on comparing bachelor nursing informatics programmes in Denmark, Canada and Australia reported significant variability in the development, evolution, and integration of nursing

informatics into undergraduate education. The findings indicated that the Denmark nursing informatics curriculum was well established at the undergraduate level, but that Canada and Australia and other studied universities were still in early stages of development (Madsen et al., 2015). Today, the issue of the missing informatics content in nursing education is still a crisis worldwide and especially in Africa, even though informatics are being implemented in the African continent hospital settings with the help of international partnerships (eHealth strategy South Africa, 2012). The in-service training given to nurses in practice is not adequate as there is a need for training in informatics from nursing education institutions to improve informatics competency in nursing practice (Adebanjo & Olubiyi, 2008). Organisations such as the American Academy of Nurses (AAN), Joint Commission on Accreditation of Healthcare Organisation (JCAHO) and the American Association of Colleges of Nursing have found solutions on how to improve this by enforcing education institutions to include informatics knowledge, skills and use in nursing curricula in the United States.

#### **2.4 Impact of nursing informatics on nursing practice and the health care system**

Information technology is emerging in health care practice using information technologies such as Electronic Health Records (EHRs), Electronic Dispensing Tools (EDTs) and electronic Patient Monitoring Systems (ePMS), which offers tremendous opportunities in the health care system (Kossman & Scheidenhelm, 2008). Information technology supports health care professionals by creating opportunities for improvement in work performance, organisation, communication, and documentation,

which reduces clinical errors and increases efficiency, and quality of care (Greenhalgh, Wong, Bark, & Swinglehurst, 2009).

The need for the use of information technologies such as the Electronic Health Record (EHR), Electronic Dispensing Tools (EDTs) and electronic Patient Monitoring Systems (ePMS) has been viewed as essential for over 20 years (Kossman & Scheidenhelm, 2008). To achieve this goal, informatics had to be used by health care professionals, something that remains a major challenge still today as not all nurses are competent not have positive attitudes towards the use of informatics. The lack in uptake may be due to working environments with problems with staffing, unsafe workplaces and/or a poor working design which might hinder the integration of informatics in nursing environments (Institute of Medicine, 2011). This is supported by Kossman and Scheidenhelm (2008) who indicated that informatics in nursing may have a negative impact on patient safety as the use of computers may decrease the time spend with patients, resulting in decreased personalized patient care.

Karsh, Weinger, Abbott, and Wears (2010) highlights additional challenges in that even though IT improves nursing practice, modern information systems are costly and requires maintenance cost. In addition, there is a strong challenge ensuring standards with some studies recommended the health care professional's role in information processing is essential to ensure that standards are maintained (Reichert & Weber, 2012). The impact of nursing informatics on health care practice may also vary daily and from hospital to hospital depending on the level of technology orientation of the hospital

(Choi, 2012). The more technologically-equipped a hospital is, the more nursing informatics competencies will be required by nurses. According to Reinchert et al. (2012) poor skills in these informatics competencies may result in a lack of knowledge, which may limit the use of data, and result in lack of information by health care professionals, impacting on quality-of-care decisions. This will create a need to improve the competence of nurses in informatics use to render effective patient care (Daniel & Oyetunde, 2013).

## **2.5 Impact of nursing informatics on nursing education**

Oroviogicoechea, Elliott and Watson (2008), 20 years ago already detailed that computerized record keeping, computerized assisted instructions, telenursing and distance learning web-based courses and degree programmes as an adaptable method of teaching and learning.

More than 25 years ago, an awareness of the importance of nursing informatics was initiated in the United States with a focus on areas capable of using electronic health records to improve the delivery of health care (McBride, 2005). This awareness has resulted in more nurses being engaged in the development of national health care information technology infrastructure and the adoption of smart, standard based interoperable technology to make delivery of health care safer, efficient, and patient centered (Gugerty, Delaney, & DuLong, 2008). Provision of informatics tools, initiation of informatics activities and resources in the curriculum and possession of

competencies by student nurses to appropriate use of these tools also resulted in increased awareness (Hyun, Bakken, Douglas, & Stone, 2008). With small workshops and seminars on informatics, consultations on appropriate activities for selected competencies and providing guest lectures or co-teaching by informatics faculty members improved the competencies of students and staff on nursing informatics (Hyun et al., 2008).

Due to the rapid development of technology, there is a need for educational recommendations to develop long and short-term courses focusing on the training of all health professionals on informatics. Nursing informatics skills in the core NI competencies need to be developed in all the levels of nursing practice and education and in health care systems through basic and continuing nursing educational programmes (Daniel & Oyetunde, 2013).

## **2.6 Nursing Informatics competencies**

The nursing Workforce is being reviewed for nursing informatics competency (Hussey & Kennedy, 2016). Primary focus is now on the nursing schools, faculty and clinical settings, where most of the nursing workforce including nursing students are based (Kinnunen, Rajalahti, Cummings, & Borycki, 2017).

In many literatures the terms competence and competency has not been clearly defined and are used interchangeably. Hunter et al. (2013). Defined competence as a sufficient knowledge and skills of informatics use in nursing care. Axley (2008) defines competency as the successful achievement of core competencies in nursing



informatics. Swing and International CBME Collaborators (2010) in their study “perspectives on competency-based medical education from the learning sciences” defined the term competency based on two meanings. One, referring to the acquired outputs, positive outcomes or results of training - that is competent performance; and the other definition referring to inputs or underlying attributes required of a person to achieve competent performance (Swing & International CBME Collaborators, 2010). Considering these inputs and outputs, competency in NI indicates an acceptable level of knowledge, skills, ability, and attitudes towards completing specific informatics tasks (Hunter et al., 2013). This also includes the nurse’s computer literacy skills, informatics literacy skills and information management skills to transform health care, as well as nursing practice that involves increased patient safety, health care quality and reduced health care costs by integrating this best practice in healthcare (Rahman, 2015; Schleyer et al.,2011).

Authors such as Hunter, McGonigle, and Hebda (2013) broadly defined competency as "that state of having sufficient knowledge, judgment, skill or strength onto a subject". and actions with the informatics skills. Strudwick, Nagle, Kassam, Pahwa, & Sequeira (2019) further defined Nursing informatics competency as an understanding of informatics in nursing, the behavior of informatics use to achieve standards and make nursing judgements. A definition that encompasses the ability to use informatics in nursing and integration of informatics knowledge in nursing care (Strudwick, et al., 2019).

Identified competencies such as computer literacy skills, informatics literacy skills and information management skills are essential to the nursing profession, as it is the ability to do a task skillfully, successfully, and masterfully (Staggers et al., 2002). The lack of NI competency in bedside nursing care was identified as a significant problem (Jeon, Kim, Park, Lee, Kim, & Jin, 2016).

According to Schleyer et al. (2011), *computer literacy skills* include the psychomotor skills to use computer tools, as well as knowledge of basic hardware and software functionality, which are all required for effective bedside nursing. Similarly, Rahman (2015) discusses computer literacy skills as the nurse's knowledge and ability to recognize the basic components of the computer systems, the ability to perform related computer functions, navigating of computer operating systems and the use of computer external devices.

*Informatics literacy skills* are nurses' abilities to recognize the need for information; to retrieve, evaluate, and use information for patient care appropriately (Schleyer et al., 2011). These abilities point to the need for nurses to be skilled in the use of related technologies such as Electronic Health Records, and electronic dispensing systems, among others; to document, dispense, review and monitor nursing data during nursing care (Rahman, 2015).

*Information management skills* are the nurses' abilities in applying the data to support clinical decisions, documentation, ensuring data integrity, confidentiality, and security (Schleyer et al., 2011). Therefore, to improve nursing care, nurses should not only know

how to computerize information and recognize the need for information but should also be able to manage this information and use it to articulate the value of information systems in improving patient safety, health care quality, and patient care outcomes (Rincon, Henneman, & Elizabeth, 2018).

Informatics competency was also taken into consideration by Staggars and colleagues (2002) through the development of four levels of nursing informatics competencies. Staggars et al. (2002) divided the four levels in the order of the beginning nurse, the experienced nurse, the informatics specialist, and the informatics innovator. Based on these four levels, the Self-Assessment of the Nursing Informatics Competency Scale (SANICS) was developed. Staggars et al. (2002) emphasised that nurses at all the four levels are required to attain specific skills, knowledge, and informatics roles to carry out during the rendering of nursing care (Table 2).

The first level which is the beginning nurse, refers to a nurse at an undergraduate level in the nursing profession who should acquire computer skills, knowledge, and perform computer roles during nursing education and practice (Staggars et al., 2002). The latter should be able to recognize the use and the importance of computerized data for improving care, the impact that data may have, privacy and security as well as ethical decisions in using the data (Table 2; Staggars et al., 2002). Emphasis should be made on including nursing informatics in the curriculum to cover these aspects in the beginning nurse education. This would make it acceptable for nursing students to be able to cope with nursing informatics in their practical and working environment (Daniel & Oyetunde, 2013).

Level two-experienced nurses refers to a graduate and postgraduate nurse who is already engaged in the computerized working environment and continuing learning (Staggers et al., 2002). This nurse is expected to be skillful in computer and informatics use to be able to carry out nursing administrative task, accessing nursing data, monitoring systems appropriately according to data needed to improve the quality of health care rendered (Staggers et al., 2002). The experienced nurse needs to participate in influencing the attitudes of other nurses toward computer and informatics use for nursing practice (Staggers et al., 2002). The table below illustrates the skills, knowledge and roles of the beginning nurse and the experienced nurse.

**Table 2: The two levels of nursing informatics competencies (Staggers., et al. 2002).**

<b>LEVEL 1: BEGINNING NURSE</b>	<b>LEVEL 2: EXPERIENCED NURSE</b>
<p><b>Computer Skills – Administration</b></p> <ul style="list-style-type: none"> <li>● uses administrative applications for practice management and for data entry</li> </ul> <p><b>Computer Skills – Communication (email, internet, telecommunications)</b></p> <ul style="list-style-type: none"> <li>● Uses telecommunication devices and the Internet to locate, download items of interest</li> </ul> <p><b>Computer Skills – Basic Desktop Software and systems</b></p> <ul style="list-style-type: none"> <li>● Uses multimedia presentations, word processing and demonstrates keyboarding (typing) skills</li> <li>● Uses networks to navigate systems, windows</li> <li>● Operates peripheral devices</li> <li>● Uses computer technology safely</li> </ul> <p><b>Computer Skills – Data access and documentation</b></p> <ul style="list-style-type: none"> <li>● Uses sources of data that relate to practice and care</li> <li>● Accesses, enters, and retrieves data used locally for patient care</li> <li>● Uses database applications to enter and retrieve information</li> <li>● Conducts on-line literature searches</li> <li>● Uses an application to document patient care, plan pts care and enter patient's data</li> </ul> <p><b>Computer Skills – Education</b></p> <ul style="list-style-type: none"> <li>● Uses information management technologies for patient education</li> </ul> <p><b>Computer Skills-Monitoring</b></p> <ul style="list-style-type: none"> <li>● Uses computerized patient monitoring systems</li> </ul> <p><b>Informatics Knowledge – Data</b></p> <ul style="list-style-type: none"> <li>● Recognizes the use and/or importance of nursing data for improving practice</li> </ul> <p><b>Informatics Knowledge - Impact</b></p>	<p><b>Computer Skills – Administration</b></p> <ul style="list-style-type: none"> <li>● Uses administrative applications for forecasting,</li> <li>● Use administrative applications for budget,</li> <li>● Use administrative application to manage aggregated data,</li> <li>● Use administrative application for staff schedule</li> <li>● Use administrative applications for maintaining employee records</li> </ul> <p><b>Computer Skills-Research</b></p> <ul style="list-style-type: none"> <li>● Uses computer applications for statistical analysis and nursing research</li> </ul> <p><b>Computer Skills-Quality improvement</b></p> <ul style="list-style-type: none"> <li>● Uses data and statistical analyses to evaluate practice and perform quality improvement</li> </ul> <p><b>Computer Skills-data access</b></p> <ul style="list-style-type: none"> <li>● Accesses shared data sets</li> <li>● Extracts data from clinical data sets</li> <li>● Extracts selected literature resources and integrates them to a personally usable file</li> </ul> <p><b>Computer Skills – Education</b></p> <ul style="list-style-type: none"> <li>● Uses applications to develop testing materials, curriculum planning and evaluate CAI as a teaching tool</li> <li>● Computer Skills-Monitoring</li> <li>● Applies monitoring system appropriately</li> </ul> <p><b>Informatics Knowledge – Data</b></p> <ul style="list-style-type: none"> <li>● Supports efforts toward development and use of a unified nursing language</li> <li>● Promotes the integrity of nursing information and access necessary for patient care within an</li> <li>● integrated computer-based patient record</li> </ul>

LEVEL 1: BEGINNING NURSE	LEVEL 2: EXPERIENCED NURSE
<ul style="list-style-type: none"> <li>● Recognizes that a computer programme has limitations due to its design</li> <li>● Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool</li> <li>● Recognizes that health computing will become more common</li> <li>● Recognizes that the computer is only a tool to provide better nursing care and</li> </ul> <p><b>Informatics Knowledge – Privacy/security</b></p> <ul style="list-style-type: none"> <li>● Seeks available resources to help formulate ethical decisions in computing</li> <li>● Describes patients' rights as they pertain to computerized information management</li> </ul> <p><b>Informatics Knowledge - Systems</b></p> <ul style="list-style-type: none"> <li>● Recognizes the value of clinicians' involvement in the design, selection, implementation, and evaluation of applications, systems in health care</li> <li>● Describes the computerized or manual paper system that is present</li> <li>● Explains the use of networks for electronic communication and identifies the basic components of the current computer system</li> <li>● Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing</li> </ul> <p><b>Informatics Knowledge – Privacy/security</b></p> <ul style="list-style-type: none"> <li>● Discusses the principles of data integrity, professional ethics, and legal requirements</li> <li>● Describes ways to protect data</li> </ul>	<ul style="list-style-type: none"> <li>● Provides for efficient data collection</li> </ul> <p><b>Informatics Knowledge - Impact</b></p> <ul style="list-style-type: none"> <li>● Defines the impact of computerized information management on the role of the nurse</li> <li>● that there are human functions that cannot be performed by computer</li> </ul> <p><b>Informatics Knowledge –Systems and research</b></p> <ul style="list-style-type: none"> <li>● Describes general applications to support administration □ Describes general applications, systems to support clinical care</li> <li>● Describes general applications to support nursing education</li> <li>● Discusses CAI as a teaching and learning tool</li> <li>● Describes general applications available for research</li> <li>● Informatics Skills – Systems Maintenance and evaluation</li> <li>● Performs basic troubleshooting in applications</li> <li>● Assesses the accuracy of health information on the Internet</li> <li>● Assists patients to use databases to make informed decisions</li> </ul> <p><b>Informatics Skills - Role</b></p> <ul style="list-style-type: none"> <li>● Participates in influencing the attitudes of other nurses toward computer use for nursing practice</li> <li>● As a clinician (nurse), participates in the selection process, design, implementation, and evaluation of systems</li> <li>● Acts as an advocate of system users including patients or clients</li> <li>● Markets self, system, or application to others</li> </ul>

The third level of nursing informatics competencies is the informatics specialist (Staggers et al., 2002). The specialist plays a further role in computer skills such as modifying computer software and managing computerised software projects (Staggers et al., 2002). The specialist demonstrates fluency in informatics and recognises the capacity for data display and linkage. The specialist also implements and evaluates training programme systems and teaches the nurses about the effective use of the applications and systems (Staggers et al., 2002).

The fourth level of nursing informatics competencies includes the informatics innovator designs, who develops, analyse and manage informatics programmes and projects for both nursing practice and nursing education (Staggers et al., 2002). The innovator also assesses and evaluates the competencies required for specific role functions for practicing nurses, administrators, and nursing educators (Staggers et al., 2002).

## **2.7 Enhancing students' informatics competencies and attitudes towards informatics use**

The changes in technology and the increased use of informatics in health care may be a problem to students and staff that are resistant to change and may present a challenge to enhance. Therefore, nursing educators should cultivate a culture of adoption of technology to facilitate changing nursing students' attitudes towards the use and acceptance of technology in the health sector (Achampong, 2017; Heidarizadeh, Rassouli, Manoochehri, Tafreshi, & Ghorbanpour, 2017). Jetté, Tribble, Gagnon, and

Mathieu (2010) evaluated the perceptions of student nurses and educators towards informatics use and identified that there was a history of non-use and resistance to informatics by health care workers. As early as 2010, Huryk (2010) argued that nurses' attitudes towards information technology would be positive when there was an increase in computer experience and understanding regarding the importance of information technology in rendering care, despite nurses' fear that the use of technology may dehumanize patient care (Fagerström, Tuveesson, Axelsson, & Nilsson, 2017). Hawkins (2012) argued that nurses in practical settings are constantly exposed to a variety of changes such as informatics, and they need to update their informatics skills to enable them to adapt to these changes.

It is therefore imperative to provide students with the informatics skills that they will need throughout their education and their nursing practices (Moore, 2012). Incorporating NI in teaching-learning activities of clinical simulations and academic electronic medical records can serve as models to bridge this practice gap in nursing programmes (Rahman, 2015). Student's perceptions of the relevance of informatics in nursing might have an influence on their attitudes towards the use of informatics (Heidarizadeh et al., 2017). If informatics is not incorporated in nursing education's training and practices from the beginning, students may have negative attitudes towards informatics as they may not understand its relevance during the provision of health care (Huryk, 2010).



Assessing the nurses' self-confidence and competency in computer literacy, informatics literacy and information management skills is important so that those aspects where nurses lack competency may be improved. The competency of all nurses and healthcare providers must be assessed and evaluated to provide safe, quality care, protect patients' information and, to maintain the integrity and reliability of nurses (Zhang, Barriball & While 2014). Effective in-service training is needed, to provide skills and knowledge, as well as experience on informatics to practicing nurses with an inadequate health information technology background, as well as to provide information on the latest developments in information technologies (Fehr, 2014).

Given the above, there would appear to be a need for nursing informatics to be guided by a framework that deals with data, information, and the creation of knowledge (McBride, 2005). Stagers' (2002) nursing informatics competencies at the four levels of nursing practice may be useful in guiding nurse educators to design a curriculum that includes nursing informatics in the preparation of student nurses for professional levels of practice (McNeil et al., 2004).

## **2.8 Adopted instruments used to measure nursing informatics competencies**

To measure nursing informatics competencies, competency scales must be developed, validated, and adopted. A nursing competency scale is a validated instrument which is used to assess the level of nurses' competencies in different aspects and settings in their various working environments (Dunn, 2017). Black, et al (2011) reported that

information on informatics competencies of nursing students was lacking, but that many proposed and validated informatics competency tools and scales were being developed. Validated competency scales need to be used because they produce valid, reliable, and authentic practices and judgments (Augustin, Reich, Schaefer, Zschocke, & Rustenbach, 2008). The oldest tool (NATC) for the assessment of nurse's attitudes towards computerisation (computers in nursing) was developed by Stronge and Brodt (1985) to determine the attitudes of nurses towards the use of computers and the factors that influence these attitudes. Many other tools and scales that have been developed, are based on Staggars, et al.'s (2002) nursing informatics competencies (McNeil, et al. 2005). The University of Columbia's School of Nursing has developed their tool integrating nursing informatics in the master's level programme.

In addition, the same institution has developed a Self-Assessment Nursing Informatics Competence Scale (SANICS). The thirty-item tool was introduced with the goal of ensuring that graduates are prepared and willing to use informatics to support the provision of health care (Zamarripa-Zoucha, 2015). The scale consists of informatics competencies of the beginning and experience nurse which are deduced from the 93 recommendations of the TIGER initiative (YOON, Yen, & Bakken, 2009). This scale consists of five competency categories, which include clinical informatics roles, basic computer knowledge and skills, clinical informatics (applied computer skills), clinical informatics attitudes and wireless device skills (Fehr, 2014).

With permission, this study used a modified tool based on the Nursing Informatics Competency Assessment Tool (NICAT) by Rahman (2015) with components of the Nurses Attitudes towards Computerisation (NATC) tool by Stronge and Brodt (1985). Rahman's tool focused on assessing the nursing informatics perceived relevance and competencies. This included assessing nurses' perceived relevance and level of competence on items related to computer literacy skills, informatics literacy skills and information management skills. Stronge and Brodt's tool (1985) though old, still provided a good yardstick for describing the nurse's attitudes towards computerisation in health care.

## **2.9 Summary Chapter Two**

According to the literature, computers and nursing informatics skills and experience are essential in the provision of nursing care and are critical to providing safe, quality and effective care to patients (American Association of College of Nursing, 2008). The early introduction, preferably at first-year level, of nursing students to computers and nursing informatics, and the provision of informatics trainings for all health care professionals will improve nursing student's competencies. As noted in this review, literatures found on nursing informatics is old, emphasising the importance of providing more current research in this field.

## **CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY**

### **3.1 Introduction**

The previous chapter dealt with a literature discussion on the concepts of nursing informatics, their origins, and the importance of nursing informatics in health care. The literature shows that nursing informatics impacts on the nursing profession in many ways and that skills in informatics competencies are essential in the provision of nursing care. Chapter Three addresses the research design and methodology used in researching this specific topic. Ethical considerations are also addressed in detail.

### **3.2 Research setting**

The study was conducted in a selected school of nursing at a university in the province of the Western Cape in South Africa. The school offers a four-year Bachelor of Nursing Degree with a 1000 students in the programme.

### **3.3 Research approach and design**

A quantitative research approach using a descriptive survey design was used for this study. Descriptive designs collect information from a representative sample of the population (Brink, Van der Walt & Van Ransburg, 2006). This design was suitable for this study as it was directed towards identifying, assessing, and understanding the perceived relevance of computer skills, informatics skills and information management skills and the perceived level of competence in these informatics skills for nursing care of the nursing students at the selected university in the Western Cape. A structured self-

administered questionnaire was undertaken to collect the required data from the respondents.

### **3.3.1 Study population and study sample**

The targeted population for this study were the undergraduate student nurses currently enrolled in the fourth-year undergraduate bachelor nursing degree programme at the selected school of nursing at a university in the Western Cape. Purposive sampling was used for the 4<sup>th</sup> year student nurses as the overall aim was to investigate how competent and prepared students are to work in highly techno-digitalized environments to render effective care in the final year of their study. Because the access population was small, an all-inclusive sampling method was used for this study (n=198), i.e. all 198 students in 4<sup>th</sup> year at the time of the study.

### **3.3.2 Description of the instrument of the study**

The questionnaire (Appendix 7) was in English which is the university language of facilitation and took the respondents 10 to 15 minutes to complete. Attached to the instrument was a consent form (Appendix 6) that elaborated on the freedom and choices of participation and an information sheet (Appendix 5) that had a clear explanation of the purpose of the study.

The study used, with permission (Appendix 4), a modified tool (modifications described later in chapter) based on the Nursing Informatics Competency Assessment Tool (NICAT) by Rahman (2015) with components of the Nurses Attitudes towards Computerisation (NATC) tool by Stronge and Brodt (1985). This tool measures the

perceived relevance and competence of nursing informatics skills in their working environment. Permission to use the tool was obtained from Rahman via e-mail on 6 September 2017. The modified tool used consisted of three sections namely.

**Section 1:** Demographic information with six items; this section of the tool focused on the demographic background of the students, nursing informatics training attended as well as specification of the type of training attended by the student and the duration.

**Section 2:** Nursing informatics perceived relevance and competencies with 30 items from the Nursing Informatics Competency Assessment Tool (NICAT). This section describes students' ratings on the perceived relevance and perceived level of competence in computer literacy, informatics literacy, and information management skills. These skills were identified as applicable to bedside nurses based on the American Nurses Association (ANA) standards (2008) and the Technology Informatics Guiding Education Reform (TIGER) summit recommendations (2009). A five-point Likert scale was used to rate relevance (1: Irrelevant, 2: Slightly relevant, 3: Moderately relevant, 4: Very relevant and 5: Extremely relevant). Students also rated their perceived level of competence in these skills based on Benner's Dreyfus model of skill acquisition (1: Novice (not competent), 2: Advanced beginner (somewhat competent), 3: Competent, 4: Proficient (very competent) 5: Expert (Benner, 1984)).

**Section 3:** This section consisted of 20 items from the Nurses Attitudes towards Computerisation (NATC) tool and describes the nursing student's attitudes towards computerisation in health care. For this section, students were expected to rank their

responses as: 1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree.

### **3.3.2.1 Instrument validity**

Instrument validity seeks certainty as to whether an instrument measures what it is supposed to (Brink, van der Walt & van Rensburg, 2014). The tool was evaluated for clarity and applicability by a team of experts of the Walden University through item analysis (Rahman, 2015).

This study's content validity is determined against the Nursing Informatics Competency Assessment Tool (NICAT), and the Nurses Attitude Towards Computerisation (NATC) tool items with the objectives (Table 3).

**Table 3: Content validity**

<b>Study objectives</b>	<b>Nursing informatics items</b>	<b>Questionnaire items</b>	<b>Literature source</b>
1. To describe the perceived relevance of computer and informatics skills for nursing of the nursing students at a selected university in the Western Cape	Computer Literacy Informatics Literacy Informatics management	6-35	(Rahman, 2015)
2. To rate perceived levels of competence in computer and informatics skills for nursing of the nursing students at a selected university in the Western Cape	Computer Literacy Informatics Literacy Informatics management	6-35	(Rahman, (2015)
3. To describe attitudes towards computerisation in health care in nursing students at a selected university in the Western Cape	Informatics attitudes	36-55	(Rahman, 2015)

### **3.3.3.2 Instrument reliability**

Reliability is concerned with the consistency, stability, and repeatability of the information as well as the researcher's ability to collect and record information accurately (Creswell, 2009). It suggests that the same thing is repeated or reoccurs under identical or similar conditions (Neuman, 2011). For this study, the questionnaire was pretested by five postgraduate nursing students to identify sensitivities, consistency, acceptability, and any ambiguity in the questions.



### **3.3.3.3 Pre-test of the instrument**

Proceeding to the data collection, a pre-test was carried out on five postgraduate students to identify inadequacy and any ambiguous issues in the instrument. Respondents were requested to complete the questionnaires and identify any questions that were not clear or difficult to understand. Pre-testing is necessary to examine the study feasibility and determines whether respondents understand what is required of them in terms of instructions, ambiguity of terms and sensitive or embarrassing items (Brink et al., 2006). The pre-test was carried out on five postgraduate students, who were conveniently sampled during the proposal presentation in the School of Nursing boardroom in mid-October 2017. The rationale for the pre-test on the postgraduate students was that most of the PhD and masters' degree students had experience in the use of informatics. They may have had training as undergraduates, they were already working in the clinical area and were daily informatics users, and, as such might have had insight into the relevance of informatics in nursing as well as noted competencies and attitudes towards informatics use. The respondents in the pre-test were asked to identify difficulties in understanding the instructions, the length of the instrument and possible changes that they would advise be made to the instrument.

In Section One, there was an item that requested students to specify the training and duration in length at the provided space. E.g. computer classes for 12 months. Respondents requested an item in Section One to be made clear. Respondents requested that this item be removed as they felt that not all the respondents would be able to describe it, and this could have led to non-completion of the questionnaire. For items four and five in the same section "indicate if you have taken any computer or

informatics training during your undergraduate training,” respondents also suggested the table should have a “yes” and “no” response. Pre-testing respondents also insisted clear information be given to respondents during data collection to avoid confusion and non-completion of the questionnaires. They also commented that even though the questionnaire was lengthy, it measured what it was supposed to (to investigate the perceived relevance, competence, and attitudes towards nursing informatics of the nursing students at a selected university in the Western Cape). The questionnaire was refined after the pre-test. The pretested data was not included in the overall data

### **3.4 Data collection process**

Data collection was done after the ethical approval of the study was received from the Senate Research Committee of the university dated 20 April 2017. The permission was granted by the University Registrar and the Head of Department of the School of Nursing on the 4th and 15th of May 2017, respectively. Arrangements concerning the data collection processes were made between the study researcher, the study supervisor, and her research assistants to help with data collection as the study researcher was employed in Namibia. The assistant researcher was the researcher’s study coach and has been assisting the researcher from the beginning of the study and was well acquainted with the research tool. The assistant researcher then communicated with the School of Nursing lecturers, both verbally and via mail, requesting that she be allowed to make use of the last minutes of their class sessions to collect the study data.

Data collection was carried out in the months of October and November 2017. Though it took time for some lecturers to respond and confirm that data could be collected during their classes, especially via email, there was a successful response from research lecturers.

The assistant researcher met the fourth-year nursing students during the class sessions as per the scheduled date and time provided by the lecturers. Fourth year students were readily available on campus and it was easy for the assistant researcher to access them during classes. It was important for the assistant researcher to carry the necessary documents such as the researcher's ethical approval letter, as well as the permission letters from both the registrar and the School of Nursing's Director, to conduct the study. Data collection was done during the last 20 minutes of class when the research assistant explained the importance and significance of the study to the students. Ideas suggested during the pre-test of the instrument were considered during data collection. A thorough explanation was given on how to respond to items in Section 2 to avoid any ambiguity. Informed consent of participation was done while handing out the questionnaires to the students. The questionnaire took students 20 minutes to complete and class lecturers were always present during data collection to ensure students' attention and cooperation during data collection. Self-reported questionnaires and signed consent forms were then handed over to the study supervisor for safe keeping and were delivered to the study researcher by the study supervisor herself on the 23 November 2017.

### **3.5 Data analysis**

Data was collected to describe the perceived relevance of computer and informatics skills in nursing care, to describe the nursing students perceived levels of competence in computer and informatics skills as well as students' attitudes towards computerisation in health care.

On completion of the data collection, returned questionnaires were sorted, cleaned and ten incomplete questionnaires were excluded. Each completed questionnaire was identified with a unique code for easy identification and comparison during data cleaning. The IBM Statistical Package for Social Sciences (SPSS) Version 24.0 was used to enter and analyse the data. All 91 questionnaires completed were entered in the SPSS. Descriptive analysis was done to describe and summarise the data. Descriptive means were calculated for individual items and the total score and each subscale score were calculated separately.

Assessing the respondents' perceived relevancies of computer literacy skills, informatics literacy and information management skills in nursing practice, nursing respondents were asked to rate their perceived relevance as either irrelevant, slightly relevant, moderately relevant, very relevant or extremely relevant out of a total score of five . All the variables were recoded into two variables relevant and irrelevant. Data was analysed calculating average relevance ratings and by frequencies of per cent respondents who rated the competencies as relevant and irrelevant.

Assessing perceived levels of competence in nursing informatics, respondents were asked to rate their perceived levels of competence in nursing as novice, advanced

beginner, competent, proficient or experts out of a score of 5. All variables were recorded into two variables: competent and not competent. Data were analysed calculating average competence ratings and by frequencies of per cent respondents who rated the competencies as competent and not competent.

To measure attitudes, respondents were asked to describe their attitudes towards computerization in health care by choosing the response that best reflect their attitudes for each statement in the research tool, Section-Three. Respondents were asked to respond by either strongly disagreeing, disagreeing, being neutral, agreeing and strongly agreeing. The five-point Likert scale was then recoded into two variables, namely Agree and Disagree. The 20 statements were separated into 14 negative statements and 6 positive statements. Data were analysed by calculating average attitude rating scores.

### **3.6 Ethical issues**

In research, ethical measures are important at all stages of the research process and must be in place from beginning to end.

#### **3.6.1 Permission**

The proposal was presented to the nursing faculty and submitted with the application for approval by the Research Ethics Committee of the university. After approval, permission to conduct the proposed study in the selected university was sought from the registrar and the director of the School of Nursing.

### **3.6.2 Procedures and mechanisms for protecting human rights**

The researcher considered procedures and mechanisms for protecting human right by providing information about the study to the respondents, its benefit to society and the choice of participation. Those who participated, contributed to the project and guidance was acknowledged.

### **3.6.3 Respect of persons**

Emphasis was placed on the free and voluntary participation of all the respondents. Their freedom to withdraw from the study, without any penalty, was explained and those who had no interest in participating in the study were not forced to, nor were they intimidated for not participating and their decisions were treated with respect (Brink et al. 2014).

### **3.6.4 Principle of justice**

Every effort was made to maintain confidentiality and anonymity, Anonymity was maintained by respondents remaining nameless as no names were entered on the questionnaire. Confidentiality was assured as no information was disclosed to any other person (Brink et al. 2014).

### **3.6.5 Principle of beneficence**

Respondent were protected from harm. The questions in the questionnaire were structured formally and carefully to identify the nursing students' competencies in nursing informatics and reviewed by the ethics committee. Respondents and institution names were not identified on the questionnaire nor in the report (Brink et al., 2014).

### **3.7 Summary Chapter Three**

Chapter Three gave a brief description of the methodology used in this study. The population for the study was also described as well as the quantitative descriptive design used to carry out this study. The study instrument, which was obtained with consent from Doctor Rahman, was clearly described and instrument validity and reliability was also elaborated on. A brief history on the pre-testing of the instrument was given and the main reasons for it, namely, to identify possible shortcomings in the instrument. Data collection and the analysis process was clearly explained as well as a summary on how the ethical measures of this research were carried out from the beginning until the end of the research process. The next chapter presents the research findings.

## **CHAPTER 4: RESULTS**

### **4.1 Introduction**

This chapter presents the findings of the survey done to investigate the competencies and attitudes towards nursing informatics of the final year nursing students at a selected university in the Western Cape. The main objectives of the study were:

- I. To describe the perceived relevance of computer and informatics skills of nursing students at a selected university in the Western Cape.
- II. To describe perceived levels of competence in computer and informatics skills of nursing students at a selected university in the Western Cape.
- III. To describe attitudes towards computerisation in health care of the nursing students at a selected university in the Western Cape.

The findings are presented in order of the objectives. Section one: demographic information, section two: nursing informatics competencies and section three: attitudes towards nursing informatics in nursing care.

### **4.2 Sample realisation**

The target population for this study was all the 198 nursing students enrolled in their undergraduate (fourth year) Bachelor of Nursing for the academic year 2017 at the selected university in the Western Cape. The target population was fourth-year nursing students it was anticipated that they would be able to provide the best reflection on the relevance and competence of nursing students in nursing informatics. All fourth-year



nursing students (n=198) were included. A total of 91 of the 198 undergraduate (UG) students (n=91, 45.9%).

### 4.3 Demographic information

A total of 91 undergraduate respondents completed the survey. Most of the respondents were female (65, 71.4%) with 27.5% (n=25) male respondents. The ages of respondents ranged between 19 years and 49 years with the majority (79.1%, n=72) between 21-30 years with an average age of 25.8 (sd 5.6) years (Table 4).

**Table 4: Demographic information**

Demographics		fourth-year students n=91 (100 %)
Gender (missing n=1)	Male	25 (27.5 %)
	Female	65 (71.4%)
	Missing	1 (1.1%)
Age (years) (missing n=3)(mea n 25.8 sd 5.6)	20 years and below	3 (3.3%)
	21-30	72 (79.1%)
	31-40	14 (15.4%)
	41-50	2 (2.2%)

### 4.4: Computer and informatics training attended

Out of the 91 undergraduate respondents, only 26 (28.6%) respondents reported that they had attended formal computer training. Only four (4.4 %) reported that they had attended informatics training (Table 5). Of those who reported that they had attended computer and informatics training, this included computer training (20 students) and computer application packages such as Microsoft Word, Microsoft Excel and Microsoft PowerPoint (5 students) and learning management training (2 students).

**Table 5: Computer and informatics training**

	Response	4 <sup>th</sup> Year students n=91 n (%)
Computer training	Yes	26 (28.6%)
	No	63 (69.2%)
	Missing data	2 (2.2%)
Informatics training	Yes	4 (4.4%)
	No	81 (89.0%)
	Missing system	6 (6.6%)

#### **4.5 Perceived relevance of nursing informatics skills**

The relevance of nursing informatics skills was assessed in three categories namely: computer literacy, informatics literacy and informatics management skills. Assessing the respondents perceived relevancies of these skills in nursing practice, nursing respondents were asked to rate their perceived relevance as either irrelevant, slightly relevant, moderately relevant, very relevant or extremely relevant out of a total score of five. Skills are reported by average score and by agreement of relevance.

##### **4.5.1 Perceived relevance of computer literacy skills for nursing practice**

A total of ten (10) computer literacy skills were assessed for relevance for effective nursing practice (Table 6) scoring an overall 4.16 (0.8) average score for relevance.

###### **4.5.1.1 Average relevance ratings**

The mean scores obtained for perceived relevance in computer literacy skills ranged between 4.0, sd 1.2 to 4.4, sd 0.9. The highest mean scores were obtained skills such as *Create, rename, move, and delete files using computer operating systems such as*

*Microsoft Windows (4.4, sd 0.9), and Use word processing function such as save, categorise documents, copy, paste, and delete (4.3, sd 0.8).*

The lowest mean scores obtained were for skills such as *Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and print (4.2, sd 1.1); Use of remote communication tools such as Skype, Zoom, WhatsApp, Hangout, etc.(4.2, sd 1.1); Manage computer systems security to protect data, devices, and passwords (4.0 sd 1.1), and Navigate computer operating systems to access installed applications and choose active printers (4.0 sd 1.2).*

**Table 6: Mean level of agreement of perceived relevance of computer literacy skills for effective nursing care**

<b>Relevance of computer literacy skills</b>	<b>Mean (sd)</b>
Create, rename, move, and delete files using computer operating systems such as Microsoft Windows	4,4 (0,9)
Use word processing function such as save, categorise documents, copy, paste, and delete.	4,3 (1)
Use external devices such as USB flash drive, digital camera, CDROM.	4,3 (1)
Recognise the basic components of the computer system such as mouse, screen, and workstation.	4,3 (0,9)
Use software to create presentations such as Microsoft PowerPoint.	4,3 (0,9)
Use of telecommunication tools such as electronic mail and facsimile (fax).	4,3 (0,8)
Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and print	4,2 (1.1)
Use of remote communication tools such as Skype, Zoom, WhatsApp, Hangout, etc.	4,2 (1,1)
Manage computer systems security to protect data, devices, and passwords	4 (1,2)
Navigate computer operating systems to access installed applications and choose active printers	4 (1,1)

#### 4.5.1.2 Agreement of relevance

Only two of the computer literacy skills were rated as NOT very or extremely relevant (rating of 75% and above) (Table 7).

Considering respondents who rated computer literacy skills as very or extremely relevant, *The use of electronic mail and facsimile; creating, renaming, moving, and deleting files, using computer operating systems such as Microsoft Windows and use of software to create presentations* were rated as very or extremely relevant for effective nursing practice 81.3% (n=74) of the respondents. *Manage computer systems security to protect data, devices, and passwords* were the lowest rated computer literacy skill in terms of very and extreme relevance (61, 67%). Only four respondents (4.4%) rated the *Use of remote communication tools such as Skype, Zoom, WhatsApp, Hangouts* as irrelevant. Three (3. 3.3%) respondents rated *Managing of computer systems security to protect data, devices, and passwords* as irrelevant skills for nursing, and two (2, 2.2%) respondents rated *Navigating of computer operating systems to access installed applications and choose active printers* as irrelevant (Table 7).

**Table 7: Level of agreement of perceived relevance of computer literacy skills for effective nursing care**

Relevance of computer literacy skills	Irrelevant	Slightly relevant	Moderately relevant	Very relevant	Extremely relevant	RELEVANT (%)
Use of telecommunication tools such as electronic mail and facsimile (fax).	0 (0%)	2 (2,2%)	15 (16,5%)	24 (26,4%)	50 (54,9%)	74 (81,3%)
Use software to create presentations such as Microsoft PowerPoint.	1 (1,1%)	3 (3,3%)	13 (14,3%)	23 (25,3%)	51(56%)	74 (81,3%)

Relevance of computer literacy skills	Irrelevant	Slightly relevant	Moderately relevant	Very relevant	Extremely relevant	RELEVANT (%)
Create, rename, move, and delete files using computer operating systems such as Microsoft Windows	0 (0%)	5 (5,5%)	13 (14,3%)	17 (18,7%)	56 (61,5%)	73 (80,2%)
Recognise the basic components of the computer system such as mouse, screen, and workstation.	1 (1,1%)	2 (2,2%)	16 (17,6%)	20 (22%)	52 (57,1%)	72 (79,1%)
Use word processing function such as save, categorise documents, copy, paste, and delete.	0 (0%)	3 (3,3%)	15 (16,5%)	19 (20,9%)	53 (58,2%)	72 (79,1%)
Use external devices such as USB flash drive, digital camera, CDROM.	0 (0%)	7 (7,7%)	13 (14,3%)	21 (23,1%)	50 (54,9%)	71 (78%)
Use of remote communication tools such as Skype, Zoom, WhatsApp, Hangout, etc.	4 (4,4%)	3 (3,3%)	14 (15,4%)	23 (25,3%)	47 (51,6%)	70 (76,9%)
Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and print	2 (2,2%)	6 (6,6%)	15 (16,5%)	20 (22%)	48 (52,7%)	68 (75,5%)
Navigate computer operating systems to access installed applications and choose active printers	2 (2,2%)	6 (6,6%)	21 (23,1%)	22 (24,2%)	40 (44%)	62 (68,1%)
Manage computer systems security to protect data, devices, and passwords	3 (3,3%)	4 (4,4%)	22 (24,2%)	20 (22%)	41 (45,1%)	61 (67%)

#### 4.5.2 Perceived relevance of informatics literacy skills for nursing care

A total of 12 literacy skills were rated for informatics literacy skills (Table 8) scoring an average of 3.9 (1.0) for relevance.

#### 4.5.2.1 Average relevance ratings

The mean scores obtained for perceived relevance in informatics literacy skills ranged between 4.4, sd 0.9 to 3.6, sd 1.4. The highest mean scores were obtained skills such *Use the internet to locate and download items of interest* (4.4, sd 0.9) (Table 8). The lowest mean scores obtained were for skills such as *Use medication administration tools such as barcode medication verification and scanning* (3.6, sd 1.4); *Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing* (3.6 sd 1.4).

**Table 8: Mean level of agreement of perceived relevance of informatics literacy skills for effective nursing care**

<b>Informatics Literacy skills</b>	<b>Mean (sd)</b>
Use the internet to locate and download items of interest	4,4 (0,9)
Navigate patients' electronic health records	4,1 (1,1)
Review and acknowledge patient orders in an electronic health record	4 (1,3)
Develop and document care plan in electronic health record	4 (1,2)
Collect and electronically document patient signs, height, and weight.	4 (1,2)
Use electronic systems to assist with admission and discharge process	4 (1,1)
Review electronic point of care data such as urine monitoring data relevant to care such as vitals dipstick,	3,9 (1,2)
Continue patient care documentation and patient identification when computer system is down	3,9 (1,2)
View trended electronic documentation to understand the effectiveness of nursing interventions	3,9 (1,1)
Respond appropriately to alerts from clinical decision-making tools such as algorithms, best practice alert, glucose check, and hemoglobin meter, bloods to make timely decisions	3,7 (1,3)
Conduct literature searches in the accessible proprietary database systems such as CINAHL, EBSCO, etc.	3,7 (1,3)
Use medication administration tools such as barcode medication verification and scanning	3,6 (1,4)
Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing	3,6 (1,4)

#### 4.5.2.2 Agreement of relevance

None of the informatics literacy skills were rated as very or extremely relevant (rating of 75% and above). The highest rating for Informatics Literacy Skills was the *Use of the internet to locate and download items of interest* which was rated as very to extremely relevant for nursing care (79.1%, n=72) (Table 9).

However, Information Literacy skills such as *Use of medication dispensing systems, or other electronic pharmacy dispensing units* were perceived as irrelevant by 12.2% (n=11) of the respondents, followed by the *Use of medication administration tools such as barcode medication verification and scanning* by 9.9% (n=9) and *Responding appropriately to alerts from clinical decision-making tools such as algorithms, best practice alerts* by 7.7% (n=7) of the respondents (Table 9).

**Table 9: Level of agreement of perceived relevance of informatics literacy skills for effective nursing care**

Informatics Literacy	Irrelevant	Slightly relevant	Moderately relevant	Very relevant	Extremely relevant	RELEVANT
Use the Internet to locate and download items of interest	1 (1,1%)	2 (2,2%)	16 (17,6%)	16 (17,6%)	56 (61,5%)	72 (79,1%)
Collect and electronically document patient signs, height, and weight.	6(6,6%)	5 (5,5%)	12 (13,2%)	28 (30,8%)	40 (44%)	68 (74,7%)
Continue patient care documentation and patient identification when computer system is down	4 (4,4%)	7 (7,7%)	11 (12,1%)	33 (36,3%)	35 (38,5%)	68 (74,7%)
Navigate patients' electronic health records	3 (3,3%)	7 (7,7%)	14 (15,4%)	17 (18,7%)	50 (54,9%)	67 (73,6%)
Review and acknowledge patient orders in an electronic health record	6 (6,6%)	6 (6,6%)	15 (16,5%)	15 (16,5%)	49 (53,8%)	64 (70,3%)
Use electronic systems to assist with admission and	3 (3,3%)	8 (8,8%)	16 (17,6%)	27 (29,7%)	37 (40,7%)	64 (70,3%)

<b>Informatics Literacy</b>	<b>Irrelevant</b>	<b>Slightly relevant</b>	<b>Moderately relevant</b>	<b>Very relevant</b>	<b>Extremely relevant</b>	<b>RELEVANT</b>
discharge process						
Review electronic point of care data such as urine monitoring data relevant to care such as vitals & urinary dipstick	7 (7,7%)	6 (6,6%)	14 (15,4%)	26 (28,6%)	38 (41,8%)	64 (70,3%)
Develop and document care plan in electronic health record	6 (6,6%)	6 (6,6%)	16 (17,6%)	21 (23,1%)	42 (46,2%)	63 (69,2%)
View trended electronic documentation to understand the effectiveness of nursing interventions	4 (4,4%)	6 (6,6%)	19 (20,9%)	26 (28,6%)	36 (39,6%)	62 (68,1%)
Respond appropriately to alerts from clinical decision-making tools such as algorithms, best practice alert, glucose check, and hemoglobin meter, bloods to make timely decisions	7 (7,7%)	9 (9,9%)	18(19,8%)	23(25,3%)	34(37,4%)	57 (62,6%)
Conduct literature searches in the accessible proprietary database systems such as CINAHL, EBSCO, etc	6 (6,6%)	11 (12,1%)	19 (20,9%)	20 (22%)	35 (38,5%)	55 (60,4%)
Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing	11 (12,1%)	8 (8,8%)	20 (22%)	21 (23,1%)	31 (34,1%)	52 (57,1%)
Use medication administration tools such as barcode medication verification and scanning	9 (9,9%)	11 (12,1%)	20 (22%)	17 (18,7%)	34 (37,4%)	51 (56%)

#### **4.5.3 Perceived relevance for information management skills for nursing**

A total of seven (7) management skills were rated for information management skills (Table 7) scoring an average of 4.0 (1.0) for average relevance.

##### **4.5.3.1 Average relevance ratings**



The mean scores obtained for perceived relevance in computer literacy skills ranged from 4.1, sd 1.1 to 3.8, sd 1.3. The highest mean scores were obtained skills such as *Use nursing data for improving practice and for clinical decision making* (4.1, sd 1.1); *Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation* (4.1, sd 1.1), *Protect confidential patient data by logging out, suspending sessions, and password protection* (4.1, sd 1.1); and *Find information stored in the clinical information system to guide patient care such as standardised care plans and guidelines* (4.1, sd 1.1) (Table 10).

The lowest mean scores obtained was for *Use information technology as a primary means of patient safety such as bedside laboratory verification, bar code scanning, etc.* (3.8 sd 1.3) (Table 10).

**Table 10: Mean level of agreement of perceived relevance of information management skills for effective nursing care**

<b>Information Management Skills</b>	<b>Mean (sd)</b>
Use nursing data for improving practice and for clinical decision making	4,1 (1,1)
Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation	4,1 (1,1)
Protect confidential patient data by logging out, suspending sessions, and password protection	4,1 (1)
Find information stored in the clinical information system to guide patient care such as standardised care plans and guidelines	4,1 (1)
Use electronic communication with colleagues, patients, or other departments	4 (1,1)
Use electronic health record and other clinical information system as per organisational policy for document	3,9 (1,1)
Use information technology as a primary means of patient safety such as bedside laboratory verification, bar code scanning, etc.	3,8 (1,3)

#### **4.5.3.2 Agreement of relevance**

Only two of the information management skills were rated as NOT very or extremely relevant (rating of 75% and above) (Table 11). *Protecting confidential patient data by logging out, suspending sessions, and password protection* (71, 78%) had the highest agreement on being very or extremely relevant, followed by *Use of nursing data for improving practice and for clinical decision making* 76.9% (n=70).

Six (6.6%) respondents perceived the *Use of information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.* as irrelevant with four (4) (4.4% ) rating the *Use of data and statistical reports for unit based quality improvement initiatives and practice evaluation* as irrelevant in nursing (Table 11).

**Table 11: Level of agreement of perceived relevance of information management skills for effective nursing care**

<b>Information Management Skills</b>	<b>Irrelevant</b>	<b>Slightly relevant</b>	<b>Moderate relevant</b>	<b>Very relevant</b>	<b>Extremely relevant</b>	<b>RELEVANT</b>
Use nursing data for improving practice and for clinical decision making	2 (2,2%)	8 (8,8%)	11 (12,1%)	27 (29,7%)	43 (47,3%)	70 (76,9%)
Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation	4 (4,4%)	5 (5,5%)	14 (15,4%)	24 (26,4%)	44 (48,4%)	68 (74,7%)
Protect confidential patient data by logging out, suspending sessions, and password protection	2 (2,2%)	5 (5,5%)	13 (14,3%)	30 (33%)	41 (45,1%)	71 (78%)

<b>Information Management Skills</b>	<b>Irrelevant</b>	<b>Slightly relevant</b>	<b>Moderate relevant</b>	<b>Very relevant</b>	<b>Extremely relevant</b>	<b>RELEVANT</b>
Find information stored in the clinical information system to guide patient care such as standardised care plans and guidelines	1 (1,1%)	8 (8,8%)	15 (16,5%)	28 (30,8%)	39 (42,9%)	67 (73,6%)
Use electronic communication with colleagues, patients, or other department	2 (2,2%)	11 (12,1%)	11 (12,1%)	31 (34,1%)	36 (39,6%)	67 (73,6%)
Use electronic health record and other clinical information system as per organisational policy for document	2 (2,2%)	12 (13,2%)	15 (16,5%)	27 (29,7%)	35( 38,5%)	62 (68,1%)
Use information technology as a primary means of patient safety such as bedside laboratory verification, bar code scanning, etc.	6 (6,6%)	10 (11%)	13 (14,3%)	25( 27,5%)	37 (40,7%)	62 (68,1%)

#### 4.5.4 Overall relevance ratings of nursing informatics skills

Relevance of the computer literacy skills (4.23 sd 0.8) were rated higher than information management skills (4.0 sd 1.0) with informatics literacy skills rated lowest (3.9 sd 1.0) (Table 12).

**Table 12: Average nursing informatics domain relevance scores**

	Minimum	Maximum	Mean	Std. Deviation
Computer literacy	2.00	5.00	4.23	0.78
Information management	1.00	5.00	4.01	0.97
Informatics literacy	1.31	5.00	3.91	0.97

The highest rated nursing informatics relevance was *Create, rename, move, and delete files using computer operating systems such as Microsoft Windows* and *Use the internet to locate and download items of interest* (4.4 sd 0.9) with the lowest rated competency being *Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing systems* (3.6, sd 1.4).

**Table 13: Relevancy of nursing informatics skills with >75% of respondents rating these as very or extremely relevant**

<b>Nursing informatics competencies</b>	<b>RELEVANT</b>
Use software to create presentations such as Microsoft PowerPoint	74 (81,3%)
Use of telecommunication tools such as electronic mail and facsimile (fax)	74 (81,3%)
Create, rename, move, and delete files using computer operating systems such as Microsoft Windows	73 (80,2%)
Use the Internet to locate and download items of interest	72 (79,1%)
Use word processing function such as save, categorise documents, copy, paste, and delete	72 (79,1%)
Recognise the basic components of the computer system such as mouse, screen, and workstation	72 (79,1%)
Use external devices such as USB flash drive, digital camera, CDROM	71 (78%)
Protect confidential patient data by logging out, suspending sessions, and password protection	71 (78%)
Use of remote communication tools such as Skype, Zoom, WhatsApp, Hangout, etc.	70 (76,9%)
Use nursing data for improving practice and for clinical decision making	70 (76,9%)

The nursing informatics skill with the highest level of agreement on relevance as very and extremely relevant was *Use software to create presentations such as Microsoft PowerPoint* (74, 81.3%) and the lowest was *Use medication administration tools such*

as *barcode medication verification and scanning* (51, 56%). However, only ten skills were rated as very or extremely relevant by 75% or more of the respondents (Table 13)

#### **4.6 Perceived levels of competence in computer literacy skills, informatics skills and information management skills for nursing students**

Respondents were asked to rate their level of competence in the 31 nursing informatics skills using a scale of novice (not competent), advanced beginners (somewhat competent), competent, proficient (very competent) and expert.

##### **4.6.1 Perceived competence levels of computer literacy skills**

A total of ten (10) computer literacy skills were rated in terms of competence for effective nursing practice (Table 14) scoring an average of 4.15 sd 0.8 for competence.

###### **4.6.1.1 Average competence ratings**

The mean scores obtained for perceived competence in computer literacy skills ranged between 4.3, sd 0.9 to 3.8, sd 1.2. The highest mean competence scores were obtained *Use word processing function such as save, categorise documents, copy, paste, and delete* (4.3, sd 0.9); *Create, rename, move, and delete files using computer operating systems such as Microsoft Windows* (4.3, sd 1.0), and *Recognise the basic components of the computer system such as mouse, screen, and workstation* (4.3, sd 0.9); and *Use software to create presentations such as Microsoft PowerPoint* (4.3, sd 0.9) (Table 11).

The lowest mean competence score was obtained for *Manage computer systems security to protect data, devices, and passwords* (3.8 sd 1.2) (Table 14)

**Table 14: Mean level of perceived competence of computer literacy skills for effective nursing care**

<b>Competency</b>	<b>Mean(sd)</b>
Use word processing function such as save, categorise documents, copy, paste, and delete	4,3 (0,9)
Create, rename, move, and delete files using computer operating systems such as Microsoft Windows	4,3 (0,9)
Recognise the basic components of the computer system such as mouse, screen, and workstation	4,3 (1)
Use software to create presentations such as Microsoft PowerPoint	4,3 (0,9)
Use of telecommunication tools such as electronic mail and facsimile (fax)	4,2 (1)
Use of remote communication tools such as Skype, Zoom, WhatsApp, Hangout, etc.	4,2 (0,9)
Use external devices such as USB flash drive, digital camera, CDROM	4,2 (0,9)
Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and printing	4 (1,1)
Navigate computer operating systems to access installed applications and choose active printers	4 (1,1)
Manage computer systems security to protect data, devices, and passwords	3,8 (1,2)

#### **4.6.1.2 Level of competence**

Competence was rated when respondents rated themselves as competent, proficient, or expert, the variation in these ratings can be seen in Table 15. The highest competent rating for computer literacy skills was for *Use word processing function such as save, categorise documents, copy, paste, and delete* (89, 97.8%) and *Use software to create presentations such as Microsoft PowerPoint* (89, 97.8%) (Table 12). The least perceived competence was for *Manage computer systems security to protect data,*

devices, and passwords (78 (85.7%). No skills were rated as not competent using a cut off of <75% of respondents (Table 15).

**Table 15: Level of perceived competence of computer literacy skills for effective nursing care**

Computer literacy skills	Novice	Advanced beginner	Competent	Proficient	Expert	COMETENT	NOT COMPETENT
Use word processing function such as save, categorise documents, copy, paste, and delete	0 (0%)	2 (2,2%)	20 (22%)	15 (16,5%)	54 (59,3%)	89 (97,8%)	2 (2,2%)
Use software to create presentations such as Microsoft PowerPoint	0 (0%)	2 (2,2%)	20 (22%)	22 (24,2%)	47 (51,6%)	89 (97,8%)	2 (2,2%)
Create, rename, move, and delete files using computer operating systems such as Microsoft Windows	1 (1,1%)	2 (2,2%)	17 (18,7%)	18 (19,8%)	53 (58,2%)	88 (96,7%)	3 (3,3%)
Use of remote communication tools such as Skype, Zoom, WhatsApp, Hangout, etc.	1 (1,1%)	2 (2,2%)	21 (23,1%)	21 (23,1%)	46 (50,5%)	88 (96,7%)	3 (3,3%)
Recognise the basic components of the computer system such as mouse, screen, and workstation	1 (1,1%)	4 (4,4%)	19 (20,9%)	11(12,1)	56 (61,5%)	86 (94,5%)	5 (5,5%)
Use external devices such as USB flash drive, digital camera, CDROM	0 (0%)	5 (5,5%)	19(20,9)	23(25,3)	44(48,4)	86 (94,5%)	5(5,5%)
Use of telecommunication tools such as electronic mail and facsimile (fax)	1 (1,1%)	6 (6,6%)	16 (17,6%)	17 (18,7%)	51 (56%)	84 (92,3%)	7 (7,7%)
Navigate computer operating systems to access installed	4 (4,4%)	3 (3,3%)	23 (25,3%)	22 (24,2%)	39 (42,9%)	84 (92,3%)	7 (7,7%)

Computer literacy skills	Novice	Advanced beginner	Competent	Proficient	Expert	COMETENT	NOT COMPETENT
applications and choose active printers							
Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and printing	3 (3,3%)	7 (7,7%)	21 (23,1%)	17 (18,7%)	43 (47,3%)	81 (89%)	10 (11%)
Manage computer systems security to protect data, devices, and passwords	4 (4,4%)	8 (8,8%)	23 (25,3%)	20 (22%)	35 (38,5%)	78 (85,7%)	12 (13,2%)

#### 4.6.2 Perceived competence of informatics literacy skills

A total of 13 informatics literacy skills were rated in terms of competence for effective nursing practice (Table 16) scoring an average of 2.96 (0.9) for competence.

##### 4.6.2.1 Average competence ratings

The mean scores obtained for perceived competence in informatics literacy skills ranged between 4.4, sd 1.0 to 2.4, sd 1.2. The highest mean competence scores were obtained *Use the internet to locate and download items of interest* (4.4, sd 1.0) (Table 13). The lowest mean competence score was obtained for *Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing units*

(3.8 sd 1.2) (Table 16).



**Table 16: Mean level of perceived competence of informatics literacy skills for effective nursing care**

<b>Informatics Literacy skills</b>	<b>Mean (sd)</b>
Use the Internet to locate and download items of interest	4,4 (1)
Use electronic systems to assist with admission and discharge process	3,7 (5,6)
Collect and electronically document patient signs, height, and weight	3,4 (1,4)
Continue patient care documentation and patient identification when computer system is down	3,2 (1,2)
View trended electronic documentation to understand the effectiveness of nursing interventions	3,2 (1,1)
Conduct literature searches in the accessible proprietary database systems such as CINAHL, EBSCO, etc.	2,8 (1,4)
Review electronic point of care data such as urine monitoring data relevant to care such as vital sdiptest, glucose check, and hemoglobin meter, bloods to make timely decisions	2,8 (1,4)
Navigate patients' electronic health records	2,7 (1,4)
Review and acknowledge patient orders in an electronic health record	2,7 (1,5)
Respond appropriately to alerts from clinical decision-making tools such as algorithms, best practice alerts	2,6 (1,3)
Use medication administration tools such as barcode medication verification and scanning	2,6 (1,3)
Develop and document care plan in electronic health record	2,5 (1,4)
Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing units	2,4 (1,2)

#### **4.6.2.2 Level of competence**

Competent was rated when respondents rated themselves as competent, proficient, or expert, the variation in these ratings can be seen in Table 14. The highest competent rating for computer literacy skills was for *Use the internet to locate and download items of interest* (86, 94.5%) (Table 14). The least perceived competence was for *Develop and document care plan in electronic health record* (42 (46.2%). Only three skills were rated as competent using a cut off of  $\geq 75\%$  of respondents, namely: *Use the internet*

*to locate and download items of interest; continue patient care documentation and patient identification when computer system is down; and View trended electronic documentation to understand the effectiveness of nursing interventions (Table 17).*

**Table 17: Level of perceived competence of informatics literacy skills for effective nursing care**

<b>Informatics Literacy skills</b>	<b>Novice</b>	<b>Advanced beginner</b>	<b>Competent</b>	<b>Proficient</b>	<b>Expert</b>	<b>COMETENT</b>	<b>NOT COMPETENT</b>
Use the Internet to locate and download items of interest	1 (1,1%)	4 (4,4%)	13 (14,3%)	15 (16,5%)	58 (63,7%)	86 (94,5%)	5 (5,5%)
Continue patient care documentation and patient identification when computer system is down	11 (12,1%)	10 (11%)	33 (36,3%)	21 (23,1%)	16 (17,6%)	70 (76,9%)	21 (23,1%)
View trended electronic documentation to understand the effectiveness of nursing interventions	9 (9,9%)	12 (13,2%)	37 (40,7%)	20 (22%)	13 (14,3%)	70 (76,9%)	21 (23,1%)
Use electronic systems to assist with admission and discharge process	8 (8,8%)	14 (15,4%)	37 (40,7%)	20 (22%)	11 (12,1%)	68 (74,7%)	22 (24,2%)
Collect and electronically document patient signs, height, and weight	11 (12,1%)	12 (13,2%)	23 (25,3%)	16 (17,6%)	29 (31,9%)	68 (74,7%)	23 (25,3%)
Conduct literature searches in the accessible database systems such as CINAHL, EBSCO, etc.	20 (22%)	14 (15,4%)	24 (26,4%)	17 (18,7%)	14 (15,4%)	55 (60,4%)	34 (37,4%)
Review electronic point of care data such as urine monitoring data relevant to care such as vital dipstick, glucose check, and hemoglobin meter, bloods to make timely decisions	23 (25,3%)	18 (19,8%)	18 (19,8%)	17 (18,7%)	14 (15,4%)	49 (53,8%)	41 (45,1%)

<b>Informatics Literacy skills</b>	<b>Novice</b>	<b>Advanced beginner</b>	<b>Competent</b>	<b>Proficient</b>	<b>Expert</b>	<b>COMETENT</b>	<b>NOT COMPETENT</b>
Navigate patients' electronic health records	27 (29,7%)	15 (16,5%)	21 (23,1%)	13 (14,3%)	15 (16,5%)	49 (53,8%)	42 (46,2%)
Respond appropriately to alerts from clinical decision-making tools such as algorithms, best practice alerts	27 (29,7%)	15 (16,5%)	22 (24,2%)	19 (20,9%)	8 (8,8%)	49 (53,8%)	42 (46,2%)
Use medication administration tools such as barcode medication verification and scanning	28 (30,8%)	14 (15,4%)	26 (28,6%)	14 (15,4%)	9 (9,9%)	49 (53,8%)	42 (46,2%)
Review and acknowledge patient orders in an electronic health record	28 (30,8%)	17 (18,7%)	17 (18,7%)	15 (16,5%)	14 (15,4%)	46 (50,5%)	45 (49,5%)
Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing units	32 (35,2%)	15 (16,5%)	28 (30,8%)	12 (13,2%)	4 (4,4%)	44 (48,4%)	47 (51,6%)
Develop and document care plan in electronic health record	32 (35,2%)	16 (17,6%)	18 (19,8%)	12 (13,2%)	12 (13,2%)	42 (46,2%)	48 (52,7%)

Just over a third (n=32, 35.2%) reported being novices in skills such as *Developing and documenting care plan in electronic health record* and *use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing units*. Closely 30.8% (n=28) also rated themselves as novices in reviewing and *Acknowledging patient orders in an electronic health record* and *use of medication administration tools such as barcode medication verification and scanning*.

### 4.6.3 Perceived competence levels of information management skills

A total of seven (7) information management skills were rated in terms of competence for effective nursing practice (Table 18) scoring an average of 3.2 (0.9) for competence.

#### 4.6.3.1 Average competence ratings

The mean scores obtained for perceived competence in information management skills ranged between 3.4, sd 1.1 to 2.4, sd 1.2. The highest mean competence scores were obtained *Protect confidential patient data by logging out, suspending sessions, and password protection* (3.4, sd 1.1); *find information stored in the clinical information system to guide patient care such as standardised care plans and guidelines* (3.4, sd 1.1); and *Use nursing data for improving practice and for clinical decision making* (3.4, sd 1.1) (Table 15). The lowest mean competence score was obtained for *Use electronic health record and other clinical information system as per organisational policy for documentation* (2.7 sd 1.4) (Table 18).

**Table 18: Mean level of perceived competence of information management skills for effective nursing care**

<b>Information management skills</b>	<b>Mean(sd)</b>
Protect confidential patient data by logging out, suspending sessions, and password protection	3,4 (1,1)
Find information stored in the clinical information system to guide patient care such as standardised care plans and guidelines	3,4 (1,1)
Use nursing data for improving practice and for clinical decision making	3,4 (1,1)
Use electronic communication with colleagues, patients, or other departments	3,3 (1,1)
Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation	3,3 (1,2)
Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.	2,9 (1,3)

Use electronic health record and other clinical information system as per organisational policy for documentation	2,7 (1,4)
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#### 4.6.3.2 Level of competence

Competence was rated when respondents rated themselves as competent, proficient, or expert, the variation in these ratings can be seen in Table 16. The highest competent rating for information management skills was for *Protect confidential patient data by logging out, suspending sessions, and password protection* (75, 82.4%) (Table 16). The least perceived competence was *Use electronic health record and other clinical information system as per organisational policy for documentation* (48(52.7%). Four skills were rated as competent using a cut off of  $\geq 75\%$  of respondents, namely: *Protect confidential patient data by logging out, suspending sessions, and password protection*; *Find information stored in the clinical information system to guide patient care such as standardised care plans and guidelines*; *Use nursing data for improving practice and for clinical decision making* and *Use electronic communication with colleagues, patients, or other departments* (Table 19)

**Table 19: Level of perceived competence of information management skills for effective nursing care**

Information management skills	Novice	Advanced beginner	Competent	Proficient	Expert	COMPETENT	NOT COMPETENT
Protect confidential patient data by logging out, suspending sessions, and password protection	5 (5,5%)	11 (12,1%)	33 (36,3%)	23 (25,3%)	19 (20,9%)	75 (82,4%)	16 (17,6%)
Find information stored in the clinical information system to guide patient care such as standardised	5 (5,5%)	13 (14,3%)	29 (31,9%)	29 (31,9%)	15 (16,5%)	73 (80,2%)	18 (19,8%)

<b>Information management skills</b>	<b>Novice</b>	<b>Advanced beginner</b>	<b>Competent</b>	<b>Proficient</b>	<b>Expert</b>	<b>COMPETENT</b>	<b>NOT COMPETENT</b>
care plans and guidelines							
Use nursing data for improving practice and for clinical decision making	5 (5,5%)	14 (15,4%)	29 (31,9%)	28 (30,8%)	15 (16,5%)	72 (79,1%)	19 (20,9%)
Use electronic communication with colleagues, patients, or other department	7 (7,7%)	15 (16,5%)	27 (29,7%)	28 (30,8%)	14 (15,4%)	69 (75,8%)	22 (24,2%)
Use data and statistical reports for unit based quality improvement initiatives and practice evaluation	7 (7,7%)	15 (16,5%)	32 (35,2%)	22 (24,2%)	15 (16,5%)	69 (75,8%)	22 (24,2%)
Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.	16 (17,6%)	22 (24,2%)	22 (24,2%)	20 (22%)	11 (12,1%)	53 (58,2%)	38 (41,8%)
Use electronic health record and other clinical information system as per organisational policy for documentation	23 (25,3%)	20 (22%)	18 (19,8%)	20 (22%)	10 (11%)	48 (52,7%)	43 (47,3%)

Thus a quarter of respondents (n=23 (25.27%)) rated themselves novice in the *Use of electronic health record and other clinical information system as per organisational policy for documentation* followed by 17.6% (n=16) in the *Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.*

#### 4.6.4 Overall competence ratings of nursing informatics skills

Competence of the computer literacy skills (4.2 sd 0.9) were rated significantly higher than information management skills (3.2 sd 1.0) with informatics literacy skills rated lowest (3.0 sd 1.0) (Table 20).

**Table 20: Average nursing informatics domain competence scores (n=91)**

	N	Minimum	Maximum	Mean	Std. Deviation
Computer literacy	91	2.00	5.00	4.15	0.82
Information management	91	1.00	5.00	3.19	0.93
Informatics literacy	91	1.23	5.00	2.96	0.93

The highest rated nursing informatics competence score was *Use the internet to locate and download items of interest* (4.4 sd 1.0) with the lowest rated competency being *Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing systems* (2.4, sd 1.2). The nursing informatics skill with the highest level of agreement competency was *Use software to create presentations such as Microsoft PowerPoint* (89, 97.8%) and the highest agreement of not competent was *Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing systems* (47, 51.6%). Eighteen skills were rated as competent by 75% or more of the respondents

## **4.7 Attitudes towards computerisation health care**

To measure attitudes, respondents were asked to describe their attitudes towards computerisation in health care by choosing the response that best reflect their attitudes for each statement in the tables below. Respondents were asked to respond by either strongly disagreeing, disagreeing, being neutral, agreeing and strongly agreeing. The five-point Likert scale was then recoded into two (2) variables, namely agree and disagree. The 20 statements were separated into 14 negative statements and six positive statements.

### **4.7.1 Positive attitudes towards computerisation in health care**

The six (6) positive attitudes reflect those statements that the respondents agreed with and with the highest score out of a possible score of five. The overall positive attitude score ranged from 4.0 (1.0) to 2.9 (1.2) with respondents' agreement with positive statements ranging from 29.7% up to 74.7% respondents agreed. The highest response rates were received for positive attitudes around *Paperwork for nurses can be reduced greatly using computers (68, 74.7%); Computers save steps and allow the nursing staff to become more efficient (63, 69.2%), and Computerisation of nursing data offers nurses a remarkable opportunity to improve patient care (59, 64.8%)*. The least positive score received was for the attitudes *Increased computer use will allow nurses more time*



to give patient care (42, 46.2%), and *Nursing data cannot be manipulated using computers* (27, 30%) (Table 21).

**Table 21: Positive Attitudes towards computerisation in health care for undergraduate nursing students**

<b>Positive Attitudes</b>	<b>Mean (sd)</b>	<b>Agree (%)</b>
Paperwork for nurses can be reduced greatly using computers	4 (1)	68 (74,7%)
Computers save steps and allow the nursing staff to become more efficient	3,8 (0,8)	63 (69,2%)
Computerisation of nursing data offers nurses a remarkable opportunity to improve patient care	3,7 (1)	59 (64,8%)
Computers make nurses jobs easier	3,6 (1,1)	52 (57,1%)
Increased computer use will allow nurses more time to give patient care	3,3 (1)	42 (46,2%)
Nursing data cannot be manipulated using computers	2,9 (1,2)	27 (29,7%)

#### **4.7.2 Negative attitudes**

The 14 negative attitudes reflect those statements that the respondents disagreed with and average scores out of five. Negative attitudes towards computerisation ranged from 89% to 49.5% and average scores of 2.0 to 3.3 out of 5. The highest level of disagreement was for *If I had my way, nurses would never have to use computers* (81, 89%), followed by *Computers should only be used in the financial department* (78, 85.7%), and *Computers represent a violation of patient privacy* (76, 83.5%) (Table 22).

**Table 22: Negative Attitudes towards computerisation in health care for final year undergraduate nursing students**

<b>Negative attitudes</b>	<b>Disagree %</b>	<b>Mean (sd)</b>
If I had my way, nurses would never have to use computers	81 (89%)	2,1 (1,2)
Computers should only be used in the financial department	78 (85,7%)	2 (1,1)
Computers represent a violation of patient privacy	76 (83,5%)	2,3 (1,2)
Because of computers, nurses will face more law suits	75 (82,4%)	2,7 (1,1)
The time spent using computers in health is out of proportion to the benefits	73 (80,2%)	2,5 (1,2)
Use of computers in health care increases costs by increasing the nurses workload	72 (79,1%)	2,5 (1,3)
Costs of health care are likely to increase because of computers	68 (74,7%)	2,7 (1,2)
Confidentiality will be sacrificed by patient records being computerized	67 (73,6%)	2,9 (1,2)
Computers can cause a decrease in communication between hospital departments	66 (72,5%)	2,8 (1,2)
Computers can cause nurses to give less time to quality nursing care	65 (71,4%)	2,9 (1,1)
Only one person at a time can use a computer terminal and, therefore, staff efficiency is inhibited.	60 (65,9%)	3 (1,2)
Orientation for new employees takes longer because of computers	60 (65,9%)	2,9 (1,3)
The more computers in an institution, the fewer the number of jobs for employees	53 (58,2%)	2,9 (1,3)
Computers contain too much personal data to be used in an area as open as a nursing station	45 (49,5%)	3,3 (1,2)

#### **4.8 Summary Chapter Four**

This chapter presented the results of the research survey done to investigate the perceived relevance and competence of several nursing informatics competency skills and attitudes towards nursing informatics of the nursing students at a selected university in the Western Cape. It presented the findings of the study as guided by the study objectives which will be further discussed in the next chapter. As evidenced by the results displayed in this chapter, the informatics skills with the highest relevance and competencies revolved around computer literacy skills which were rated significantly

higher than informatics literacy and information management skills. The results further presented the attitudes of respondents towards computerisation, as depicted by both positive and negative trends. Even though elements of negativity were evident, the overall trend of responses towards computerisation in health care was positive. An in-depth discussion of these attitudinal trends will follow in the next chapter.

## CHAPTER 5: DISCUSSION OF RESULTS

### 5.1 Introduction

The previous chapter (Chapter 4) presented findings of the survey to investigate the perceived relevance and competence and attitudes towards nursing informatics of the final year undergraduate nursing students at a selected university in the Western Cape. In this chapter, the discussion of the results is presented. This chapter discuss the key findings by linking them to the literature review and other research findings on similar studies. The discussions are presented in line with the research objectives of the study.

The main objectives of the study were:

1. To describe the perceived relevance of computer and informatics skills of nursing students at a selected university in the Western Cape.
2. To describe perceived levels of competencies in computer and informatics skills of nursing students at a selected university in the Western Cape.
3. To describe attitudes towards computerisation in health care of the nursing students at a selected university in the Western Cape.

In this study respondents were asked to rate the perceived relevance of nursing informatics and perceived competence in nursing informatics. This included questions on relevance and competence on computer literacy skills, informatics literacy skills and information management skills. In addition, respondents were asked to choose the response that best reflected their attitudes from 20 statements on computerisation in health care. The above-mentioned nursing informatics skills were defined as follows in the study:

- Computer literacy skills was described in the study as *the psychomotor skills to use computer tools, as well as knowledge of basic hardware and software functionality that are required for effective bedside nursing* (Schleyer et al., 2011).
- Informatics literacy skills was described as *the nurse's abilities to recognise the need for information and to retrieve, evaluate, and use information for patient care appropriately* (Schleyer et al., 2011).
- Information management skills was described as *ability to apply data to support clinical decisions, documentation, ensuring data integrity, confidentiality, and security* (Schleyer et al., 2011).

## **5.2 Perceived relevance of computer literacy skills, informatics literacy skills and information management skills for nursing practice**

The need for student nurses to be well prepared for the use and application of information technology in nursing is arguably important (Mills, Francis, McLeod, and Al-Motlaq., 2015). The results showed that overall respondents agreed that nursing informatics skills are relevant to nursing with average ratings of relevance of 4 – 4.4 out of a possible score of 5.

### **5.2.1 Relevance of computer literacy skills**

The relevance of the computer literacy skills (4.23 sd 0.8) was rated higher than information management skills (4.0 sd 1.0), with informatics literacy skills being rated

lowest (3.9 sd 1.0). This may be attributed to the fact that the use of information technologies such as computers, electronic health monitors (for example, electronic blood pressure machines, electro cardio machines), remote high-tech surveillances, and imaging technologies, amongst others, have become an integral part of daily nursing practice in health care settings (Schleyer et al., 2011). Telecommunication tools such as electronic mails, facsimiles (fax), WhatsApp groups, and Zoom meetings are also used daily in hospitals and other health care settings as methods of communication (Mills et al., 2015). It is possible that exposure of respondents to these skills in the clinical environment may have enhanced their perceived relevance of these skills for effective nursing.

The higher relevance in computer literacy skills is supported by a study by Mills, Francis, McLeod, and Al-Motlaq (2015) of Australian rural nurses and midwives that aimed to increase basic computer skills such as the utilisation of common computer software, the use of the internet and the enhancement of email communications. The study demonstrated that respondents identified the relevance of computer literacy skills and indicated that increased confidence led to increased access to contemporary, reliable, and important information on the internet, and health personnel adopting emails and facsimile as a regular method of communication (Mills et al., 2015).

The computer literacy skills, that achieved the highest ratings for relevance, were rated as very or extremely relevant for effective nursing practice by 81.3% (n=74) of the respondents, included the use of electronic mail and facsimile; use of software to create presentations; and creating, renaming, moving, and deleting of files using computer

operating systems such as Microsoft Windows. Some of these results augments the importance of telecommunication tools such as emails, zoom meetings and remote surveillance technology which allows clinicians to communicate patient care easily and to move more efficiently between patients when rendering care (Rincon et al., 2018). In addition, telecommunication tools allow more information to be gathered and patients can be better monitored for adverse events, as well as ensuring compliance with best practices (Koivunen & Saranto, 2018). Hence, health institutions and nursing teaching organisations need to make sure that practicing nurses and nursing students have the relevant resources and support to use telecommunication tools in nursing practice (Koivunen & Saranto, 2018).

The computer literacy skill that achieved the lowest rating for relevance included the ability to manage computer systems security to protect data, devices, and passwords as rated by 67% (n=61) of respondents. Respondents therefore perceived themselves as less literate in this skill. This is to be expected as many information technologies are designed by information technology specialists who may lack knowledge on aspects of safety and security in nursing and hence may not integrate these into the software (Rincon et al. 2018). Since the overall goal of information technology in nursing is to improve quality care and patient safety, this proves that there is an urgent need for nurses to be directly involved in software design to ensure that the essence and complexity of nursing is not lost in the system (Kowitlawakul, 2011). This may simultaneously enhance their knowledge on the management of technologies such as

telecommunication systems, as well as increase the relevance of these systems in ensuring the safety and security of patient data. (Rincon et al., 2018).

### **5.2.2 Relevance of information management skills**

The overall relevance rating for Information management skills was (4.0 sd 1.0), the second highest rating among the three informatics skill categories. Skills that were rated as very or extremely relevant for effective nursing practice, included protecting confidential patient data by logging out, suspending sessions, and password protection as evidenced by 78% (n=71) of agreement level by respondents. This was followed by the use of nursing data for improving practice and for clinical decision making (70, 76,9%). Being able to apply data to support clinical decisions and documentation, ensuring data integrity, confidentiality, and security were therefore perceived as most relevant by respondents in this category. Schleyer et al. (2011) confirmed the value of clinical decision-making tools such as computerised monitor alerts and reminders to care providers and patients, as well as online clinical guidelines and computerised imaging, and how these impact positively on improving care quality, patient safety, and rendering efficient and effective health care. When nurses acknowledge the importance of incorporating these clinical decisions making informatic tools into their daily practice, it will be highly relevant and beneficial to patient outcomes (Kossman & Scheidenhelm, 2008).



### **5.2.3 Relevance of informatics literacy**

The lowest overall rating for relevance (3,9 sd 1.0) was achieved for Informatics literacy. The use of the Internet to locate and download items of interest was rated as very to extremely relevant for nursing care (79.1%, n=72), and was the highest rating for Informatics literacy skills. Good Internet access and connectivity is commonly adequate in urban hospitals, which additionally may improve the use of electronic health records to save and retrieve and communicate patient information (Xu, 2016). As respondents have done their clinical practice in mostly urban health care settings, it may have contributed to their increased level of perceived relevance of this skill. These findings are further emphasized by a study that highlighted the relevance of informatics literacy skills to the nursing profession, as perceived by nurses in a Nigerian academic hospital (Agu, Eze, & Obi, 2015). The study revealed the usefulness and importance of informatics literacy skills in the monitoring of patients, nursing documentation, clinical decision making, nursing diagnosis, sources of information, conducting of research, and management of human resources (Agu et al., 2015).

Informatics skills perceived as irrelevant included the use of medication dispensing systems, or other electronic pharmacy dispensing units by 12.2% (n=11) of the respondents; followed using medication administration tools such as barcode medication verification and scanning by 9.9% (n=9) of the respondents; and responding appropriately to alerts from clinical decision-making tools such as algorithms, best practice alerts by 7.7% (n=7) of the respondents. This may be due to the lack of availability of these systems in South African hospitals (Bhebe & Harpe, 2013). Even

though South Africa has started to prioritise ICT to improve health services provision, the public health system lacks a functional health information system due to fragmentation and a lack of coordination, manual systems, complete or partial lack of automation, and mixing of paper-based and computerised systems (SA Health Strategy, 2012).

### **5.3 Perceived competence of computer literacy skills, informatics literacy skills and information management skills for nursing students**

Competence in computer and informatics skills is important to deliver safe and quality care in any health care setting and has become a clinical requirement in health care (TIGER, 2012). Competence of the computer literacy skills (4.2 sd 0.9) were rated significantly higher than information management skills (3.2 sd 1.0) with informatics literacy skills rated lowest (3.0 sd 1.0).

#### **5.3.1 Perceived competence in computer literacy skills**

Even if only 28.6% (n=26) of respondents have attended computer training, most respondents perceived themselves to be competent in computer literacy skills (being the highest rated competency). The highest competent rating for Computer Literacy Skills was for use word processing function such as save, categorise documents, copy, paste, and delete (89, 97.8%), and use of software to create presentations such as Microsoft PowerPoint (89, 97.8%). All the computer literacy skills were rated as competent with scores of four or more, except for managing security and passwords.

Computer literacy skills are the most basic skills that these undergraduate nursing respondents have been equipped with, as these skills form part of the orientation to their nursing programme (Swing & International CBME Collaborators, 2010). During such orientation, students are introduced to the basic skill of how to navigate the computer, the use of the internet and other software (Achampong, 2017). These skills are also applied by students when they are exposed to basic health technology in the clinical environment during their practical training. In the same vein, the integration of new informatics skills often takes place on a more regular basis in the workplace environment so practicing nurses' performance may be even more efficient if standardised informatics orientation programmes were also available in the practical setting (Kristina, 2017). As in the case of relevance of computer literacy skills, the least perceived competence was for manage computer systems security to protect data, devices, and passwords (78, 85.7%), which may further point to the lack of nurse involvement in the software design of health systems (Kowitlawakul, 2011).

### **5.3.2 Perceived competence in information management skills**

Information management skills achieved the second highest overall rating for perceived competence among respondents (3.2 sd 1.0). The highest competent rating for information management skills was for protect confidential patient data by logging out, suspending sessions, and password protection (75, 82.4%). Schleyer et al. (2011) emphasised that nursing students need to be competent in the use of data and ability to maintain data confidentiality and use of data for improving practice and for clinical

decision making. The least perceived competence was for the use of electronic health records and other clinical information systems as per organisational policy for documentation (n= 48 (52.7%). A quarter of respondents (n=23 (25.27%) rated themselves novice in the use of electronic health records and other clinical information systems as per organisational policies for documentation; followed by 17.6% (n=16) in the use of information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc. A possible explanation for this trend may be the fact that respondents have not been exposed to many of these health technologies in their practical training environment (Hussey & Kennedy, 2016). Further to this, several health care settings are still experiencing difficulty in the integration and implementations of information technologies (Choi, 2012). Other health facilities may have digital technologies that are under-utilised when nurses lack the motivation and willingness to acquire experience of digitalisation in their professional context (Kinnunen, et al., 2017). Ineffective implementation of electronic documentation, and a lack of capacity to produce adequate data and information for management and monitoring of healthcare services may all be factors that will be further aggravated if nurses lack adequate knowledge and skills to effectively use healthcare technology in different healthcare settings (SA eHealth Strategy, 2012). Collegial and organisational support is necessary when new technologies are implemented as this may improve the nurses competence (Konttila, Siira, Kyngäs, Lahtinen, Elo, Kääriäinen, Kaakinen, Oikarinen, Yamakawa, Fukui, and Utsumi, 2019).

### **5.3.3 Perceived competence in informatics literacy skills**

The overall competence rating for informatics literacy skills were the lowest (3.0 sd 1.0). Ray (2017) felt that informatics literacy skills are needed to operate computerised medical equipment such as blood pressure machines, heart monitors, intravenous dispensers and scales that rely on computers to take measurement. Nurses need these informatics literacy skills to operate complicated computerised testing equipment, monitor patient progress, and record and retrieve important medical information from these health information technologies (Konttila et al., 2019). The highest competent rating for informatics literacy skills was for use of the internet to locate and download items of interest (86, 94.5%) This may possibly be because the university has free Wi-Fi and students use their cell phones and computers to access and download information and, thus using the internet is not new to them.

The least perceived competence was to develop and document care plan in electronic health record (42, 46.2%). This finding is supported by a study by Kowitlawakul, Chan, Pulcini and Wang (2015) on factors influencing nursing students' acceptance of electronic health records for a nursing education software programme, which revealed that students were not competent in this discipline. One of the reasons for this could be because these components were not in their nursing education curricula, thus influencing their attitude towards use and their perception that it was less important in nursing practice (Kowitlawakul, et al. 2015). Over a third of respondents (n=32, 35.2%) reported being novices at the use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing units, while 30.8%

(n=28) also rated themselves as novices in reviewing and acknowledging patient orders in an electronic health record, and the use of medication administration tools such as barcode medication verification and scanning. Respondents may have rated themselves less competent because the use of these services were not part of their learning environment, and because they were not exposed to these practices during their four-year clinical training.

#### **5.4 Attitudes towards computerisation in health care for the nursing students**

Computerised technological interventions exist in different sections of health care, such as telehealth and mHealth in primary health care, and are used in the prevention, treatment and aftercare of different illnesses (Musiat, Goldstone, & Tarrier, 2014; Blaya, Fraser, & Holt, 2010). However, despite the existence of numerous effective technological interventions, the transition of computerised interventions into health care has been slow, or there may have been poor system design in facilities (Huryk, 2010).

Even with the substantial, and ever increasing, evidence suggesting successful implementation of hospital information systems, minimal studies have been done on nursing staff's acceptance of technological interventions to identify their attitudes towards computer use (Huryk, 2010). Studies revealing the attitudes of nurses towards computerisation in health care may be helpful in identifying factors influencing their attitudes and may help to develop strategies to address undesirable factors hindering the successful implementation of informatics in nursing care (Kipturgo, Kivuti-Bitok, Karani, & Muiva, 2014).

The findings in this study also highlights the attitudes of nursing students towards computerisation in health care by highlighting the differences between respondents' positive and negative attitudes towards the use of computers in health care.

#### **5.4.1 Positive attitudes towards computerisation in health care**

The highest response rates received for positive attitudes revolves around *paperwork for nurses can be reduced greatly using computers (68, 74.7%); computers save steps and allow the nursing staff to become more efficient (63, 69.2%), and computerisation of nursing data offers nurses a remarkable opportunity to improve patient care (59, 64.8%)*.

This result indicates that the respondents favor the presence of computers in health care settings and understand that if there is competence and awareness of data handling and protection, computers are safe to use in health care settings. These findings agree with a study on nurses' computer literacy skills and their attitudes towards the use of computers in health care (Gürdaş, Topkaya & Kaya, 2015). Their study indicated that nurses generally had positive attitudes towards computers, and that their computer literacy skills were adequate. The nurses also perceived computers as an effective and beneficial part of the health care system and regarded it as a necessary means to help nurses improve their computer competency (Gürdaş Topkaya & Kaya, 2015). Moreover, computer education and experience were found to be a significant factor contributing to nurses' positive attitude towards computers (Vijayalakshmi & Math, 2013).

#### 5.4.2 Negative attitudes towards computerisation in health care

The highest level of disagreement was for *if I had my way, nurses would never have to use computers* (81, 89%), followed by *computers should only be used in the financial department* (78, 85.7%), and *computers represent a violation of patient privacy* (76, 83.5%). Given the fact that informatics has been lacking in the respondents' curriculum and their lack of exposure during clinical training these respondents may be showing elements of resistance to computer use in health care. Furthermore, there could also have been an effect due to computer training. Chow, et al. (2014) noted in a study that respondents who did not undergo computer training felt that computers were frustrating to use, and hence they ignored the importance of computers in providing care and this affected their attitudes towards its use. The adoption of computer technology to provide healthcare is increasing progressively, However, its implementation may be hampered in unprepared public hospitals and nursing institutions (Nkosi, Asah & Pillay, 2011; SA eHealth strategy, 2012).

Various studies have revealed that factors such as a lack of access to computers and computer skills, lack of internet access, nurse shortages which reduce the time nurses have to use the computer, lack of support and faulty informatics systems, and a view that computers may dehumanise patient care, are all factors that may aggravate nurses' negative attitudes towards computers in health care (Daniel & Oyetunde, 2013; Vijayalakshmi & Math, 2013; Gürdaş Topkaya & Kaya, 2015).



Overall, the attitudes of the respondents in this study were positive. To improve nurses' attitudes towards computerisation in health care, Vijayalakshmi and Math (2013) suggested that the integration of informatics throughout nursing curricula with increasing levels of difficulty is needed. This may be helpful to decrease computer anxiety and ensure strengthening of computer knowledge and skills. In addition, the creation of a better practical and educational environment that supports the use for HIT may influence the attitudes of students positively.

## **5.5 Conclusion**

This chapter discussed the results by linking them to the literature review and other research findings on similar studies. The discussions showed that computer literacy skills, informatics literacy skills and information management skills are relevant to nursing. The discussions also revealed that students show positive attitudes towards computerisation in health care. In the following chapter the conclusion and recommendations for this study will be discussed.

## **CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS**

### **6.1 Introduction**

The study investigated the perceived relevance, level of competence and attitudes towards nursing informatics of the nursing students at a selected university in the Western Cape. The study was done through the literature review as a secondary study and the survey of a sample of 91 nursing students currently enrolled at the selected school of nursing at a university in the Western Cape. The study was guided by the following objectives:

1. To describe the perceived relevance of computer and informatics skills for nursing of the nursing students at a selected university in the Western Cape.
2. To describe the levels of competence in computer and informatics skills for nursing of the nursing students at a selected university in the Western Cape.
3. To describe attitudes towards computerisation in health care for the nursing students at a selected university in the Western Cape.

Following the results and findings of the primary survey presented in chapter 4 and discussed in chapter five, chapter six presents a summary of key findings and give recommendations for future action.

### **6.2 Key findings**

The study makes the following conclusions in addressing each of the objectives:

**6.2.1 Objective 1:** In describing the perceived relevance of nursing informatics skills at a selected university in the Western Cape, respondents reported that nursing informatics skills were rated as highly relevant with computer literacy skills rated most relevant in nursing followed, by information management skills and informatics literacy skills. The most relevant computer literacy skills were skills such as use of telecommunication tools such as electronic mail and facsimile (fax) and use of software to create presentations such as Microsoft PowerPoint (74,81.3%), rated highest. These findings may relate to a study by Salahuddin and Ismail (2015) that emphasised that the recognition of the relevancies of computers in health care, willingness of computer use while studying, and the increase use of information technologies in hospitals and health care delivery, is an effective part of health care.

**6.2.2 Objective 2:** In describing the levels of competence in nursing informatics skills at a selected university in the Western Cape, the perceived competence in these skills were rated lower than the perceived relevance in computer literacy, informatics literacy and information management skills. Levels of competencies were rated high in computer literacy skills, followed by lower ratings for information management skills, and lastly informatics literacy skills. The higher ratings of competence in computer skills may be contributable to a small portion of respondents (4,4%) having received some form of computer training, though this cannot be confirmed. The low levels of reported competence in information management skills and information literacy skills highlight the need to ensure adequate practical exposure and training in these areas. It is important that nursing students have the ability to recognise the need for information,

how to retrieve, evaluate, and use information for patient care appropriately and apply this data to support clinical decisions, documentation and to ensuring confidentiality, and security. As prospective nursing practitioners, these students will soon form part of the largest user-group of healthcare technology, therefore making its use essential for both their practice and patient outcomes (Abu Raddaha, 2018; Jeon et al. 2016; Olajubu, Irinoye, & Olowokere, 2014).

**6.2.3 Objective 3:** In describing the attitudes towards computerisation in health care for the nursing students at a selected university in the Western Cape, overall, respondents reported more positive attitudes than negative attitudes towards computers in nursing. This may reflect an awareness among respondents about the benefits of computers in the workplace in supporting the nursing workforce to effectively manage their workload. It is this kind of realisation that will help nurses to capitalise on the benefits of computerised information (Fagerström et al. 2017) because of their higher levels of confidence and a willingness to use healthcare technology in the work environment (Heidarizadeh, Rassouli, Manoochehri, Tafreshi, & Ghorbanpour, 2017).

### **6.3 Recommendations**

Considering the findings and conclusions arrived at in this study, the following recommendations are put forward:

### 6.3.1 Nursing Education Recommendations

- *The university need to review the nursing curriculum and consider integrating nursing informatics skills such as computer literacy skills, informatics literacy skills and information management skills in terms of the relevance of nursing informatics in health care.*

Incorporating these skills into the nursing curriculum, will also help students to understand how NI integrates nursing science, computer science and information science to manage and communicate data, information, and knowledge in nursing practice (Jeon et al. 2016; Staggers, Gassert, & Curran, 2001; Staggers & Thompson, 2002).

- *Incorporating nursing informatics skills (not viewed as highly relevant) in the nursing curriculum*

Specific nursing informatics skills such as: managing and navigating of computer systems security to protect data; use electronic health records to develop and document care plans; use of medication administration tools and dispensing tools; ensuring patient safety using bedside laboratory verification, barcode scanning, though perceived as less relevant, should be given more focus in curricula for students to acknowledge their importance in nursing care.

- *Upskill preceptors in nursing informatics skills to ensure role modeling*

For the institution to prepare future nurses to become more competent in this era of information technology, the role of clinical preceptors in the reviewed

curriculum should also include orientating and training students on the nursing informatics present in hospitals. Specific focus should be on nursing informatics such as informatics literacy skills and informatics management where students lack competence. The SA eHealth Strategy (2012) encourages the training and capacity building of nursing staff in NI to ensure that enough skilled practitioners are available to support the delivery of the eHealth strategy in the country.

- *Early introduction of nursing informatics skills to build familiarity*

Nursing informatics skills for nursing students and nurses must be introduced early in nurses' training curriculum during the undergraduate stage and as continuing education, training and simulation teaching. Early orientation to nursing informatics in nursing training may positively improve students' competence in nursing informatics and change student's attitudes towards informatics use in health care. This is important for the future of nurses in the workplace, be it as a student or eventually as a practicing nurse, as they cannot be expected to exhibit informatics competencies if basic informatics education is lacking throughout the course of a nursing programme. Nursing curricula should thus aim to incorporate present needs as well covering future demands, to facilitate nursing in the 21st century (Kaur & Rawat, 2015).

### **6.3.2 Nursing Practice recommendations**

- *Competent graduates skilled in nursing informatics competencies will support*

### *competent nurse practice*

It will be imperative to equip nursing students with the necessary knowledge and skills to use new and emerging digital tools that will support their practice, for example, high frequency ventilators, electronic health records (EHRs), electronic medication administration, and so forth (Collins et al. 2017).

### **6.3.3 Nursing Research recommendations**

- Studies of nursing informatics competencies in post graduate students should be conducted to compare undergraduate and postgraduates' perceived competence in nursing informatics competencies skills.
- Studies should be conducted on the perceived relevance and competence for nurses in practice on the nursing informatics competencies.
- Identifying core NICs for professional nursing practice, may help to identify job-specific competencies for future nurses (Collins, Yen, Phillips, & Kennedy, 2017).
- Surveys about the type of technology used in hospitals should be carried out to guide the integration of nursing informatics in the university nursing curriculum.
- An investigation of the factors that contribute to attitudes towards computer use in health care and understanding of nurses' attitudes toward computerisation in the hospitals in South Africa should be conducted.
- Research should be conducted on the development of nursing informatics competencies at all level of practice from student to experts such as nurse informatics specialists.

#### **6.4 Conclusion of the study**

This study showed that computer literacy skills, informatics literacy skills and information management skills are relevant to nursing. However, the absence of computer and informatics training in the curriculum may not adequately prepare student nurses for practice when exposed to computerisation in health care. This study can help to increase the emphasis of informatics in nursing practice and its results can be used to facilitate nursing in the 21st century by guiding new curricular developments in nursing education programmes.



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## APPENDICES

### Appendix 1: Ethical clearance



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20 April 2017

Ms J Agabus  
School of Nursing  
Faculty of Community and Health Sciences

**Ethics Reference Number:** HS17/1/27

**Project Title:** Nursing informatics competencies in nursing students in a university in the Western Cape

**Approval Period:** 19 April 2017 – 19 April 2018

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval. Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

A handwritten signature in black ink, appearing to read 'Patricia Josias'.

*Ms Patricia Josias  
Research Ethics Committee Officer  
University of the Western Cape*

**PROVISIONAL REC NUMBER - 130416-049**

## Appendix 2: Permission to collect data from the Registrar



**STUDENT  
ADMINISTRATION**  
Administration Building, 1<sup>st</sup> Floor  
ashaikjee@uwc.ac.za, nschoeman@uwc.ac.za  
021 959 2110

04 May 2017

Dear Jakobina Foibe Agubus

**RE: PERMISSION TO CONDUCT RESEARCH AT THE UNIVERSITY OF THE WESTERN CAPE**

As per your request, we acknowledge that you have obtained the necessary permissions and ethics clearances and are welcome to conduct your research as outlined in your proposal and communication with us.

Please note that while we give permission to conduct such research (i.e. interviews and surveys) staff and students at this University are not compelled to participate and may decline to participate should they wish to.

Should you wish to make use of or reference to the University's name, spaces, identity, etc. in any publication/s, you must first furnish the University with a copy of the proposed publication/s so that the University can verify and grant permission for such publication/s to be made publicly available.

Should you require any assistance in conducting your research in regards to access to student contact information please do let us know so that we can facilitate where possible.

Yours sincerely

A handwritten signature in black ink, appearing to read "A. Shaikjee".

**DR AHMED SHAIKJEE  
DEPUTY REGISTRAR: ACADEMIC ADMINISTRATION  
OFFICE OF THE REGISTRAR**

### Appendix 3: Permission to conduct data from the Head of Department

Dear Ms Agabus (3614567)

RE: PERMISSION TO CONDUCT RESEARCH AT THE UNIVERSITY OF THE WESTERN CAPE

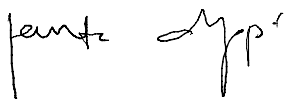
As per your request, we acknowledge that you have obtained all the necessary permissions and ethics clearances (HS17/1/27) and are welcome to conduct your research as outlined in your proposal and communication with the School of Nursing.

Please note that while we give permission to conduct such research (i.e. surveys) staff and students at this School are not compelled to participate and may decline to participate should they wish to.

Should you wish to make use of or reference to the School's name, spaces, identity, etc. in any publication/s, you must first furnish the School with a copy of the proposed publication/s so that the School can verify and grant permission for such publication/s to be made publicly available.

Should you require any assistance in conducting your research in regards to access to student contact information please do let us know so that we can facilitate where possible.

Yours sincerely



A/Prof Jennifer Chipps  
A/Director School of Nursing  
Faculty of Community and Health  
THE UNIVERSITY OF THE WESTERN CAPE

T: [+27 21 959 3024](tel:+27219593024)  
E: [jchipps@uwc.ac.za](mailto:jchipps@uwc.ac.za)

5/15/2017

#### Appendix 4: Permission to use the tool

On Sep 13, 2017 8:58 PM, "Jennifer-Anne Chips" <[jchipps@uwc.ac.za](mailto:jchipps@uwc.ac.za)> wrote:

----- Forwarded message -----

From: "AlphieRahman" <[arahima1@jhmi.edu](mailto:arahima1@jhmi.edu)>

Date: 13 Sep 2017 8:54 PM

Subject: RE: [FWD: Contact email for DrAlphonsaRahman]

To: "[jchipps@uwc.ac.za](mailto:jchipps@uwc.ac.za)" <[jchipps@uwc.ac.za](mailto:jchipps@uwc.ac.za)>

Cc: "[alphie12@gmail.com](mailto:alphie12@gmail.com)" <[alphie12@gmail.com](mailto:alphie12@gmail.com)>

Hello Jennifer,

Thank for reaching out to me and for your interest in NICAT. You have my permission to use the tool. I am interested in learning more about your project and let me know if you have any questions.

Alphie

**From:** Kairali of Baltimore [mailto:[info@kairaliofbaltimore.com](mailto:info@kairaliofbaltimore.com)]

**Sent:** Wednesday, September 06, 2017 8:01 AM

**To:** AlphieRahman<[arahima1@jhmi.edu](mailto:arahima1@jhmi.edu)>

**Cc:** AlphieRahman<[alphie12@gmail.com](mailto:alphie12@gmail.com)>

**Subject:** [FWD: Contact email for DrAlphonsaRahman]

----- Original Message -----

Subject: Contact email for DrAlphonsaRahman

From: Jennifer-Anne Chips<[jchipps@uwc.ac.za](mailto:jchipps@uwc.ac.za)>

Date: Tue, August 22, 2017 8:39 am

To: [info@kairaliofbaltimore.com](mailto:info@kairaliofbaltimore.com)

I am a Professor in Nursing in South Africa and am looking for a contact email for DrRahman.

We would like to ask permission to use a tool which she developed as part of her PHD work.

I hope you can assist me

Thank you

A/Prof Jennifer Chips

A/Director School of Nursing

Faculty of Community and Health

THE UNIVERSITY OF THE WESTERN CAPE



## Appendix 5: Information document



### UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa  
**Tel: +27 21-959 3024 Fax: 27 21-959 2679**  
**E-mail:3614567@myuwc.ac.za**

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### INFORMATION SHEET

#### **Project Title: NURSING INFORMATICS COMPETENCIES IN NURSING STUDENTS IN A UNIVERSITY IN THE WESTERN CAPE**

This is a research project being conducted by a Masters in Nursing Education student Jakobina Agabus at the University of the Western Cape. We are inviting you to participate in this research project because your university is one of the popular nurses training institution and you have been identified as a nursing informatics user. Due to the fact that you are a nursing student, you are expected to provide your self-reported competencies on nursing informatics accessed and used in your university and at the training hospital settings.

#### **What is nursing informatics?**

Nursing informatics is an integration of computer science, Information science and nursing science in nursing education and practice (Staggers et al., 2002). Defining it in lame words, nursing informatics is the use of information technologies such as,

computers, networks, cell phones, Personalised Digital Assistants in nursing education and during rendering of health care. This also includes the knowledge and the skills on the use of available packages of software's in the hospital environment, use of telehealth or telemedicine's in different health care arenas to render health care and use of information communication technologies in provision of health care.

The purpose of this research project is to investigate the competencies of the nursing student regarding nursing informatics and identify what needs to be improved or changed in our nursing education or training to improve and update the nursing informatics education to prepare you as a student for your future role and to strengthen the use of informatics in nursing by the users.

**What will I be asked to do if I agree to participate?**

You will be provided with a questionnaire and will be asked to none other than read the questionnaire and answer the questions, if need for clarification you are welcomed to ask the researcher on her presence or on provided contact details. The researcher will self-administer the questionnaires to the respondents; the study will be conducted within the university premises and will take the respondents not more than 15 minutes to complete the questionnaire. Questions that will be asked are more related to your informatics knowledge, skills and attitude towards use. However there is also a section of demographic data that needs to be completed by the respondent.

**Would my participation in this study be kept confidential?**

The researcher undertakes to protect your identity and the nature of your contribution, Anonymity will be maintained as respondents' will remain nameless and no names will

be entered on the questionnaire. Confidentiality will be assured as no information will be disclosed to any other person.

If we write a report or article about this research project, your identity will be protected because respondents and institutions names will not be identified in the report of publication.

In accordance with legal requirements and/or professional standards, we will disclose to the appropriate individuals and/or authorities information that comes to our attention concerning child abuse or neglect or potential harm to you or others. In this event, we will inform you that we have to break confidentiality to fulfil our legal responsibility to report to the designated authorities.

#### **What are the risks of this research?**

There may be some risks from participating in this research study as there are risks in every day's life. Any discomfort when completing the questionnaire is a psychological risk. You are advised to feel comfortable completing this questionnaire, and provide yourself reported knowledge and information on nursing informatics. Any discomfort when completing this questionnaire you are welcome to withdraw at any time and point.

All human interactions and talking about self or others carry some amount of risks. We will nevertheless minimise such risks and act promptly to assist you if you experience any discomfort, psychological or otherwise during the process of your participation in this study. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention.

### **What are the benefits of this research?**

The benefits to you include the fact that yourself reported competencies will be heard, changes and recommendations from you as a participant will be considered and adhered too. The findings will probe the institution to improve in nursing informatics teaching and learning bringing about the increased competencies of informatics use by the students. This research is not designed to help you personally, we hope in future, other students and the community can benefit from this study through improved understanding of the nursing informatics by the users guiding to improving the health care that will be rendered by the trained nurses of this institution to the community at large.

### **Do I have to be in this research and may I stop participating at any time?**

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify. Your decision to partake or not to partake in this study will be respected and accepted at any point and any time. To decide not to participate, you do not need to fill any consent for not participating, you can firmly discontinue at any point.

### **What if I have questions?**

This research is being conducted by ***Jakobina Foibe Agabus***, Nursing department, University of the Western Cape. If you have any questions about the research study itself, please contact Jakobina Agabus at cell number (+27) 60 941 8448, email address: 3614567@myuwc.ac.za

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Dr Sathasivan Arunachallam

Acting Director: School of Nursing

University of the Western Cape

Private Bag X17

Bellville 7535

[sarunachallam@uwc.ac.za](mailto:sarunachallam@uwc.ac.za)

Prof José Frantz

Dean of the Faculty of Community and Health Sciences

University of the Western Cape

Private Bag X17

Bellville 7535

[chs-deansoffice@uwc.ac.za](mailto:chs-deansoffice@uwc.ac.za)

This research has been approved by the University of the Western Cape's Humanities and Social Sciences Research Ethics Committee) –

(REFERENCE

NUMBER:

HS17/1/27)

**Appendix 6: Consent form**



**UNIVERSITY OF THE WESTERN CAPE**

Private Bag X 17, Bellville 7535, South Africa

**Tel: +27 21-959 3024, Fax: 27 21-959 2679**

**E-mail: 3614567@myuwc.ac.za**

**CONSENT FORM**

**Title of Research Project: NURSING INFORMATICS COMPETENCIES IN NURSING STUDENTS IN A UNIVERSITY IN THE WESTERN CAPE**

The study has been described to me in language that I understand. My questions about the study have been answered. I understand what my participation will involve and I agree to participate on my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits.

**Participant's name.....**

**Participant's signature.....**

**Date.....**

**Appendix 7: Questionnaire**

**A SURVEY ON NURSING INFORMATICS COMPETENCIES IN NURSING STUDENTS IN A UNIVERSITY IN THE WESTERN CAPE**

**SECTION 1: DEMOGRAPHIC INFORMATION**

Please tick at the appropriate space provided

1. Gender: Male.....Female.....

2. Age.....

3. Year of study :( **please tick in the appropriate box**)

4 <sup>th</sup> Year Nursing student	
Master in Nursing (Education)	
Master of Advanced Psychiatric Nursing	
Master of Nursing by research	
PHD in Nursing	

<b>Indicate if you have taken any computer or informatics training during your UG training or since completing your training by ticking in a “Yes” or “No” box</b>	<b>UG</b>	<b>PG</b>
	<b>Yes</b>	<b>Yes</b>
4.Computer classes taken		
5.Informatics classes taken		
<b>Please specify (duration length and type of training):</b>		

For each item, please indicate your score of relevance to nursing of 1 to 5 and your perceived competency on a scale of 1 to 5. Competency levels are defined as follows:

<b>1 Novice</b>	Beginners have had no experience in technology or computers. Novices are taught rules to help them perform. Novice behavior typical of the novice is extremely limited and inflexible
<b>2. Advanced Beginner</b>	Advanced beginners are those who can demonstrate marginally acceptable performance in the use of technology or computers
<b>3. Competent</b>	Have used technology or computers two or three years
<b>4. Proficient</b>	Are very competent in the use of computers and or technology and have used for > 3 years
<b>5. Expert</b>	Is an expert in computer and or technology and cad provide mentorship and training?

	<b>Relevance to nursing</b>						<b>Competency</b>				
	1-irrelevant,	2-slightly	3-moderate	4-very	5-extremely relevant		1-Novice	2-Advanced beginner	3-Competent	4-Proficient	5-Expert
	1	2	3	4	5		1	2	3	4	5



*Computer literacy skills include the psychomotor skills to use computer tools, as well as knowledge of basic hardware and software functionality; these are all required for effective bedside nursing (Schleyer, Burch, & Schoessler, 2011).*

6. Recognize the basic components of the computer system such as mouse, screen, and workstation.	1	2	3	4	5		1	2	3	4	5
7. Use of telecommunication tools such as electronic mail and facsimile (fax).	1	2	3	4	5		1	2	3	4	5
8. Use of remote communication tools such as Skype, Zoom, WhatsApp, Hangout, etc.	1	2	3	4	5		1	2	3	4	5
9. Create, rename, move, and delete files using computer operating systems such as Microsoft Windows	1	2	3	4	5		1	2	3	4	5
10. Use word processing function such as save, categorize documents, copy, paste, and delete.	1	2	3	4	5		1	2	3	4	5
11. Navigate computer operating systems to access installed applications and choose active printers	1	2	3	4	5		1	2	3	4	5
12. Use software to create presentations such as Microsoft PowerPoint.	1	2	3	4	5		1	2	3	4	5
13. Use external devices such as USB flash	1	2	3	4	5		1	2	3	4	5

drive, digital camera, CDROM.											
14. Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and printing	1	2	3	4	5		1	2	3	4	5
15. Manage computer systems security to protect data, devices, and passwords	1	2	3	4	5		1	2	3	4	5
<i>Informatics literacy skills are the nurses' abilities to recognize the need for information and to retrieve, evaluate, and use information for patient care appropriately (Schleyer, Burch, &amp; Schoessler, 2011).</i>											
16. Use the Internet to locate and download items of interest	1	2	3	4	5		1	2	3	4	5
17. Navigate patients' electronic health records	1	2	3	4	5		1	2	3	4	5
18. Review and acknowledge patient orders in an electronic health record	1	2	3	4	5		1	2	3	4	5
19. Develop and document care plan in electronic health record	1	2	3	4	5		1	2	3	4	5
20. Review electronic point of care data such as urine dipstick, glucose check, and hemoglobin meter, bloods to make timely decisions	1	2	3	4	5		1	2	3	4	5
21. Respond appropriately to alerts from clinical decision-making tools such as	1	2	3	4	5		1	2	3	4	5

algorithms, best practice alerts										
22. Conduct literature searches in the accessible proprietary database systems such as CINAHL, EBSCO, etc.	1	2	3	4	5	1	2	3	4	5
23. Use medication administration tools such as barcode medication verification and scanning	1	2	3	4	5	1	2	3	4	5
24. Use of medication dispensing system such as Pyxis, Pharmacy of the Future or other electronic pharmacy dispensing units	1	2	3	4	5	1	2	3	4	5
25. Collect and electronically document patient monitoring data relevant to care such as vital signs, height, and weight.	1	2	3	4	5	1	2	3	4	5
26. View trended electronic documentation to understand the effectiveness of nursing interventions	1	2	3	4	5	1	2	3	4	5
27. Use electronic systems to assist with admission and discharge process	1	2	3	4	5	1	2	3	4	5
28. Continue patient care documentation and patient identification when computer system is down	1	2	3	4	5	1	2	3	4	5
<i>Information Management Skills are applying the data to support clinical decisions,</i>										

*documentation, ensuring data integrity, confidentiality, and security. Information management skill is the knowledge to articulate the value of information system in improving patient safety, quality, and outcome (Schleyer, Burch, & Schoessler, 2011).*

29. Protect confidential patient data by logging out, suspending sessions, and password protection	1	2	3	4	5		1	2	3	4	5
30. Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.	1	2	3	4	5		1	2	3	4	5
31. Use electronic health record and other clinical information system as per organizational policy for documentation.	1	2	3	4	5		1	2	3	4	5
32. Use electronic communication with colleagues, patients, or other departments	1	2	3	4	5		1	2	3	4	5
33. Find information stored in the clinical information system to guide patient care such as standardized care plans and guidelines	1	2	3	4	5		1	2	3	4	5
34. Use nursing data for improving practice and for clinical decision making.	1	2	3	4	5		1	2	3	4	5
35. Use data and statistical reports for unit	1	2	3	4	5		1	2	3	4	5



based quality improvement initiatives and practice evaluation.																				
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**Attitudes toward Computers in Healthcare**

<p><i>. Each indicator is to be rated using a five-point Likert scale. Choose the response that best reflects your attitude for each statement.</i></p>	<p>1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree</p>				
	1	2	3	4	5
36. Use of computers in health care increases costs by increasing the nurses workload	1	2	3	4	5
37. Costs of health care are likely to increase because of computers	1	2	3	4	5
38. The time spent using computers in health is out of proportion to the benefits	1	2	3	4	5
39. Computers represent a violation of patient privacy	1	2	3	4	5
40. Only one person at a time can use a computer terminal and, therefore, staff efficiency is inhibited.	1	2	3	4	5
41. Computerization of nursing data offers nurses a remarkable opportunity to improve patient care	1	2	3	4	5
42. Computers contain too much personal data to be used in an area as open as a nursing station	1	2	3	4	5
43. Computers can cause nurses to give less time to quality nursing care	1	2	3	4	5
44. If I had my way, nurses would never have to use computers	1	2	3	4	5
45. Computers should only be used in the financial department	1	2	3	4	5
46. Computers make nurses jobs easier	1	2	3	4	5
47. Paperwork for nurses can be reduced greatly using computers	1	2	3	4	5
48. Orientation for new employees takes longer because of computers	1	2	3	4	5
49. Nursing data cannot be manipulated using computers	1	2	3	4	5
50. Computers save steps and allow the nursing staff to become more efficient	1	2	3	4	5

51. The more computers in an institution, the less number of jobs for employees	1	2	3	4	5
52. Increased computer use will allow nurses more time to give patient care	1	2	3	4	5
53. Because of computers, nurses will face more law suits	1	2	3	4	5
54. Computers can cause a decrease in communication between hospital departments	1	2	3	4	5
55. Confidentiality will be sacrificed by patient records being computerized	1	2	3	4	5

## Appendix 8: Turnitin Score

assignment list		portfolio for Jakobina AGABUS				
show grades						
#	Assignment	Title	Submitted	Similarity	GradeMark	D
1	<a href="#">PhD chapters and reports</a> start: 25-Aug-2015 due: <b>31-Dec-2017</b>					
2	<a href="#">Final Report for Examination</a> start: 19-Nov-2015 due: <b>31-Dec-2017</b>					
3	<a href="#">Masters THesis</a> start: 23-Feb-2018 due: <b>31-Dec-2019</b>	<a href="#">Nursing Informatics Masters Th...</a>	08-Dec-2020	24% 		

## Appendix 9: Letter from Editor

**ENGLISH LANGUAGE GRAMMAR EDIT**

This is to certify that the attached titled

NURSING INFORMATICS COMPETENCIES  
IN THE NURSING STUDENTS IN A UNIVERSITY  
IN THE WESTERN CAPE

prepared and submitted by


AGABUS JAKOBINA FOIBE  
Student Number: 3614567

has gone through an English language grammar edit  
carried out by Duncan Harford.

08/12/2020

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**DATE**



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**SIGNATURE**