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RESEARCH ARTICLE

Information Technology in Nursing Education: Perspectives of Student Nurses

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Abstract:

Background:

Nursing education institutions in South Africa are integrating Information Technology (IT) into nursing programmes to prepare student nurses to meet the demands of a contemporary healthcare landscape.

Objective:

To explain and describe the perspectives of student nurses at a private nursing education institution on the use of IT in nursing education.

Methods:

A quantitative, non-experimental descriptive research design was selected. The target population included student nurses registered for basic and post-basic qualifications. A structured self-administered questionnaire was used for data collection.

Results:

The respondents acknowledged the importance of IT in nursing education but also experienced challenges in terms of training and internet connectivity, owned at least one IT device, used IT frequently for study and work purposes, reported IT competence, and had positive attitudes to IT. The respondents were significantly competent in general IT ($M=3.5410$, $SD=.98619$), $t(243)=8.569$, $p<.0005$; used IT significantly frequently for medical purposes/learning ($M=3.2917$, $SD=0.76598$), $t(243)=5.948$, $p<.0005$, and were significantly competent in the use of IT for medical purposes/learning ($M=3.3646$, $SD=.94497$), $t(242)=6.015$, $p<.0005$; and had significantly positive attitude towards using IT ($M=4.2964$, $SD=0.66557$), $t(243)=30.426$, $p<.0005$.

Conclusion:

While there are numerous advantages to IT in nursing education, IT challenges are a reality for student nurses. Identified gaps must be closed to ensure that IT is accepted, adopted and used effectively and efficiently. The inclusion of an IT module in the curriculum is recommended to improve the use of IT in nursing education.

Keywords: Information technology, Nursing education, Nursing education institution, Perspectives, Student nurses, Unified theory of acceptance.

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1. INTRODUCTION

Advances in Information Technology (IT) have impacted the healthcare landscape globally. There is constant pressure to challenge the status quo and improve the quality of nursing education and nursing practice in order to keep up to date with contemporary developments and challenges [1]. While developed countries remain the pioneers and at the forefront of IT, developing countries like South Africa acknowledge and

slowly respond to the need for IT in the healthcare environment [2]. This changing environment requires healthcare practitioners to keep pace with practice innovations such as Health Information Technology (HIT) and Electronic Health Records (EHR). Nurses must be motivated and willing to utilise IT for the advancement of science and nursing practice [3]. It is therefore pivotal that nursing education equips nurses with the necessary knowledge, skills and competencies to utilise IT effectively and efficiently.

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1.1. Background

Public and private healthcare institutions in South Africa have incorporated IT in varying degrees from computerised medical equipment, automated systems for admissions and stock controls to EHR [4]. Nursing forms a major component of the healthcare sector. The effective and efficient utilisation of IT is dependent on nurses' knowledge, attitudes and facilitating conditions [5]. Therefore, nursing institutions must be challenged to include IT education as part of nursing programmes [6].

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

IT is a powerful and valuable tool for supporting learning [7]. IT integration into the nursing curriculum provides innovative teaching and learning strategies to actively engage the students in the learning process [8]. One of the main private NEIs in the country has taken active steps to integrate IT into nursing programs, ensuring ample opportunities for exposure to and experience in IT. Both nurse academics and student nurses are expected and compelled to utilise IT in teaching and learning. All new students registered for any of the nursing programmes at the private NEI receive a mandatory short course on computer and research literacy to assist with programme requirements.

There are numerous benefits to IT, but challenges are also a reality. Developing countries often face challenges related to technological, financial, and organisational factors. Lack of infrastructure, financial constraints, poor quality hardware and software [9] can lead to frustration, impaired learning and resistance to IT in nursing education. Threats related to cyber viruses and malware attacks plague individuals' willingness to utilise IT. Inadequate training and supervision in IT can cause student nurses to feel overwhelmed by the "information overload". Cybersafety, plagiarism, IT accountability and responsibility are non-negotiable in IT. A study conducted in South Africa highlighted the lack of accountability and the unethical use of social media by student nurses [10]. Private and sensitive information may be posted and shared without consent, thereby breaching individuals' rights to privacy and confidentiality, exposing the healthcare practitioner and institution to litigation. Negative attitudes and challenges can threaten acceptance, adoption and effective utilisation of IT [11].

There is no shying away from IT in this digital era. In order to make IT more attractive and acceptable to student nurses, it is vital to gain a better understanding of their perspectives on IT in nursing education.

1.2. Research Objectives

The objectives of the study were to

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

2. MATERIALS AND METHODS

2.1. Research Design

A quantitative non-experimental, descriptive research design was selected for the study.

2.2. Research Setting

The study was conducted at a private NEI, which is a sub-division of one of the three main private healthcare groups that contribute to nursing education in South Africa. The private NEI is situated in the province of Kwa-Zulu Natal (KZN), South Africa.

2.3. Sampling

A non-probability convenience sample was used to select respondents who met the study inclusion criteria of having 6 or more months of experience on the nursing programmes, thus ensuring adequate exposure to and experience in IT.

The minimum sample required with a population of 260 was 156, calculated using a margin of error of 0.05 and a value for alpha of 0.05. 12% was added to this figure to accommodate missing data items. Therefore, a total sample of 175 respondents was suggested. However, the entire accessible target population of 260 student nurses was invited to participate and voice their perspectives. 244 respondents completed the questionnaires.

2.4. Data Collection

Data were collected using a self-administered structured questionnaire that was developed by the researcher after an extensive review of the literature and guided by the key factors and moderators of the Unified Theory of Acceptance and Use of Technology (UTAUT) model [12]. UTAUT is often described as a modified extension of the Technology of Acceptance Model (TAM) [13]; developed by Fred Davis in 1985 to explain computer usage behaviour [14]. Both the TAM and UTAUT have been used to determine IT acceptance by nursing personnel [13].

The questionnaire consisted of 4 sections. The items in section A covered the respondents' biographical profile; section B examined their knowledge, and section C examined their perspectives, attitudes, perceptions, behaviours and characteristics. The response sets varied from simple dichotomous responses and rating scales to graded 5-point Likert scale options. Section D included an open-ended question on recommendations to improve the use of IT in nursing education.

Data were collected over several days at the private NEI. The respondents were briefed by the researcher, while support administrative personnel assisted in data collection. A covering

letter, informed consent form and questionnaire were handed to all the respondents. Respondents were afforded 45 minutes to complete the questionnaire in private. The respondents placed the consent form and questionnaire into separate boxes provided.

2.5. Data Analysis

Data were analysed using descriptive and inferential statistics. Many items on the questionnaire had response options on a scale of 1 to 5. The scales went from one extreme on the left to the other on the right. Respondents were asked to rate their frequency of IT use on a scale from 1 = never to 5 = very often; and competency in IT from 1 = not at all competent to 5 = extremely competent. The respondents' perspective on various statements related to IT was measured using the following scale options, namely strongly disagree, disagree, neutral, agree and strongly agree. Frequencies, means, standard deviation, *p*-value, *t*-test, analysis of variance (ANOVA), *Chi*-square test and binomial test were used in data analysis.

3. RESULTS AND DISCUSSION

3.1. Respondents' Biographical Profile

54.9% (n=134) of the respondents were 18-30 years old; 42.6% (n=104) were 31-40 years old, and 2.5% (n=6) were 41-50 years old.

The majority of the respondents were young adults from the Millennials or Net Generation and accustomed to IT in all spheres of life [15]. It is assumed that these younger generations would appreciate, accept and adopt IT more readily in nursing education. Familiarity with IT stimulates continued use of IT in higher education environments [16].

91% (n=223) were registered for the Bridging Programme for Enrolled Nurses leading to registration as a General Nurse (R683) and 9% (n=21) were general nurses pursuing the post-basic programmes for Advanced Diploma in Medical and Surgical Nursing Science with specialisation in either Critical Care, Trauma and Emergency, or Perioperative Nursing (R212) [17, 18].

The fact that the private NEI incorporated IT in all the nursing programmes augurs well for the profession because, on completion of training, these nurse practitioners should be able to cope with the demands of the fourth industrial revolution, particularly in healthcare. Educators must assist students to become comfortable with IT and develop IT skills [19]. IT literacy is essential for nurse practitioners to utilise high-technology medical devices and EHR [20].

62.7% (n=153) had between 0-5 years of clinical experience; 31.6% (n=77) had 6-10 years of clinical experience; 4.1% (n=10) had 11-15 years of clinical experience, and 1.6% (n=4) had 16 and more years of clinical experience.

It was inferred that the respondents with fewer years of clinical experience were younger and exposed to IT early, while those with more years of clinical experience were older and accustomed to traditional nursing practices with little IT exposure. Younger healthcare practitioners are more inclined to

use IT in clinical practice [21]; therefore, older practitioners would require greater support to adjust to IT in the profession.

89% (n=216) did not possess a formal IT qualification ($p<.0005$), while 61% (n=150) also indicated no prior IT training before registering for the nursing programmes ($p<.0005$).

The lack of IT education and training was reflective of the South African schooling system that did not support IT exposure and teaching across all schools. While private schools often provided IT courses as part of the curriculum, many public schools did not have the necessary infrastructure and resources to offer IT. The respondents, therefore, faced the challenge of learning and using IT in addition to the discipline of nursing and this could limit full educational and professional potential.

97% (n=229) owned smartphones ($p<.0005$); 82% (n=185) owned computers ($p<.0005$), and 55% (n=108) owned tablets. 95% (n=230) had access to the Internet ($p<.0005$).

Even though South Africa is a developing country, the respondents' IT ownership compared favourably with that of the developed countries. The majority of the respondents had access to the Internet and, therefore numerous learning opportunities. The results suggested an awareness and desire to keep pace with technological evolution trends and facilitate a constant state of connection with the ability to learn at any time and place. Access to IT helps to reduce IT anxiety and improves IT confidence and learning in nursing students [3].

3.2. Frequency of Use and Competency in IT

The World Wide Web gives easy access to various types of media from text, audio, images, animation and video streaming [22]. Nurses require IT knowledge and skills to access and use these information sources [23]. Therefore, competency in IT skills is no longer an advantage but a key requirement for nurse practitioners for job performance [24]. The researcher was interested in determining which software programmes were most frequently used by student nurses including their perceived level of competency in the programmes. Academics have important roles to play in online learning [25]. The information would impact curriculum development, designing of lesson plans and provision of support and guidance in IT [26].

3.2.1. Respondents' Frequency of Use and Competency in General IT

3.2.1.1. Respondents Frequency of use of General IT

The respondents reported that IT was used significantly frequently for communicating and networking ($M=4.55$, $SD=.869$), $t(241)=27.747$, $p<.0005$, followed by Internet searches and/or research ($M=4.52$, $SD=.889$), $t(241)=26.615$, $p<.0005$; compiling assignments and presentations ($M=4.12$, $SD=1.167$), $t(239)=14.879$, $p<.0005$; for administrative activities, such as bed status, leave applications, *etc.* ($M=3.44$, $SD=1.419$), $t(238)=4.833$, $p<.0005$, and patient care, such as for monitoring and diagnosis, access to test results, *etc.* ($M=3.31$, $SD=1.428$), $t(238)=3.353$, $p=.001$.

The educational and clinical health environments require that nurse practitioners use IT to communicate, study and work. IT is often used for daily allocation rosters, automated patient appointments, and forecasting workload and staffing requirements [27]. According to the UTAUT model, the impact of social influence on mandatory contexts becomes significant over time and with sustained IT use, indicating that the IT user responds to social gains and changes behavioural intention to ensure compliance [12].

3.2.1.2. Respondents' Competency in General IT Utilisation

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

The respondents did not work extensively on presentations and spreadsheets compared to the Internet, Word and email in the nursing programmes. Their varying degrees of experience may have contributed to their levels of competence. Israeli bachelor degree for nursing students also reported most knowledge in Word and Internet searches with limited or no competency in Excel and other software [7].

3.2.2. Respondents' Frequency of Use and Competency in IT Utilisation for Medical Purposes/Learning

3.2.2.1. Respondents' Frequency of IT use for Medical Purposes/Learning

The respondents reported significant frequent use of the Internet, *e.g.*, Google ($M=4.60$, $SD=.792$), $t(243)=31.604$, $p<.0005$, and medical videos ($M=3.34$, $SD=1.231$), $t(243)=4.263$, $p<.0005$; frequent use of medical applications (Apps) *e.g.*, nursing pharmacology ($M=3.12$, $SD=1.287$), $t(242)=1.396$, $p=.164$, and medical databases, *e.g.* OVID and PubMed ($M=3.09$, $SD=1.076$), $t(241)=1.254$, $p=.211$; and significant infrequent use ($M<3$) of the Intranet, *e.g.*, group website ($M=2.80$, $SD=1.225$), $t(242)=-2.566$, $p=.011$, and online medical journals, *e.g.*, Advances in Nursing Science ($M=2.80$, $SD=1.183$), $t(242)=-2.603$, $p=.010$.

Learning through electronic media provides a stimulating, enhanced experience in traditional learning approaches [28]. The use of videos in educational landscapes has a significant impact on students' learning performance and satisfaction [29] and is useful for revision and preparation for practice [30]. While medical Apps engage undergraduate nursing students and assist with memory and the development of patient interview skills [31]; the validity and reliability of some of the Apps are of concern. Medical formularies, textbooks and clinical decision support systems are the most commonly used Apps in the United Kingdom but the Apps are not usually risk assessed [21].

The infrequent use of the Intranet was of concern since updated policies, procedures and quality initiatives to ensure

standardisation and quality of care were often only available online *via* the group's website. The infrequent use of online medical journals may have been related to financial implications associated with online medical journals and/or a lack of awareness. Adult students decide what and when to learn according to the needs and relevance of subject matter [32], and this could possibly explain the results.

3.2.2.2. Respondents' Competency in IT Utilisation for Medical Purposes/Learning

The respondents' reported significant competence in using the Internet ($M=4.43$, $SD=.952$), $t(239)=23.187$, $p<.0005$; medical videos ($M=3.54$, $SD=1.315$), $t(242)=6.391$, $p<.0005$, and medical Apps ($M=3.23$, $SD=1.287$), $t(241)=2.798$, $p=.006$; competence in using medical databases ($M=3.11$, $SD=1.208$), $t(242)=1.381$, $p=.169$; and a lack of competence in using the Intranet ($M=2.97$, $SD=1.253$), $t(242)=-.410$, $p=.682$ and online medical journals ($M=2.95$, $SD=1.265$), $t(242)=-.608$, $p=.543$.

The infrequent use of the Intranet and online medical journals coupled with differences in navigation and cost implications could have explained the reported lack of competence. According to the UTAUT model, facilitating conditions including the removal of barriers to IT use is significant in both voluntary and mandatory contexts [12]. Students' IT self-efficiency impacts IT usage and should be cultivated for better learning performance and learning satisfaction [29].

3.2.3. Respondents' Frequency of Utilisation of Social Networks for Study and/or Work Purposes

The respondents reported using WhatsApp significantly frequently ($M=4.50$, $SD=.962$), $t(243)=24.417$, $p<.0005$ for study and/or work-related issues; significant infrequent use of email ($M=2.33$, $SD=1.378$), $t(241)=-7.558$, $p<.0005$ and Facebook ($M=2.10$, $SD=1.552$), $t(241)=-8.989$, $p<.0005$; and almost never used Twitter ($M=1.25$, $SD=.747$), $t(242)=-36.564$, $p<.0005$ and Instagram ($M=1.38$, $SD=.980$), $t(241)=-25.658$, $p<.0005$ for study and/or work purposes.

The results concur with another study, which found that WhatsApp was the most frequently used social App for communicating with lecturers and peers, and sharing instructional videos at a higher education institution in the Western Cape, South Africa [33]. WhatsApp is user-friendly and the most affordable compared to email and Facebook. Facebook, Twitter and Instagram are often viewed as Apps for recreational purposes and not often used for study or work purposes. While many students appreciate the learning experience associated with social networks, many remain resistant to its full usage as a formal learning tool [34].

3.2.4. Respondents' Frequency of Utilisation of E-learning Platforms for Medical Purposes/Learning

The respondents reported significantly infrequent use of games ($M=1.96$, $SD=1.365$), $t(237)=-11.777$, $p<.0005$; assessments ($M=1.80$, $SD=1.206$), $t(238)=-15.389$, $p<.0005$; chatrooms ($M=1.51$, $SD=1.104$), $t(242)=-20.986$, $p<.0005$; blogs ($M=1.39$, $SD=.930$), $t(240)=-26.807$, $p<.0005$, and

discussion/E-forums ($M=1.37$, $SD=.886$), $t(240)=-28.501$, $p<.0005$ for medical purposes/learning.

While there are many advantages to using these platforms in learning, a lack of awareness, exposure, interest, time constraints, and fears related to being judged and financial implications can deter the use of these E-learning platforms. Cyber bullying affects the well being of students [35] and students may not feel motivated to participate in E-learning platforms such as blogs, if it does not form part of an assessment [36]. According to the UTAUT model, normative pressure in terms of reward and punishment is strong during the early stages of IT use, whilst increased experience provides an instrumental basis for IT use [12].

A study conducted amongst undergraduate IT students also found low participation rates in gamification and social networking during E-learning [37]. These E-learning platforms are traditionally associated with play and leisure and consequently, may be viewed negatively and be discouraged in nursing education.

3.3. IT Exposure, Training and Support

3.3.1. Exposure to Interactive Video Conferencing, Simulation Devices and/or Manikins

Of the respondents, 50% ($n=122$) reported having been part of an interactive video conference *via* the Smartboard.

Synchronous virtual classrooms promote student interaction, develop learning community, and provide accessibility to students at various locations [38]; with the ability to connect and chat at any given time [39] allowing ideas, experiences and new content to be exchanged and created in learning [40]; however, challenges related to venue capacity, equipment capabilities, connectivity and number of participating persons may interfere with the quality of the sessions.

71% ($n=173$) reported having been exposed to simulation devices and/or manikins.

Simulations and manikins provide opportunities for student nurses to develop clinical decision-making skills in a “safe” environment. IT allows students to enact difficult situations to trial responses and test solutions that may not be possible in clinical practice [41].

3.3.2. In-House IT training and Support in IT

The respondents rated the in-house training as good ($M=3.38$, $SD=1.156$), $t(242)=5.161$, $p<.0005$.

In-house training is often used to best prepare personnel for specific IT use to meet job requirements. Registered nurses in primary healthcare facilities found that IT training on the use of mobile computing devices enabled them to better access information necessary for patient diagnosis, treatment and education [42].

58% ($n=142$) indicated having received ongoing support in IT throughout the nursing course while 42% ($n=102$) felt unsupported.

This was of concern in the light of the fact that continuous

IT support was available to the respondents. Continuous IT support is pivotal to reduce frustration and IT anxiety, which may create fear and resistance to learn and use IT [3]. This was duly reflected at healthcare facilities in Ethiopia, where practitioners had received basic IT training, yet less than 20% demonstrated good IT knowledge and less than 30% demonstrated good IT utilisation [43].

3.3.3. Encouragement to Use IT and Training on IT-enabled Equipment in the Nursing Programmes

The respondents indicated significant agreement that they were encouraged to use IT in the nursing programmes, ($M=4.21$, $SD=0.837$), $t(243)=22.556$, $p<.0005$.

Student nurses who are encouraged to use IT in education and training are better prepared for IT use in clinical environments, including continuous professional development [3].

The respondents reported having received adequate training on IT-enabled equipment (*e.g.*, medical devices, such as monitors, infusion pumps, and ventilators) at the hospital ($M=3.86$, $SD=1.089$), $t(243)=12.291$, $p<.0005$.

Training on the proper use, calibration, troubleshooting and care of medical devices is imperative to ensure quality, safe and cost-effective practices. IT-based tasks in nursing motivate for higher levels of IT utilisation [43] and IT literacy impacts on the acceptance of IT in healthcare landscapes.

3.4. Perspectives on IT in Nursing Education

The respondents indicated significant agreement that working knowledge of IT was important in nursing ($M=4.38$, $SD=.815$), $t(243)=26.401$, $p<.0005$; IT improved the quality of healthcare rendered ($M=4.30$, $SD=.851$), $t(242)=22.833$, $p<.0005$; IT made work easier ($M=4.26$, $SD=.905$), $t(243)=21.777$, $p<.0005$; IT afforded access to a wealth of knowledge ($M=4.42$, $SD=.764$), $t(242)=28.975$, $p<.0005$; IT was used to clarify information when unsure, ($M=4.49$, $SD=0.794$), $t(242)=29.154$, $p<.0005$; IT facilitated learning, ($M=4.32$, $SD=.822$), $t(240)=24.852$, $p<.0005$; IT improved theoretical and clinical performance ($M=4.14$, $SD=.907$), $t(243)=19.689$, $p<.0005$; IT reduced dependence on the lecturer ($M=3.83$, $SD=1.092$), $t(242)=11.804$, $p<.0005$; and student nurses enjoyed IT-related learning activities, ($M=4.08$, $SD=.911$), $t(243)=18.498$, $p<.0005$.

Nursing students acknowledge that IT literacy in nursing is important for application to clinical environments [44]. Healthcare practitioners in both public and private facilities in South Africa believe that IT has the ability to improve healthcare processes [4], smooth workflow and decrease financial costs [45]. IT makes work easier and more efficient [11], with EHR improving patient care, productivity and job satisfaction [46]. Faster and ready access to patient information improves the quality, accuracy and comprehensiveness of healthcare records [47] including the ability to improve the overall safety and efficiency in healthcare landscapes [48]. IT can guide clinical practice and provide clarity about health-related matters [33]. Mobile computing devices increase access to information, thereby increasing knowledge, assisting in

accurate diagnosis, reducing unnecessary referrals and providing motivation for sustained use of IT [42]. It is important that healthcare practitioners experience the benefits of IT in terms of contributing to effective and efficient processes, and this may enhance adoption of IT in healthcare landscapes.

IT has been used in various educational disciplines to augment teaching and learning. IT better engages nursing students through active learning methodologies and enhances the retention of learning content [31]. IT improves self-directedness and responsibility to learn and culminates in student success [49]. Nursing students often express a liking for IT-facilitated learning activities [50], and experiences greater overall learning enjoyment and social interaction [51]. Access to information sources *via* IT means that student nurses can obtain multiple opinions and dimensions in learning with the ability to connect with professionals all over the world [52], thereby reducing the need for face-to-face interaction between student and lecturer [53]. This is monumental in the light of brain drain challenges affecting educational and clinical disciplines. IT can improve the integration of theory and clinical practice [54] but can also contribute to the attainment of higher averages [51]. Innovative learning approaches utilising IT improve critical thinking in students [55].

The respondents reported significant disagreement that IT increased workload ($M=2.77$, $SD=1.205$), $t(243)=-2.923$, $p=.004$; IT was only used in education because it was mandatory ($M=2.66$, $SD=1.178$), $t(241)=-4.476$, $p<.0005$; and they preferred IT learning activities over lectures ($M=2.81$, $SD=1.203$), $t(240)=-2.464$, $p=.014$.

Millennials and the iGeneration often prefer learning through smart devices and web-enabled technologies [32] and while students experienced much of the advantages of E-learning platforms, many still prefer to have courses and examinations in the traditional way [53]. Therefore, blended learning approaches may be more suitable to enhance student satisfaction.

The respondents reported significant disagreement that their level of IT knowledge and skills restricted their study and career development, ($M=2.61$, $SD=1.119$), $t(239)=-5.423$, $p<.0005$.

Their perspectives could have been influenced by the fact that the level of competency was self-reported and they believed that their level of IT knowledge and skills were sufficient for study and career progression. In addition, the job requirements and job descriptions for nursing positions in South Africa did not request IT knowledge and skills. IT knowledge and skills related to the job could be acquired through on-the-job training and experience.

3.5. Challenges in using IT in nursing education

The respondents indicated significant agreement that insufficient training was a challenge in utilising IT ($M=3.32$, $SD=1.127$), $t(240)=4.459$, $p<.0005$; there was a lack of continued support in IT ($M=3.21$, $SD=1.166$), $t(242)=2.862$, $p=.005$; there was a lack of Internet connection ($M=3.26$, $SD=1.277$), $t(241)=3.221$, $p=.001$; service provider contracts

were too expensive ($M=3.82$, $SD=1.226$), $t(241)=10.385$, $p<.0005$; slow and/or outdated IT devices posed a challenge to utilising IT ($M=3.18$, $SD=1.217$), $t(238)=2.232$, $p=.027$; and insufficient time to surf the net/work on the computer, *etc.* ($M=3.35$, $SD=1.218$), $t(239)=4.451$, $p<.0005$.

Barriers to IT are often related to human, financial, legal, organisational, technical and professional factors [56]. IT is seen as a threat and challenge in clinical environments due to unfamiliarity [7]. Good Internet connections are key to information accessibility for learning, communication and clinical support. Lack of access, slow connections and multiple periods of downtime due to load shedding are challenges to the implementation of IT in South African healthcare facilities [4]. IT without proper connectivity is as good as a car without wheels. Costly expenses related to IT and connectivity are drawbacks to E-learning [32, 57]. Data purchases and contracts in the country are expensive and consumers are limited in choice between only a few service providers. The advancement of technology is so fast-paced that hardware often needs to be replaced to support the latest technologies and software requires frequent updates for optimal functioning. Student nurses are often on constrained budgets and an inability to afford adequate data packages, hardware and software upgrades restrict learning *via* IT.

The respondents indicated significant disagreement that the vast amount of information generated on the Internet was too much to process ($M=2.68$, $SD=1.073$), $t(242)=-4.604$, $p<.0005$; there was no interest in IT ($M=1.95$, $SD=0.945$), $t(240)=-17.171$, $p<.0005$; IT took nurses away from patient care ($M=2.73$, $SD=1.237$), $t(239)=-3.443$, $p=.001$; activities in nursing courses did not adequately refer students to use IT, *e.g.*, data searches or references to websites, *etc.* ($M=2.64$, $SD=1.103$), $t(241)=-5.010$, $p<.0005$; there was inadequate access to IT ($M=2.86$, $SD=1.205$), $t(240)=-1.764$, $p=.079$.

Students must be able to sift through extensive amounts of information using only what is accurate and relevant [58]. The skill of being able to differentiate between valid and reliable information is pivotal to ensure accurate and safe practice. The researcher found it of concern that respondents disagreed with the statement that there was too much information. This raised the question of whether Wikipedia or first information sources were used with no other comparisons.

Other studies also found that nurses disagreed that IT wasted time and interfered with patient care [21]. Nurses disagreed that IT increased workload and took nurses away from quality patient care [11]. A study conducted in South African found that healthcare personnel were keen on IT and preferred to move to IT systems in practice. The move to paperless processes was welcomed [4].

Adequate exposure to and experience in IT in nursing education is pivotal to develop IT competency. It is the nurse educator's responsibility to include IT in the nursing curriculum in order to reduce challenges and anxieties associated with IT use in educational and clinical environments [7].

The respondents indicated significant disagreement that there was fear of IT viruses and/or malware ($M=2.93$,

SD=1.290), $t(239)=-851, p=.396$.

This was of concern in the light of the fact that many computers did not have an installed antivirus program or the installed program was not updated regularly. The computers allowed the connection of external drives, which posed a threat of carrying viruses from one device to another. The results indicated that the respondents lacked awareness of IT threats and safety issues. The lack of awareness meant an ability to compromise not only personal IT devices but also institutional devices. A study conducted in South Africa indicated that a lack of antivirus systems posed a challenge to the successful implementation of IT in healthcare facilities [4].

3.5.1. Overall Use, Competency and Attitude to IT

Analysis revealed that the respondents were significantly competent in general IT ($M=3.5410, SD=.98619, t(243)=8.569, p<.0005$); IT was used significantly frequently for medical purposes/learning ($M=3.2917, SD=0.76598, t(243)=5.948, p<.0005$), and the respondents were significantly competent in the use of IT for medical purposes/learning ($M=3.3646, SD=.94497, t(242)=6.015, p<.0005$).

The analysis revealed that the online use of E-learning platforms such as Chatrooms, discussions/E-forums, blogs, assessments and games was significantly infrequent ($M=1.6156, SD=0.85801, t(242)=-25.151, p<.0005$).

The results showed that there was a significantly positive attitude towards using IT ($M=4.2964, SD=0.66557, t(243)=30.426, p<.0005$).

The results concurred with other studies. Turkish nursing students displayed positive views regarding IT for learning [57]; and personnel in public and private facilities in South Africa were positive about IT in the healthcare landscape [4]. In contrast, a study conducted in Israel found that the participants had neither a positive nor a negative attitude to IT [7].

Knowledge of attitudes to IT is beneficial in order to facilitate the acceptance and adoption of IT in education [59]. The UTAUT model theorises that self-efficacy, anxiety and attitude do not directly influence behavioural intention to use IT, however, these become significant in the absence of performance expectancy and effort expectancy constructs [12]. Yet some studies using the UTAUT model found that attitude does influence behavioural intention to use IT [60, 61]. Positive attitudes exerted a positive influence on IT usage [62].

3.5.2. Comparisons between Respondents' Age Groups, Nursing Programmes, Clinical Experience, IT Training and Internet Access

3.5.2.1. Comparison between Respondents' Age Groups

The level of competency in general IT application differed significantly across the age groups, $F(2,241)=17.471, p<.0005$. Higher competency was found in the 18-30 age group compared to those above 30 years of age. IT use for medical purposes/learning differed significantly across age, $F(2,241)=4.290, p=.015$. IT was utilised more frequently by the respondents in the 18-30 age group compared to those above

30 years of age. The level of competency for medical purposes/learning differed significantly across age, $F(2,240)=11.563, p<.0005$. Higher competency was found in the 18-30 age group when compared to those above 30 years.

Younger generation age groups are familiar with IT in personal, educational and work environments [15]. Familiarity and experience with IT equate to increased usage and competence in IT and this may have contributed to the sustained use of IT beyond social environments. Differences in IT perceptions and usage between the generations of university students in South African do exist [63]. The younger students, who very often used IT to a greater extent, would report higher levels of IT competency; while older nursing students reported low levels of IT competency and difficulty in using IT [64].

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

3.5.2.2. Comparison between Nursing Programmes

There was a significant difference in IT use for medical purposes/learning across the nursing programmes, $t(242)=-2.113, p=.036$. The respondents registered for the Advanced Diploma in Nursing (R212) ($M=3.627$) used IT significantly more than the respondents doing the Bridging Programme (R683) ($M=3.260$).

Educational and operational requirements in specialty nursing meant that the Advanced Diploma respondents had greater IT exposure and use in practice compared to the Bridging Programme. Health practitioners with higher levels of education are more likely to use IT compared to those with lower levels of education [43].

3.5.2.3. Comparison of Respondents' Years of Clinical Experience

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

In contrast, younger rural African healthcare workers with 5 or less years of experience had reported more basic computer knowledge than the older generations with more years of clinical experience [65].

3.5.2.4. Comparison of Respondents with and without IT Training

There were significant differences between respondents who had undertaken IT training prior to registering for the nursing programmes and those who had not, in terms of general IT competency, $t(220.479)=4.587, p<.0005$; IT use for medical purposes/learning, $t(242)=2.054, p=.04$; and IT competency for medical purposes/learning, $t(241)=2.147, p=.033$. The respondents who had undertaken IT training before having registered for the nursing programmes ($M=3.88$) showed higher competency, in general, compared to those who had not ($M=3.32$). IT was used more frequently for medical purposes/learning by the respondents who had undertaken IT

training before registering for nursing ($M=3.41$) in comparison to the respondents who had not ($M=3.21$). The respondents who had undertaken IT training prior to nursing showed higher IT competency for medical purposes/learning ($M=3.52$) than the respondents who had not ($M=3.26$).

The results suggest that the respondents who had acquired IT knowledge and skills were, therefore, more confident to use IT and suggest that prior experience in IT would enhance IT literacy and competency for medical purposes/learning. Healthcare professionals with previous IT training were more likely to use IT compared to ones who did not [43].

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

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

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

3.5.2.5. Comparison between Respondents with and without Access to the Internet

There was a significant difference in the frequency of IT use for medical purposes/learning, $t(241)=2.935$, $p=.004$; and IT competency for medical purposes/learning, $t(240)=3.507$, $p=.001$. IT use for medical purposes/learning occurred significantly more frequently among the respondents who had access to the Internet ($M=3.31$) than those who did not ($M=2.69$); and IT competency for medical purposes/learning was significantly higher in the respondents who had access to the Internet ($M=3.40$) than those who did not ($M=2.48$).

The results suggest that access to the Internet created opportunities to enhance IT utilisation and competencies. The results concur with another study, which found that public healthcare practitioners with less IT access demonstrated lower levels of IT knowledge and utilisation [43].

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

3.6. Respondents' Recommendations to Improve Use of IT in Nursing Education

The respondents recommended more intensive IT education and training in nursing programmes with refresher courses and continued IT support. The inclusion of IT training and/or an informatics module in the curriculum [66] is recommended to improve IT operational skills [67]. The respondents also recommended that IT training be extended to all healthcare personnel in clinical facilities; in order to improve the quality of care and reduce resistance that might arise through a gap in IT education between younger and older

generations [58]. Skills development programmes equip nurse practitioners to utilise IT safely and effectively [68]. Education and clinical institutions have the responsibility to provide IT training that keeps pace with technological innovations and global trends [6]. Dedicated, specialised IT personnel who are readily available to assist in times of need may provide a sense of relief, support and encouragement, thereby reducing IT anxiety and enhancing the adoption of IT in clinical environments [4].

The respondents recommended the availability of more computers and updated devices with better and faster Internet connectivity. The respondents recommended that IT be integrated more in clinical environments through the use of smart devices and EHR. Continuous exposure to and experience in IT will improve practice, reduce fears and build confidence, thus facilitating acceptance and adoption of IT [43].

CONCLUSION

The study highlights that while there are numerous advantages to IT in nursing education, IT challenges are a reality for student nurses. The identified gaps must be closed to ensure that IT is accepted, adopted and used effectively and efficiently in nursing education. The following recommendations are suggested. Policies should be formulated to stipulate the extent of IT use in educational and clinical facilities. Nursing curriculums must include a specific IT module with formal assessments to ensure competency. Refresher courses and continuous IT support must be readily available with updated devices and technologies including fast, reliable connectivity. IT-related activities must be incorporated into lesson plans to enhance exposure to and experience in IT. Regular meetings should be held with student nurses and healthcare practitioners to discuss IT challenges in order to provide support in overcoming difficulties.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The researcher obtained approval and ethical clearance from the Higher Degrees Committee of the Department of Health Studies at the University of South Africa (UNISA), the private healthcare group's Ethics and Research Committee and the campus manager at the private NEI with UNISA clearance number: REC-012714-039 (NHERC) HSHDC/705/2017 Private healthcare group and campus : UNIV-2017-0047.

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Informed consent was obtained from the respondents.

AVAILABILITY OF DATA AND MATERIALS

The authors confirm that the data supporting the findings of this study are available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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