Types of ICT applications used and the skills' level of nursing students in higher education: A cross-sectional survey

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ABSTRACT

Background: The healthcare system is increasingly becoming technology dependent; consequently, nurses in all regions of the world are expected to develop their information and communication technology (ICT) skills, and integrating ICT in the nursing curriculum is fundamental.

Aim: This study aims to explore the types of ICT applications used and the skills level of nursing students at a selected university in South Africa.

Methods: A non-experimental, descriptive quantitative research design was used in this study, and it was conducted at a selected university in South Africa. A total number of 150 nursing students participated in this study. Data were collected using a structured questionnaire and were analysed using SPSS version 25.

Findings: The majority of the respondents reported being skilled in using Word processing application (Ms Word) (86.7%), Ms PowerPoint (70.7%), Moodle (81.3%), and online resources (74.7%). However, 82% reported not being skilled to use SPSS for data analysis, and 65.3% were not skilled in using reference manager applications (EndNote). Data indicated that there was a progressive increase in skills with the level of the study, with upper levels being more skilled than the lower levels (K = 22.625, p = .001). The ownership of digital devices, such as laptops and tablets, was significantly associated with the skills level of using ICT applications (p < .05).

Conclusion: The use of technology in nursing education is essential to prepare future nurses for the information technology-rich workplace.

1. Background

The healthcare system is increasingly becoming technology dependent; consequently, nurses in all regions of the world are expected to develop their skills in information and communication technology (ICT) (Glasgow, Colbert, Viator, & Cavanagh, 2018; Shen et al., 2018). Developing nurses' skills in nursing informatics is pivotal in the technological era (Austria, 2017), and this should start by integrating ICT in nursing curriculum and ensuring that nursing students are computer literate (Gonen, Sharon, & Lev-Ari, 2016; Pilarski, 2010). The term "nursing informatics" is defined as 'combining nursing, information, and computer sciences for managing and processing data into knowledge for using in nursing practice' (Murphy, 2010, p. 3). Nursing informatics is concerned with the use of technology, such as mobile computers and wireless solutions, and automated exchanges between providers and patients (Onu & Agbo, 2013).

In the education of health professionals, the use of ICT is receiving special attention, particularly in nursing education (Hallila, Al Zubaidi, Al Ghamdi, & Alexander, 2014; Harerimana & Mtshali, 2018; Rouleau et al., 2017; Wilkinson, Roberts, & While, 2013), and the computer and internet being the entry point to ICT, are considered to be essential tools for teaching and learning in higher education (Bhattacharjee & Deb, 2016; Geladze, 2015).

Nursing students are required to have the necessary skills in using computers and internet technologies for academic and professional purposes (Wilkinson et al., 2013). Nurse educators need to build students' applied skills appropriate to the competence levels required at different stages of their careers for two reasons: firstly, to help them develop ICT skills relevant to the academic study, and, secondly, to introduce the ICT skills relevant to practice (Wilkinson et al., 2013). Those competencies include the use of computer hardware and specific programmes, word processor and spreadsheets, search engines and databases, citing sources, data analysis applications, health information system, and email for communication and collaboration (Masouras, 2016). These competencies are fundamental to nursing informatics (Fung, 2016; Masouras, 2016; Skiba, 2016).

The literature indicates that the required competencies should be built upon computer science, information processing, cognitive science

and nursing science (Asiri, 2016; Godsey, 2015). However, there are indications that the ICT skills development of nursing students has been mostly incidental, with substantial variation in how the development of those skills has been embedded into curricula, despite information literacy being regarded an essential skill for contemporary nurses (Eley, Fallon, Soar, Buikstra, & Hegney, 2008; Wilkinson et al., 2013).

Building nursing students' computer and internet literacy helps them to achieve their learning goals and the skills required are essential for their future career (Hallila et al., 2014). Computer competencies are essential for nurses, and the use of ICT in the provision of healthcare has been reported to enhance their decision-making, competencies and improve quality care practices (Gomes, Hash, Orsolini, Watkins, & Mazzoccoli, 2016; Gürdaş Topkaya & Kaya, 2015; Kaya, 2011). In their daily activities, nurses use personal computers to gather data, access information, implement actions and record the outcomes (Gomes et al., 2016). The study conducted by Kaya (2011) indicated that nurses viewed ICT tools as important to the development of society and were passionate about the potential impact of computer technologies in the delivery of healthcare.

Although ICT is developing rapidly in the healthcare system, and nurses being the majority of the healthcare team (Hughes, n.d; Joshi et al., 2013; Lipke, 2014), the literature reveals that nurses did not keep up with the technology advancement (Çetin, Ergün, Tekindal, Tekindal, & Tekindal, 2015; Okeyo, 2016). A number of challenges have hindered the acquisition of ICT competencies among nurses, and nursing students, and they include: lack of proper integration of informatics in nursing; inadequate computer literacy; resistance to change; resource constraints; poor access to internet and slow internet speed; and lack of information searching skills (Bello et al., 2017; Harerimana et al., 2016).

A study conducted by Aurore, Valens, Lune, and Nyssen (2016) at the University of Rwanda on "the assessment of health informatics competencies in undergraduate training of healthcare professionals in Rwanda" indicated that there is a low presence of health informatics in the curricula being used across the college of medicine and health sciences. Other challenges surrounding the use of technology include slow internet connections, an insufficient number of computers and insufficient training on how to use computers and internet as educational tools among nursing students (Dery, Vroom, Godi, Afagbedzi, & Dwomoh, 2016; Harerimana & Mtshali, 2018).

In order to respond to the challenges brought by technology, developing ICT competencies among nurses should start from their school training, and this should include developing technical abilities to use a computer and other ICT devices, and accessing the computer-based applications and locating information from the internet (Lipke, 2014). In nursing, computer and network literacy have a significant impact on technology-mediated learning. The use of technology in education requires a change in the educator's method of teaching (Govender & Govender, 2014), and the literature indicates the importance of facilitation for teaching and learning in higher education (Jarosinski & Heinrich, 2010; Rienties, Brouwer, & Lygo-Baker, 2013; Sithole, 2011; Ţîru, 2013).

As the integration of informatics into nursing education is becoming mandatory in many universities around the world, it is essential to analyse the skills levels of using computers and ICT applications among nursing students. Hence, this study aimed at exploring the types of ICT applications used and the skills level of nursing students at a selected tertiary institution in South Africa.

2. Methodology

A non-experimental, descriptive, quantitative research design was used in this study, and it was conducted at a university in South Africa. The population of the study was 441 nursing students registered for 2018 academic year (302 were from the undergraduate programme and 139 from the postgraduate programme). The sample size was calculated

based on the confidence interval of 95%, the margin error of 5%, and the response distribution of 50%. The calculated sample size was 206. It was later distributed into strata according to the programme of the study, and 141 were from the undergraduate programme and 65 from the postgraduate programme.

Simple random sampling was performed in order to select participants from different strata. It was done by using the sampling frame of each programme of the study (a list of both undergraduate and postgraduate students) and writing on pieces of paper all students' ID numbers. They were put in a box, mixed, and thereafter the researcher picked the papers randomly, till the calculated number for each academic programme was reached.

After selecting the calculated sample of 206 participants, the research instruments were distributed, and a total of 150 nursing students (121 from the undergraduate programme, and 29 from the postgraduate programme) returned the completed questionnaires. The overall response rate was 72.68%. According to Fincham (2008, p. 1), "response rates approximating 60% for most research should be the goal of researchers." Furthermore, Baruch and Holtom (2008) indicated that the average level of the response rate is between 35.7 and 52.7% after analysing 1607 studies conducted between 2000 and 2005, and which were published in peer review journals.

A structured questionnaire on the use of ICT in schools adapted from European Commission (2013) was used. The adapted instrument contained socio-demographics, types of technology devices used and the level of skills in using ICT applications for academic purposes. A four-point Likert scale was used, and the responses ranged from 1 = very unskilled to 4 = very skilled. Data were collected from March 2018 to September 2018 by the researcher, and questionnaires were distributed to the respondents in their respective classrooms after obtaining permission from the school, the lecturers, and students. The purpose of the study was explained, and those who accepted to participate signed a consent form. Students were requested to drop the completed questionnaires in the pre-prepared boxes, and they were collected later by the researcher.

The content validity of the research instrument was confirmed by ensuring that the items in the research instruments were related to the concepts of using ICT in education. An expert in nursing education was also consulted to ensure the usability, reliability of content, layout and visual appearance of the tool. The reliability of the instrument was guaranteed through test and retest of the research, and the Cronbach Alpha was 0.89, which indicated high reliability of the instrument.

Data were analysed using SPSS Version 25. Descriptive statistics were conducted using frequencies, percentages, minimum and maximum scores, mean and standard deviations. An overall score was calculated for the skills level in using ICT applications and the types of devices used. Statistical tests were performed using the Kruskal Wallis Test, Mann Withney *U* test, and Chi-square, in order to establish the association between socio demographics, the types of devices and applications used and students skills levels. The significance level was determined by a P. value < .05.

The study began after securing the ethical clearance, and gatekeepers' permissions, and the entire research process adhered to ethical principles. The ethics approval number for this study is HSS/0028/018PD.

3. Findings

3.1. Socio demographics

In this study, the socio demographics included the programme of the study, the year of the study of the respondents, age group, gender, mode of attendance (full-time/part-time), the area of the residence (on-campus/ off-campus) and years of experience in using computers. In this study, the majority of the respondents, 80.7% (n = 121) were from the undergraduate programme, and only 19.3% (n = 29) were from the

postgraduate programme. The findings indicated that 36% (n = 54) were in the 1st year of the study, 20% (n = 30) in the 2nd year, 18% (n = 27) in the 3rd year, and 26% (n = 39) in the 4th year.

The majority of the students (88.7%; n = 127) were registered full-time. A significant percentage (54%, n = 81) were in the age group between 20 and 29 years, followed by those who were under 20 years old (30.7%, n = 46), and only 13.3% were 30 years old and above. The majority of the respondents were females (84.7%, n = 127).

Regarding the experiences of nursing students in using computers, it was noted that 24% (n = 36) had computer experience for less than 1 year, 32% (n = 48) between 1 and 3 years, 26% (n = 39) between 4 and 6 years, and only 18% (n = 27) had an experience of more than 6 years.

Concerning the place of the residence, it was found that 63.3% (n = 95) of the students were residing off-campus, and only 36.7% (n = 55) were residing on campus.

3.2. Types of ICT applications used by nursing students and their skills levels

The findings from this study indicated that many ICT applications were used by nursing students, with varying levels of competences. The top-rated items were: using MS Word for writing documents (3.14 ± 0.74); creating, reading, sending an email (3.13 ± 0.76); using Moodle for completing learning activities or accessing information for courses (3.10 ± 0.77). The least rated items were: using SPSS for data analysis (1.78 ± 0.81), creating web pages for e-portfolio (1.76 ± 0.84), using video/audio software for creating and editing movies and audio (1.88 ± 0.82); participating in a forum discussion on the internet (1.83 ± 0.88); and registering and participating in online training programmes (1.87 ± 0.91) (Table 1).

The majority of nursing students reported having adequate skills in the use of two computer-based applications, which were using MS Word for writing documents (86%, n = 129) and in using Ms PowerPoint (70.7%, n = 106). However, the majority of the respondents reported not being skilled in using applications for data analysis, and 82% (n = 123) reported not being skilful to use SPSS, and 54% (n = 81) were not skilful to use Ms Excel for data analysis and creating plots. The majority of nursing students were not skilled in using applications for creating and editing graphics, videos. A significant percentage of the respondents also reported not being skilful to use EndNote as a reference manager (65.3%, n = 98) (Fig. 1).

For the application accessed via the internet or web-based applications, the majority of the nursing students felt they were skilled in using Moodle as LMS (81.3% n = 122); creating, reading and sending emails (86%, n = 129) and using online resources (74.7%, n = 112). However, the majority of the respondents reported not being skilled in using Turnitin (62%, n = 93) and participating in online forum discussion (74.7%, n = 112). It was also noted that they were not skilled in creating web pages for e-portfolios (85.1%, n = 86), registering and participating in online training programmes (73.3%, n = 110); and installing software on their computers (60.7%, n = 91) (Fig. 1).

The Chi-square test indicated that there is an association between the students' skills in using ICT applications and socio demographics. The programme of the study was significantly associated with the skills to use Moodle (χ^2 = 7.691; p = .006) with the majority of undergraduate students (86%) reporting to be skilful to use Moodle, compared to only 62.1% of the postgraduate students.

The findings indicated a positive progress in the acquisition of skills with the year of study (Table 2); and Chi-square test indicated the following statistically significant associations:

- creating, reading, sending email (1st year = 72.2%; 2nd year = 86.7%; 3rd year = 100%; 4th year = 94.7%; and $\chi2$ = 15.016; p = .001);
- using MS word for writings documents (1st year = 74.1%; 2nd years = 90.0%; 3rd year = 92.6; 4th year = 97.4%; and $\chi2$ = 11.442; p = .007);
- using excel for creating spreadsheets or charts (1st year = 31.5%; 2nd year = 46.7%; 3rd year = 51.9%; 4th year = 61.5%, and $\chi2$ = 8.767; p = .032);
- using PowerPoint for creating presentations (1st year = 44.4%; 2nd year = 73.3%; 3rd year = 81.5%; 4th year = 97.4%, and $\chi2$ = 35.278; p = .001);
- using endnote (1st year = 20.4%, 2nd year = 36.7%; 3rd year = 48.1%; 4th year = 43.6%; and $\chi2$ = 8.702; p = .032);
- using Turnitin (1st year = 20.4%; 2nd year = 20%; 3rd year = 55.6%; 4th year = 64.1%, and $\chi2$ = 25.923; p = .001);
- installing software on the computer (1st year = 24.1%; 2nd year = 43.3%; 3rd year = 55.6%; 4th year = 46.2%; and $\chi2$ = 9.368; p = .024).

Similarly, there was a progressive acquisition of the skills with the years of experience in using computers (Table 2); and statistically significant association were observed with the following:

- creating, reading, sending email (less than 1 year = 66.7%; 1–3 years = 89.6%; 4–6 years = 97.2%; more than 6 years = 92.6%; and $\chi2$ = 14.952; p = .001),
- using MS word for writings documents (less than 1 year = 66.7%; 1–3 years = 91.7%; 4–6 years = 97.2%; more than 6 years = 92.6; and $\chi2$ = 15.779; p = .001);
- using excel for creating spreadsheets or charts (less than 1 year = 15.4%; 1–3 years = 39.6%; 4–6 years = 69.4%; more than

Table 1
Types of ICT applications used by nursing students and their skills levels.

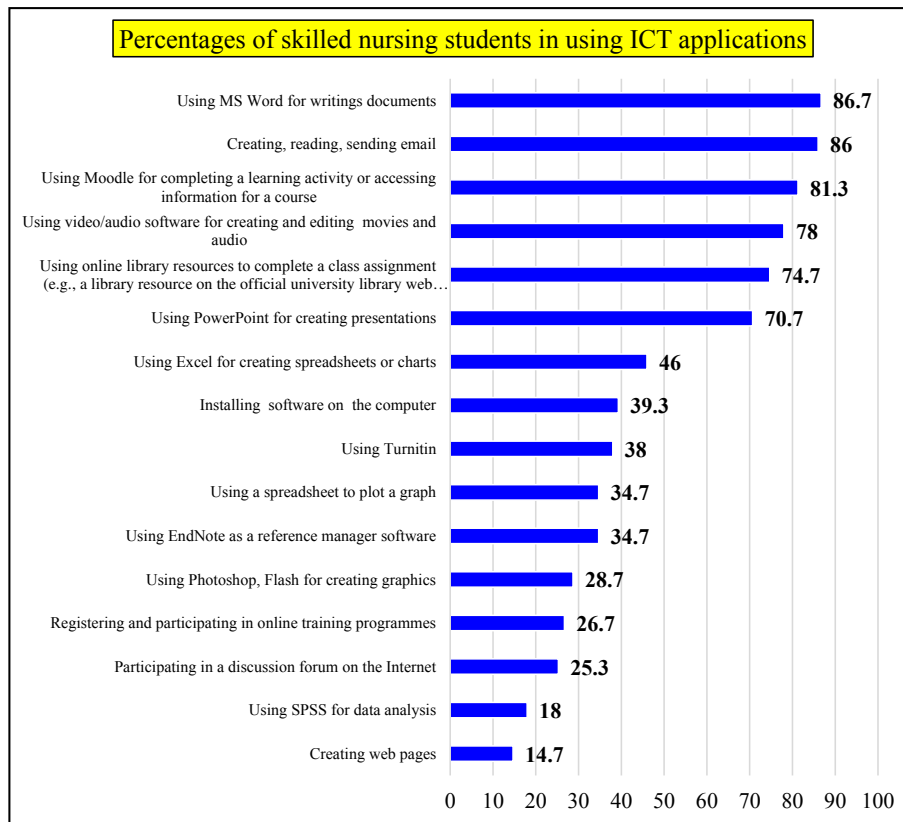|	N	Min	Max	Mean & S.D
Using MS Word for writings documents	150	1	4	3.14 ± 0.74
Creating, reading, sending email	150	1	4	3.13 ± 0.76
Using Moodle for completing a learning activity or accessing information for a course	150	1	4	3.10 ± 0.77
Using a library resource to complete a class assignment (e.g., a library resource on your official university library web site)	150	1	4	2.84 ± 0.84
Using PowerPoint for creating presentations	150	1	4	2.83 ± 0.86
Using Excel for creating spreadsheets or charts	150	1	4	2.38 ± 0.91
Using EndNote as a reference manager software	150	1	4	2.12 ± 0.95
Installing the software on the computer	150	1	4	2.12 ± 0.93
Using Turnitin	150	1	4	2.10 ± 0.98
Using a spreadsheet to plot a graph	150	1	4	2.05 ± 0.92
Using Photoshop, Flash for creating graphics	150	1	4	2.00 ± 0.88
Using video/audio software for creating and editing movies and audio	150	1	4	1.88 ± 0.82
Registering and participating in online training programmes	150	1	4	1.87 ± 0.91
Participating in a discussion forum on the Internet	150	1	4	1.83 ± 0.88
Using SPSS for data analysis	150	1	4	1.78 ± 0.81
Creating web pages for e-portfolio	150	1	4	1.76 ± 0.84

Fig. 1. The percentage of the skilled nursing students in using ICT applications.

6 years = 70.4%; and χ2 = 30.981; p = .001);

- using PowerPoint for creating presentations (less than 1 year = 38.5%; 1–3 years = 70.8%; 4–6 years = 88.9%; more than 6 years = 92.6%; and χ2 = 30.669; p = .001);
- using Photoshop, flash for creating graphics (less than 1 year = 10.3%; 1–3 years = 22.9%; 4–6 years = 36.1%; more than 6 years = 55.6%; and χ2 = 17.540; p = .001);
- using video/audio software for creating and editing movies and audio (less than 1 year = 7.7%; 1–3 years = 27.1%; 4–6 years = 19.4; more than 6 years = 37.0%; and χ2 = 9.369; p = .023);
- using endnote (less than 1 year = 17.9%; 1–3 years = 35.4%; 4–6 years = 41.7%; more than 6 years = 48.1%; and χ2 = 8.019; p = .044);
- using Turnitin (less than 1 year = 10.3%; 1–3 years = 35.4%; 4–6 years = 61.1%; more than 6 years = 51.9%; and χ2 = 24.701; p = .001);
- installing software on the computer (less than 1 year = 23.1%; 1–3 years = 37.5%; 4–6 years = 47.2%; more than 6 years = 55.6%; and χ2 = 8.352; p = .039);
- using a spreadsheet to plot a graph (less than 1 year = 12.8%; 1–3 years = 27.1%; 4–6 years = 47.2; more than 6 years = 63%; and χ2 = 21.635; p = .001);
- participating in a discussion forum on the internet (less than1 year = 10.3%; 1–3 years = 27.1%; 4–6 years = 30.6%; more than 6 years = 37.0%; and χ2 = 7.751; p = .048);
- registering and participating in online training programmes (less than 1 year = 7.7%; 1–3 years = 18.8%; 4–6 years = 41.7%; more than 6 years = 48.1%; and χ2 = 19.502; p = .001).

The findings from this study further revealed that the age group of the respondents was statistically associated with having skills in using some ICT applications such as:

- creating, reading, sending email (less than 20 years = 71.7%; 20–29 years = 92.6%; 30–39 years = 80.0%; more than 40 years = 100.0%; and χ2 = 12.005; p = .004);
- Using Excel for creating spreadsheets or charts (less than 20 years = 26.1%; 20–29 years = 53.1%; 30–39 years = 50.0%; more than 40 years = 69.2%; and χ2 = 12.003; p = .007);
- PowerPoint for creating presentations (less than 20 years = 43.5%; 20–29 years = 82.7%; 30–39 years 70.0%; more than 40 years = 92.3%; and χ2 = 23.687; p = .001)
- Using Turnitin (less than 20 years = 17.4%; 20–29 years = 50.6%; 30–39 years = 30.0%; more than 40 years = 38.5%; and χ2 = 14.476; p = .002) (Table 2).

3.3. Number of ICT applications used by nursing students, and socio-demographics

The number of ICT applications used by nursing students was explored. Overall, the mean of the applications used by the respondents was 7.23 ± 4.00, the median was seven, and the mode was five. The results indicated that 10.7% (n = 16) reported to use 1 to 3 ICT applications, 28% (n = 42) 4 to 6, 24% (n = 36) 6 to 9, and 31.3% (n = 47) more than 9 ICT applications. There were variations in the number of ICT applications used by the respondents according to the socio-demographics. Nursing students in the upper levels of their studies reported using more ICT applications than lower levels, with the 4th year (8.89 ± 3.83) and the 3rd year (8.51 ± 3.04), scoring higher than the 2nd year (7.10 ± 3.30) and the 1st year (5.57 ± 4.2). The Kruskal Wallis test indicated that the mean rank was 56.49 for the 1st year; 74.08 for the 2nd year; 90.20 for the 3rd year and 92.73 for the 4th year. Those differences were statistically significant (K = 19.733, d.f = 3, p = .001). This finding indicated a progressive acquisition of skills in using ICT applications with an academic level of nursing students.

Table 2
Level of skills in using ICT applications and socio-demographics.

		Level of the study				Test	Program of the study		Test	Experience In using computers				Test
		1st Year (=54)	2nd Year (n = 30)	3rd Year (n = 27)	4th Year (n = 39)	Chi-square (Fisher exact)	Undergrad (n = 121).	Postgrad (n = 29).	Chi-square	< 1 year (n = 39)	1–3 years (n = 48)	4–6 years (n = 27)	> 6 years	Chi-square (Fisher exact)
Creating, reading, sending email	Inadequate skills (%)	27.8	13.3	0	5.1	χ2 = 15.01-6; p = .001**	15.7	6.9	χ2 = 1.289; p = .370	33.3	10.4	2.8	7.4	χ2 = 14.95-2; p = .001**
	Adequate skills (%)	72.2	86.7	100.0	94.9		84.3	93.1		66.7	89.6	97.2	92.6	
Using MS Word for writings documents	Inadequate skills (%)	25.9	10.0	7.4	2.6	χ2 = 11.44-2; p = .007**	14.9	6.9	χ2 = 1.289; p = .387	33.3	8.3	2.8	7.4	χ2 = 15.77-9; p = .001**
	Adequate skills (%)	74.1	90.0	92.6	97.4		85.1	93.1		66.7	91.7	97.2	92.6	
Using Excel for creating spreadsheets or charts	Inadequate skills (%)	68.5	53.3	48.1	38.5	χ2 = 8.767; p = .032*	57.9	37.9	χ2 = 3.737; p = .063	84.6	60.4	30.6	29.6	χ2 = 30.98-1; p = .001**
	Adequate skills (%)	31.5	46.7	51.9	61.5		42.1	62.1		15.4	39.6	69.4	70.4	
Using PowerPoint for creating presentations	Inadequate skills (%)	55.6	26.7	18.5	2.6	χ2 = 35.27-8; p = .001**	32.2	17.2	χ2 = 2.749; p = .172	61.5	29.2	11.1	7.4	χ2 = 30.66-9; p = .001**
	Adequate skills (%)	44.4	73.3	81.5	97.4		67.8	82.8		38.5	70.8	88.9	92.6	
Using Photoshop, Flash for creating graphics	Inadequate skills (%)	77.8	76.7	70.4	59.0	χ2 = 4.278; p = .234	71.1	72.4	χ2 = .021; p = 1.00	89.7	77.1	63.9	44.4	χ2 = 17.54-0; p = .001**
	Adequate skills (%)	22.2	23.3	29.6	41.0		28.9	27.6		10.3	22.9	36.1	55.6	
Using video/audio software for creating and editing movies and audio	Inadequate skills (%)	87.0	76.7	77.8	66.7	χ2 = 5.547; p = .130	75.2	89.7	χ2 = 2.827; p = .133	92.3	72.9	80.6	63.0	χ2 = 9.369; p = .023*
	Adequate skills (%)	13.0	23.3	22.2	33.3		24.8	10.3		7.7	27.1	19.4	37.0	
Creating web pages for e-portfolio	Inadequate skills (%)	85.2	90.0	81.5	84.6	χ2 = 0.931; p = .848	85.1	86.2	χ2 = .022; p = 1.00	87.2	91.7	72.2	88.9	χ2 = 6.051; p = .100
	Adequate skills (%)	14.8	10.0	18.5	15.4		14.9	13.8		12.8	8.3	27.8	11.1	
Using Moodle	Inadequate skills (%)	25.9	16.7	11.1	15.4	χ2 = 2.930; p = .413	14.0	37.9	χ2 = 7.691; p = .006**	25.6	16.7	11.1	22.2	χ2 = 2.973; p = .400
	Adequate skills (%)	74.1	83.3	88.9	84.6		86.0	62.1		74.4	83.3	88.9	77.8	
Using online library resources	Inadequate skills	37.0	16.7	18.5	20.5	χ2 = 5.736; p = .124	24.0	31.0	χ2 = .597; p = .478	41.0	20.8	16.7	22.2	χ2 = 6.611; p = .185
	Adequate skills	63.0	83.3	81.5	79.5		76.0	69.0		59.0	79.2	83.3	77.8	
Using EndNote	Inadequate skills	79.6	63.3	51.9	56.4	χ2 = 8.702; p = .032*	65.3	65.5	χ2 = .001; p = .582	82.1	64.6	58.3	51.9	χ2 = 8.019; p = .044*
	Adequate skills	20.4	36.7	48.1	43.6		34.7	34.5		17.9	35.4	41.7	48.1	
Using SPSS for data analysis	Inadequate skills	81.5	83.3	81.5	82.1	χ2 = 0.137; p = 1.000	83.5	75.9	χ2 = .866; p = .419	87.2	85.4	75.0	77.8	χ2 = 2.626; p = .461
	Adequate skills	18.5	16.7	18.5	17.9		16.5	24.1		12.8	14.6	25.0	22.2	

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Table 2 (*continued*)

Item		Level of the study				Test Chi-square (Fisher exact)	Program of the study		Test Chi-square	Experience In using computers				Test Chi-square (Fisher exact)
		1st Year (=54)	2nd Year (n = 30)	3rd Year (n = 27)	4th Year (n = 39)		Undergrad (n = 121)	Postgrad (n = 29)		< 1 year (n = 39)	1–3 years (n = 48)	4–6 years (n = 27)	> 6 years	
Using Turnitin	Inadequate skills	79.6	80.0	44.4	35.9	χ2 = 25.923; p = .001**	62.0	62.1	χ2 = .000; ; p = .585	89.7	64.6	38.9	48.1	χ2 = 24.701; p = .001**
	Adequate skills	20.4	20.0	55.6	64.1		38.0	37.9		10.3	35.4	61.1	51.9	
Installing software on the computer	Inadequate skills	75.9	56.7	44.4	53.8	χ2 = 9.368; p = .024*	58.7	69.0	χ2 = 1.062; p = .398	76.9	62.5	52.8	44.4	χ2 = 8.352; p = .039*
	Adequate skills	24.1	43.3	55.6	46.2		41.3	31.0		23.1	37.5	47.2	55.6	
Using a spreadsheet to plot a graph	Inadequate skills	75.9	60.0	59.3	59.0	χ2 = 4.351; p = .228	66.1	62.1	χ2 = .167; p = .682	87.2	72.9	52.8	37.0	χ2 = 21.635; p = .001**
	Adequate skills	24.1	40.0	40.7	41.0		33.9	37.9		12.8	27.1	47.2	63.0	
Participating in a discussion forum on the Internet	Inadequate skills	79.6	86.7	63.0	66.7	χ2 = 6.207; p = .100	74.4	75.9	χ2 = .027; p = 1.00	89.7	72.9	69.4	63.0	χ2 = 7.751; p = .048*
	Adequate skills	20.4	13.3	37.0	33.3		25.6	24.1		10.3	27.1	30.6	37.0	
Registering and participating in online training programmes	Inadequate skills	79.6	80.0	70.4	61.5	χ2 = 4.517; p = .209	75.2	65.5	χ2 = 1.079; p = .350	92.3	81.3	58.3	51.9	χ2 = 19.502; p = .001**
	Adequate skills	20.4	20.0	29.6	38.5		24.8	34.5		7.7	18.8	41.7	48.1	

Item	Place of residence		Test chi-square	Mode of the study		Test Chi-square	Gender		Test Chi-square	Age group				Test Chi-square (Fisher exact)
	On campus (n = 55)	Off-campus (n = 95)		Full time (n = 133)	Part-time (n = 17)		Females (n = 127)	Males (n = 23)		< 20 years (n = 46)	20–29 years (n = 81)	30–39 years (n = 10)	≥40 years (n = 13)	
Creating, reading, sending email	9.1 / 90.9	16.8 / 83.2	χ2 = 1.049; p = .469	15.0 / 85.0	5.9 / 94.1	χ2 = 1.838; p = .228	12.6 / 87.4	21.7 / 78.3	χ2 = 1.219; p = .323	28.3 / 71.7	7.4 / 92.6	20.0 / 80.0	0 / 100.0	χ2 = 12.005; p = .004**
Using MS Word for writings documents	9.1 / 90.9	15.8 / 84.2	χ2 = .921; p = .472	14.3 / 85.7	5.9 / 94.1	χ2 = 1.422; p = .322	11.0 / 89.0	26.1 / 73.9	χ2 = 3.260; p = .087	21.7 / 78.3	9.9 / 90.1	20.0 / 80.0	0 / 100.0	χ2 = 5.725; p = .095
Using Excel for creating spreadsheets or charts	49.1 / 50.9	56.8 / 43.2	χ2 = .009; p = 1.00	45.9 / 54.1	52.9 / 47.1	χ2 = .842; p = .398	52.8 / 47.2	60.9 / 39.1	χ2 = .521; p = .504	73.9 / 26.1	46.9 / 53.1	50.0 / 50.0	30.8 / 69.2	χ2 = 12.003; p = .007**
Using PowerPoint for creating presentations	18.2 / 81.8	35.8 / 64.2	χ2 = 1.263; p = .397	30.8 / 69.2	17.6 / 82.4	χ2 = 5.460; p = .026*	27.6 / 72.4	39.1 / 60.9	χ2 = 1.204; p = .320	56.5 / 43.5	17.3 / 82.7	30.0 / 70.0	7.7 / 92.3	χ2 = 23.687; p = .001**
Using Photoshop, Flash for creating graphics	72.7 / 27.3	70.5 / 29.5	χ2 = .397; p = .572	72.2 / 27.8	64.7 / 35.3	χ2 = .083; p = .852	70.9 / 29.1	73.9 / 26.1	χ2 = .090; p = .810	78.3 / 21.7	69.1 / 30.9	70.0 / 30.0	61.5 / 38.5	χ2 = 2.070; p = .570
Using video/audio software for creating and editing movies and audio	72.7 / 27.3	81.1 / 18.9	χ2 = 2.903; p = .121	75.9 / 24.1	94.1 / 5.9	χ2 = 1.380; p = .306	78.0 / 22.0	78.3 / 21.7	χ2 = .001; p = 1.00	80.4 / 19.6	74.1 / 25.9	80.0 / 20.0	92.3 / 7.7	χ2 = 2.173; p = .557
Creating web pages for e-portfolio	81.8 / 18.2	87.4 / 12.6	χ2 = 1.182; p = .469	84.2 / 15.8	94.1 / 5.9	χ2 = .838; p = .352	85.8 / 14.2	82.6 / 17.4	χ2 = .155; p = .749	84.8 / 15.2	85.2 / 14.8	80.0 / 20.0	92.3 / 7.7	χ2 = 0.814; p = .848

Table 2 (*continued*)

	Place of residence		Test	Mode of the study		Test	Gender		Test	Age group				Test
	On campus (n = 55)	Off-campus (n = 95)	chi-square	Full time (n = 133)	Part-time (n = 17)	Chi-square	Females (n = 127)	Males (n = 23)	Chi-square	< 20 years (n = 46)	20–29 years (n = 81)	30–39 years (n = 10)	≥ 40 years (n = 13)	Chi-square (Fisher exact)
Using Moodle	18.2 / 12.7	12.6 / 22.1	$\chi2 = 2.112$; p = .194	15.8 / 17.3	5.9 / 29.4	$\chi2 = 1.458$; p = .317	14.2 / 16.5	17.4 / 30.4	$\chi2 = 2.234$; p = .145	15.2 / 13.0	14.8 / 17.3	20.0 / 30.0	7.7 / 38.5	$\chi2 = 5.219$; p = .136
Using online library resources	87.3 / 16.4	77.9 / 30.5	$\chi2 = 3.870$; p = .079	82.7 / 24.1	70.6 / 35.3	$\chi2 = .944$; p = .375	83.5 / 23.6	69.6 / 34.8	$\chi2 = 1.212$; p = .299	87.0 / 28.3	82.7 / 22.2	70.0 / 30.0	61.5 / 30.8	$\chi2 = 1.267$; p = .780
Using EndNote	83.6 / 60.0	69.5 / 68.4	$\chi2 = 1.082$; p = .374	75.9 / 64.7	64.7 / 70.6	$\chi2 = .239$; p = .789	76.4 / 65.4	65.2 / 65.2	$\chi2 = .000$; ; p = .582	71.7 / 69.6	77.8 / 63.0	70.0 / 70.0	69.2 / 61.5	$\chi2 = 0.801$; p = .885
Using SPSS for data analysis	40.0 / 70.9	31.6 / 88.4	$\chi2 = 6.986$; p = .014*	35.3 / 81.2	29.4 / 88.2	$\chi2 = .554$; p = .739	34.6 / 82.7	34.8 / 78.3	$\chi2 = .247$; p = .567	30.4 / 78.3	37.0 / 86.4	30.0 / 70.0	38.5 / 76.9	$\chi2 = 3.226$; p = .371
Using Turnitin	29.1 / 49.1	11.6 / 69.5	$\chi2 = 6.092$; p = .015*	18.8 / 60.2	11.8 / 76.5	$\chi2 = 1.704$; p = .289	17.3 / 59.1	21.7 / 78.3	$\chi2 = 3.263$; p = .103	21.7 / 82.6	13.6 / 49.4	30.0 / 70.0	23.1 / 61.5	$\chi2 = 14.476$; p = .002**
Installing software on the computer	50.9 / 52.7	30.5 / 65.3	$\chi2 = 2.280$; p = .165	39.8 / 56.4	23.5 / 94.1	$\chi2 = 8.991$; p = .001**	40.9 / 62.2	21.7 / 52.2	$\chi2 = .808$; p = .365	17.4 / 58.7	50.6 / 58.0	30.0 / 70.0	38.5 / 76.9	$\chi2 = 1.985$; p = .604
Using a spreadsheet to plot a graph	47.3 / 65.5	34.7 / 65.3	$\chi2 = .001$; p = 1.00	43.6 / 63.9	5.9 / 76.5	$\chi2 = 1.050$; p = .420	37.8 / 63.0	47.8 / 78.3	$\chi2 = 2.004$; p = .233	41.3 / 65.2	42.0 / 65.4	30.0 / 70.0	23.1 / 61.5	$\chi2 = 0.268$; p = .991
Participating in a discussion forum on the Internet	34.5 / 69.1	34.7 / 77.9	$\chi2 = 1.404$; p = .248	36.1 / 72.2	23.5 / 94.1	$\chi2 = 3.835$; p = .072	37.0 / 73.2	21.7 / 82.6	$\chi2 = .969$; p = .440	34.8 / 80.4	34.6 / 71.6	30.0 / 70.0	38.5 / 76.9	$\chi2 = 1.468$; p = .719
Registering and participating in online training programmes	30.9 / 65.5	22.1 / 77.9	$\chi2 = 2.705$; p = .125	27.8 / 71.4	5.9 / 88.2	$\chi2 = 2.520$; p = .242	26.8 / 71.7	17.4 / 82.6	$\chi2 = 1.287$; p = .318	19.6 / 84.8	28.4 / 67.9	30.0 / 80.0	23.1 / 61.5	$\chi2 = 5.574$; p = .127
	34.5	22.1		28.6	11.8		28.3	17.4		15.2	32.1	20.0	38.5	

* p-value is significant at ≤ 0.05.
** P-value is significant ≤ 0.01.

Students who resided on campus reported using more computer and internet applications (8.25 ± 3.84) than those who resided off-campus (6.70 ± 4.00). The mean rank was 86.24 for students staying at on-campus residences, and 69.28 for those who stay at the off-campus residences, and Mann Witney *U* Test indicated that those differences were statistically significant (U = 2022.00, p = .021).

The experience of using computers influenced significantly the number of applications used by the students, with positive progress with the year of experiences: less than one year (4.46 ± 3.33); between one to three years (7.08 ± 3.57); between 4 and 6 years (9.02 ± 3.44); and for more than 6 years (9.33 ± 4.00), with the mean rank of 43.76; 74.02; 94.68; and 98.41 respectively. Those differences were statistically significant (K = 35.645, p = .001).

Differences which were noted between the number of applications used by the respondents and the programme of the study (mean rank of 76.67 for postgraduate and 75.22 for undergraduate); gender (mean rank of 77.06 for females, and 66.91 for males); mode of attendance (mean rank of 77.15 for full-time students and 62.59 for part-time students) and age group (mean rank of 62.34 for students aged less than 20 years; 82.83 for 20–29 years; 70.60 for 30–39 years, and 80.15 for more than 40 years of age). However, those differences were not statistically significant (p > .05) Table 3.

3.4. Overall skills level of nursing students in using ICT applications

The overall score for skills level in using the computer-based and web-based applications among nursing students was calculated after computing 16 items on a four-point Likert scale. The responses ranged from 1 = very unskilled, 2 = unskilled, 3 = skilled, and 4 = skilled. The higher score indicated a high level of skills in using the computer-based and web-based applications. The minimum score was 16, and the maximum score was 79. The mean and standard deviations were 50.66 ± 11.25, the median was 52, and the mode 51.

The findings indicated that the level of the ICT skills was statistically associated with the year of the study, place of the residence, experiences in using computers and age group. It was noted that there was a progressive increase in skills related to the year of the study, with nursing students in their 1st year (46.08 ± 12.57), and 2nd year (48.96 ± 8.74) perceiving themselves less skilled, compared to those from the 3rd year (52.62 ± 7.02), and the 4th year (56.96 ± 10.40).

Those differences were statistically significant (K = 22.625, p = .001) with the mean rank of 58.47 for the 1st year; 67.75 for the 2nd year; 82.41 for the 3rd year; and 100.26 for the 4th year (Table 4).

Similarly, nursing students, who were residing on campus, perceived themselves more skilled in using ICT applications (54.86 ± 9.73), compared to those who were residing off campus (48.23 ± 11.40). The Mann Whitney *U* test indicated that those differences were statistically significant (U = 1716.000, p = .001), with the mean rank of 91.80 for on campus students; and 66.06 for off campus students.

The years of experience in using computers were significantly associated with the perceived level in using ICT applications (K = 26.194, p = .001) with the mean rank of 49.90 for those with less than 1 year of experience; 71.28 for 1–3 years; 95.44 for 4–6 years; and 93.39 for more than 6 years of experience.

The age group of the respondents was also associated with their level of skills in using computers, with those under 20 years old rating themselves less competent (47.22 ± 11.03), compared to those who were between 20 years to 29 years (52.79 ± 10.40), 30 years to 39 years (50.05 ± 17.79) and those who were 40 years and above (50.07 ± 8.97). The mean rank was 61.71 for students less than 20 years old; 83.96 for 20–29 years; 73.65 for 30–39 years; and 73 for those who were 40 years and above. These differences were statistically significant (K = 7.781, p = .050).

Statistical test indicated that overall there is no association between with the skills to use ICT applications and the programme of the study (undergraduate and postgraduate programmes) (p > .05). However, based on the mean and standard deviation, postgraduate students perceived themselves more skilled to use ICT applications (50.86 ± 11.26) compared to undergraduate students (49.84 ± 11.37). There were no statistically significant differences between the overall perceived level of the skills, gender and mode of attendance (full-time/part-time) (p > .05) (Table 4).

3.5. Technology devices owned by nursing students

Nursing students reported to own different types of electronic devices with the majority having smartphones (89.3%, n = 134), followed by laptops (78.7%, n = 118), tablets (47.3%, n = 71) and a small percentage owned desktops (22%, n = 33). These findings indicated

Table 3
Number of ICT applications used by nursing students and socio-demographics.

		Descriptive stats					Tests	
		N	Min	Max	Mean & S.D	Mean Rank	Value	p.value
Program of the study	Undergraduate	121	0	16	7.24 ± 0.36	75.22	U = 1720.500	p = .871
	Postgraduate	29	0	15	7.37 ± 0.72	76.67		
Year of the study	First Year	54	0	16	5.57 ± 4.28	56.49	K = 19.733	p = .001**
	Second Year	30	0	14	7.10 ± 3.30	74.08		
	Third Year	27	0	14	8.51 ± 3.04	90.20		
	Fourth Year	39	0	16	8.89 ± 3.83	92.73		
Mode of attendance	Full-time	133	0	16	7.42 ± 4.09	77.15	U = 911.000	p = .192
	Part-time	17	0	13	6.11 ± 3.10	62.59		
Place of Residence	On campus	55	0	16	8.25 ± 3.84	86.24	U = 2022.000	p = .021*
	Off-campus	95	0	16	6.70 ± 4.00	69.28		
Experience in using computers	Less than 1 year	39	0	14	4.46 ± 3.33	43.76	K = 35.645	p = .001**
	1–3 years	48	0	16	7.08 ± 3.57	74.02		
	4–6 years	36	3	15	9.02 ± 3.44	94.68		
	More than 6 years	27	0	16	9.33 ± 4.00	98.41		
Gender	Female	127	0	16	7.44 ± 3.98	77.06	U = 1263.000	p = .301
	Male	23	0	13	6.34 ± 4.052	66.91		
Age group	less than 20	46	0	16	6.15 ± 4.19	62.34	K = 6.854	p = .077
	20–29	81	0	16	7.88 ± 3.75	82.83		
	30–39	10	0	16	6.90 ± 5.32	70.60		
	greater than40	13	4	13	7.69 ± 3.22	80.15		

* p-value is significant at ≤0.05.

Table 4
Association of socio-demographic and the overall skills' level of using ICT applications.

Socio-demographics	Variables	Descriptive stat.					Statistical Test	
		N	Min	Max	Mean & S.D	Mean Rank	Value	p.value
Program of the study	Undergraduate	121	19	79	50.86 ± 11.26	76.08	U = 1684.000	p = .737
	Postgraduate	29	16	68	49.84 ± 11.37	73.07		
Year of the study	First Year	54	16	76	46.08 ± 12.57	58.47	K = 22.625	p = .001**
	Second Year	30	24	62	48.96 ± 8.74	67.75		
	Third Year	27	38	67	52.62 ± 7.02	82.41		
	Fourth Year	39	34.59	79	56.96 ± 10.40	100.26		
Full-time verse Part-time	Full-time	133	16	79	51.19 ± 11.41	77.89	U = 812.500	p = .059
	Part-time	17	34.59	61	46.56 ± 9.18	56.79		
Place of Residence	On campus	55	24	79	54.86 ± 9.73	91.80	U = 1716.000	p = .001**
	Off-campus	95	16	76	48.23 ± 11.40	66.06		
Experience in using computers	Less than 1 year	39	19	67	44.26 ± 10.32	49.90	K = 26.194	p = .001*
	1–3 years	48	16	79	49.49 ± 10.92	71.28		
	4–6 years	36	37	75	55.86 ± 9.19	95.44		
	More than 6 years	27	34.59	76	55.08 ± 10.89	93.39		
Gender	Female	127	16	79	51.02 ± 11.52	77.00	U = 1269.500	p = .319
	Male	23	24	61	48.66 ± 9.60	67.20		
Age group	less than 20	46	19	76	47.22 ± 11.03	61.71	K = 7.781	p = .050*
	20–29	81	24	75	52.79 ± 10.40	83.96		
	30–39	10	16	79	50.05 ± 17.79	73.65		
	greater than40	13	38	61	50.07 ± 8.97	73.00		

* p-value is significant at ≤0.05.

that students preferred portable electronic devices to desktop computers. The Chi-square test indicated that there is a significant association between the year of the study and the ownership of the laptops (1st year = 59.3%; 2nd year = 86.7%; 3rd year = 88.9%; 4th year = 92.3%; and χ2 = 17.713; p = .001).

Similarly, the year of the study was significantly associated with the ownership of tablets (1st year = 38.9%; 2nd year = 46.7%; 3rd year = 33.3%; 4th year = 69.2%; and χ2 = 11.114; p = .011). The majority of students residing on-campus had their laptops (87.3%), and 73.7% of those residing off-campus had their own laptops, and those differences were statistically significant (χ2 = 3.833; p = .037) (Table 5). Furthermore, the findings indicated that there is a significant association between the ownership of desktop and the place of residence (χ2 = 8.433; p = .004) with 29.9% of students staying at the off campus residences reporting to have desktops compared to 9.1% from the on campus residences.

Although the majority postgraduate students reported possessing more smartphones (96.6%) and laptops (89.7%) than undergraduate students (87.6 and 76% respectively), those differences were not statistically significant (p > .05) (Table 5).

The Chi-square test indicated that there is an association between the type of electronic devices owned by the students and their skills level in using different ICT applications (Table 6). The ownership of laptops was statistically associated with the use of the following ICT applications:

- creating, reading, sending email (with laptops = 91.5%; without laptops = 65.6%; and χ2 = 14.026; p = .001);
- using Ms Word for writing documents (with laptops = 92.4%; without laptops = 65.6%; and χ2 = 15.586; p = .001);
- using Excel for creating spreadsheets or charts (with laptops = 52.5%; without laptops = 21.9%; and χ2 = 9.531; p = .002);
- using PowerPoint for creating presentations (with laptops = 82.2%; without laptops = 28.1%; and χ2 = 35.515; p = .001);
- using Photoshop, flash for creating graphics (with laptops = 33.1%; without laptops = 12.5%; and χ2 = 5.199; p = .027);
- creating web pages for e-portfolio (with laptops 17.8%; without laptops = 3.1; and χ2 = 4.330; p = .046);
- using online library resources (with laptops = 79.7%; without laptops = 56.3%; and χ2 = 7.294; p = .011);
- using Turnitin (with laptops = 44.1%; without laptops = 15.6%; and χ2 = 8.644p = .004);
- installing software on the computer (with laptops = 44.1%; without laptops = 1.9%; and χ2 = 5.196; p = .025);
- using a spreadsheet to plot a graph (with laptops = 41.5%; without laptops = 9.4%; and χ2 = 11.489; p = .001);
- participating in a discussion forum on the internet (with

Table 5
Technology devices owned by nursing students.

		Year of the study					Nursing programme			Place of the residence		
	N = 150	1st year	2nd Year	3rd Year	4th year	Chi-square	Undergrad.	Postgrad.	Chi-square	On-campus	Off-campus	Chi-square
Desktop	No (78%)	81.5	66.7	85.2	76.9	χ2 = 3.294; ; ;	78.5	75.9	χ2 = 0.096;	90.9	70.5	χ2 = 8.433;
	Yes (22%)	18.5	33.3	14.8	23.1	p = .347	21.5	24.1	p = .804	9.1	29.5	p = .004**
Laptop	No (21.3%)	40.7	13.3	11.1	7.7	χ2 = 17.713; ;	24.0	10.3	χ2 = 2.587;	12.7	26.3	χ2 = 3.833;
	Yes (78.7%)	59.3	86.7	88.9	92.3	p = .001**	76.0	89.7	p = .134	87.3	73.7	p = .037*
Tablet	No (52.7%)	61.1	53.3	66.7	30.8	χ2 = 11.114;	52.9	51.7	χ2 = 0.013;	58.2	49.5	χ2 = 1.060; ;
	Yes (47.3%)	38.9	46.7	33.3	69.2	p = .011*	47.1	48.3	p = 536	41.8	50.5	p = .315
Smartphone	No (10.7%)	9.3	16.7	11.1	7.7	χ2 = 1.668;	12.4	3.4	χ2 = 1.966;	12.7	9.5	χ2 = 0.387;
	Yes (89.3%)	90.7	83.3	88.9	92.3	p = .642	87.6	96.6	p = .311	87.3	90.5	p = .588

* p-value is significant at ≤0.05.

Table 6
The levels of skills in using ICT applications and the types of electronic devices owned by the students.

Levels of skills in using ICT applications		N = 150	Desktop No (n = 117)	Yes (n = 33)	Stat. Test Chi-square	Laptop No (n = 32)	Yes (n = 118)	Stat. Test Chi-square	Tablet No (n = 79)	Yes (n = 71)	Stat. Test Chi-square	Smartphone No (n = 16)	Yes (n = 134)	Stat. Test Chi-square
Creating, reading, sending email	Inadequate skills	21	13.7%	15.2%	$\chi2 = .047$; p = .829	34.4%	8.5%	$\chi2 = 14.026$; ; p = .001**	16.5%	11.3%	$\chi2 = .836$; p = .481	31.3%	11.9%	$\chi2 = 4.426$; ; p = .050*
	Adequate skills	129	86.3%	84.8%		65.6%	91.5%		83.5%	88.7%		68.8%	88.1%	
Using MS Word for writings documents	Inadequate skills	20	12.8%	15.2%	$\chi2 = .121$; p = .773	34.4%	7.6%	$\chi2 = 15.586$; p = .001**	13.9%	12.7%	$\chi2 = .050$; p = 1.00	25.0%	11.9%	$\chi2 = 2.110$; p = .232
	Adequate skills	130	87.2%	84.8%		65.6%	92.4%		86.1%	87.3%		75.0%	88.1%	
Using Excel for creating spreadsheets or charts	Inadequate skills	81	58.1%	39.4%	$\chi2 = 3.634$; p = .044*	78.1%	47.5%	$\chi2 = 9.531$; p = .002**	62.0%	45.1%	$\chi2 = 4.327$; p = .049*	62.5%	53.0%	$\chi2 = 0.521$; p = .598
	Adequate skills	69	41.9%	60.6%		21.9%	52.5%		38.0%	54.9%		37.5%	47.0%	
Using PowerPoint for creating presentations	Inadequate skills	44	30.8%	24.2%	$\chi2 = .529$; p = .523	71.9%	17.8%	$\chi2 = 35.515$; p = .001**	40.5%	16.9%	$\chi2 = 10.051$; p = .002**	37.5%	28.4%	$\chi2 = 0.576$; p = 562
	Adequate skills	106	69.2%	75.8%		28.1%	82.2%		59.5%	83.1%		62.5%	71.6%	
Using Photoshop for creating graphics	Inadequate skills	107	76.1%	54.5%	$\chi2 = 5.499$; p = .028*	87.5%	66.9%	$\chi2 = 5.199$; p = .027*	78.5%	63.4%	$\chi2 = 4.170$; p = .048*	75.0%	70.9%	$\chi2 = 0.118$; p = .493
	Adequate skills	43	23.9%	45.5%		12.5%	33.1%		21.5%	36.6%		25.0%	29.1%	
Using video/audio software for creating and editing movies and audio	Inadequate skills	117	82.1%	63.6%	$\chi2 = 5.087$; p = .032*	84.4%	76.3%	$\chi2 = .963$; p = .353	82.3%	73.2%	$\chi2 = 1.780$; p = .236	87.5%	76.9%	$\chi2 = 0.942$; p = .374
	Adequate skills	33	17.9%	36.4%		15.6%	23.7%		17.7%	26.8%		12.5%	23.1%	
Creating web pages for e-portfolio	Inadequate skills	128	83.8%	90.9%	$\chi2 = 1.051$; p = .409	96.9%	82.2%	$\chi2 = 4.330$; p = .046*	89.9%	80.3%	$\chi2 = 2.749$; p = .110	81.3%	85.8%	$\chi2 = 0.239$; p = .707
	Adequate skills	22	16.2%	9.1%		3.1%	17.8%		10.1%	19.7%		18.8%	14.2%	
Using Moodle	Inadequate skills	28	17.1%	24.2%	$\chi2 = .866$; p = .447	21.9%	17.8%	$\chi2 = .276$; p = .613	17.7%	19.7%	$\chi2 = .098$; p = .835	18.8%	18.7%	$\chi2 = 0.001$; p = .570
	Adequate skills	122	82.9%	75.8%		78.1%	82.2%		82.3%	80.3%		81.2%	81.3%	
Using online library resources	Inadequate skills	38	23.9%	30.3%	$\chi2 = .552$; p = .499	43.8%	20.3%	$\chi2 = 7.294$; p = .011*	24.1%	26.8%	.145; p = .712	18.8%	26.1%	$\chi2 = 0.410$; p = .540
	Adequate skills	112	76.1%	69.7%		56.3%	79.7%		75.9%	73.2%		81.3%	73.9%	
Using EndNote	Inadequate skills	99	65.0%	66.7%	$\chi2 = .033$; p = .515	71.9%	63.6%	$\chi2 = .769$; p = .412	67.1%	63.4%	$\chi2 = .227$; p = .731	68.8%	64.9%	$\chi2 = 0.092$; p = .792
	Adequate skills	52	35.0%	33.3%		28.1%	36.4%		32.9%	36.6%		31.3%	35.1%	
Using SPSS for data analysis	Inadequate skills	123	79.5%	90.9%	$\chi2 = 2.275$; p = .198	84.4%	81.4%	$\chi2 = .155$; p = .800	82.3%	81.7%	$\chi2 = .009$; p = .546	87.5%	81.3%	$\chi2 = 0.367$; p = .738
	Adequate skills	27	20.5%	9.1%		15.6%	18.6%		17.7%	18.3%		12.5%	18.7%	
Using Turnitin	Inadequate skills	93	59.0%	72.7%	$\chi2 = 2.066$; p = .162	84.4%	55.9%	$\chi2 = 8.644$; p = .004**	64.6%	59.2%	$\chi2 = .463$; p = .506	75.0%	60.4%	1.285; p = .291
	Adequate skills	57	41.0%	27.3%		15.6%	44.1%		35.4%	40.8%		25.0%	39.6%	

Table 6 (*continued*)

Levels of skills in using ICT applications		N = 150	Desktop No (n = 117)	Yes (n = 33)	Stat. Test Chi-square	Laptop No (n = 32)	Yes (n = 118)	Stat. Test Chi-square	Tablet No (n = 79)	Yes (n = 71)	Stat. Test Chi-square	Smartphone No (n = 16)	Yes (n = 134)	Stat. Test Chi-square
Installing software on the computer	Inadequate skills	91	64.1%	48.5%	χ2 = 2.631; p = .112	78.1%	55.9%	χ2 = 5.196; p = .025*	65.8%	54.9%	χ2 = 1.859; p = .185	68.8%	59.7%	χ2 = 0.490; p = .594
	Adequate skills	59	35.9%	51.5%		21.9%	44.1%		34.2%	45.1%		31.3%	40.3%	
Using a spreadsheet to plot a graph	Inadequate skills	98	70.1%	48.5%	χ2 = 5.118; p = .037*	90.6%	58.5%	χ2 = 11.489; p = .001**	75.9%	53.5%	χ2 = 8.305; p = .006**	75.0%	64.2%	χ2 = 0.739; p = .426
	Adequate skills	52	29.9%	51.5%		9.4%	41.5%		24.1%	46.5%		25.0%	35.8%	
Participating in a discussion forum on the Internet	Inadequate skills	112	72.6%	81.8%	χ2 = 1.144; p = .367	87.5%	71.2%	χ2 = 3.542; p = .044*	82.3%	66.2%	χ2 = 5.112; p = .026*	75.0%	74.6%	χ2 = 0.001; p = .621
	Adequate skills	38	27.4%	18.2%		12.5%	28.8%		17.7%	33.8%		25.0%	25.4%	
Registering and participating in online training programmes	Inadequate skills	110	70.9%	81.8%	χ2 = 1.558; p = .268	90.6%	68.6%	χ2 = 3.542; p = .013*	82.3%	63.4%	χ2 = 6.829; p = .010**	87.5%	71.6%	χ2 = 1.838; p = .238
	Adequate skills	40	29.1%	18.2%		9.4%	31.4%		17.7%	36.6%		12.5%	28.4%	

* p-value is significant at ≤ 0.05.
** P-value is significant ≤0.01.

laptops = 28.8%; without laptops = 12.5%; and χ2 = 3.542; p = .044);

• registering and participating in online training programmes (with laptops = 31.4%; without laptops = 9.4%; and χ2 = 3.542p = .013) (Table 6).

Furthermore, owning the desktop was associated with the skills to use the following ICT applications: Excel (with desktops = 60.6%; without desktop = 41.9%; and χ2 = 3.634; p = .044); using Photoshop for creating graphics (with desktops = 45.5%, without desktops = 23.9%; and χ2 = 5.499; p = .028); using video/audio software (with desktops = 36.4%; without a desktops = 17.9%; and χ2 = 5.087; p = .032); using a spreadsheet to plot a graph (with a desktops = 51.5%; and without a desktops = 29.9%; and χ2 = 5.118; p = .037) (Table 6).

The ownership of the tablets was also statistically associated with participating in online forum discussion (with tablets = 33.8%; without tablets = 17.7%; and χ2 = 5.112; p = .026); registering and participating in online training programmes (with tablets = 36.6%; without tablets = 17.7%; and χ2 = 6.829; p = .010), the use of PowerPoint (with tablets = 83.1%; without tablets = 59.5%; and χ2 = 10.051; p = .002); using Excel for creating spreadsheet (with tablets = 54.9%; without tablets = 38.0%; and χ2 = 4.327; p = .049), using spreadsheet for plotting graphs (with tablets = 46.5%; without tablets = 24.1%; and p = .006); using of Photoshop software (with tablets = 36.6%, without tablets = 21.5%; and χ2 = 4.170, p = .048); installing software (with tablets = 44.1%; without tablets = 15.6%; and χ2 = 8.644; p = .004 (Table 6).

Possessing the smartphone was statistically associated with the skills to create, and read an email (with smartphones = 88.1%; without smartphones = 68.8%; and χ2 = 4.426; p = .05) (Table 6).

3.6. Type of the devices owned by the students and the overall level of the skills in information technologies

A statistically significant association was noted between the level of the ICT skills and the types of ICT devices owned by nursing students. Those who owned laptops reported to be more skilled in using ICT applications (52.49 ± 10.52) than those who did not (43.91 ± 11.42) and those differences were statistically significant (U = 1099.000, p = .001) with mean rank of mean rank = 82.19 for those who have laptops; and 50.84 for those without laptops.

It was also noted that owning the tablet was significantly associated with the level of skills in using ICT applications (U = 2258.00, p = .040) with those who owned the tablets being more skilled (52.56 ± 12.07); with the mean rank of 83.19 compared to those who did not have tablets (48.95 ± 10.23) with the mean rank of 68.59. There was no statistically significant association between the students' skills in using ICT applications and owning desktop computers and smartphones (p > .05) although those who possessed those devices perceived themselves more skilled (Table 7).

4. Discussion

Developing ICT competencies among nurses should be enhanced during their training, not only for academic purposes but also for shaping their professional carrier; thus the need for nursing informatics in the nursing curriculum (Harerimana & Mtshali, 2017, 2018). Integrating ICT in teaching and learning requires a certain level of ICT literacy among students. This study explored necessary competencies in nursing informatics, such as the use of computer hardware and specific programmes, such as word processors and spreadsheets, search engines and databases, reference manager, data analysis, health information systems and emails for communication and collaboration.

The majority of the respondents felt they were skilled in using applications for writing and presenting their assignments, such as MS

Word (86.7%). Furthermore, it was noted that 85.1% of undergraduate students and 93.1% of the postgraduate students reported having skills to use a word processor. Studies show that both undergraduate and postgraduate nursing students use word processing application as part of their learning process (Choi & De Martinis, 2013; Foster & Sethares, 2017). A study conducted by Choi and De Martinis (2013) found that postgraduate nursing students were more competent than undergraduate nursing students in basic computer literacy such as the use of word processor. The same authors reported that this might be due to prolonged exposure to computers, particularly in their working environment (Choi & De Martinis, 2013).

According to Tech Supporting (2015), the Microsoft word processor in an essential tool in the writing process, or getting ideas organised. Word processing is used in universities and schools for academic and communication purposes in various situations. The benefits of using word processors range from deciding on the font, size colours and styles which can be changed easily. There are also other features, such as tables and illustrations, which could be added to the text, utilities to auto correct and auto-complete the spellings (Tech Supporting, 2015).

The use of MS Word for academic purposes goes hand in hand with reference manager software. Although EndNote, as a reference manager, was explored in this study, the literature indicates that there are other reference management software tools, such as Mendeley, RefWorks and Zotero (Basak, 2014; MacMillan, 2012; Sungur & Seyhan, 2013). The findings from this study indicated that not students were able to EndNote, with only 34.7% of undergraduate students and 34.5% of postgraduate students reporting to be skilled in using the EndNote as a reference manager recommended by the university. A similar study conducted by Fruin (2013) found out that only 14.2% were able to use EndNote, and less than 10% used RefWorks, and Easy bib as reference managers. Reference management software tools are widely used by scholars, as it makes referencing and citations much easier than the manual one (Basak, 2014).

The importance of using PowerPoint for presenting information is recognised throughout the literature. In the current study, the majority of postgraduate students (82.8%), and undergraduate students (67.8%) reported being skilful in using Ms PowerPoint. A study conducted by Lari (2014) indicated that students preferred the use of PowerPoint in class, as it makes it easy to follow the lesson, makes the presentation more appealing and helps to get the students' attention. Carefully mixing audio-visual media in the PowerPoint presentation is vital in order to meet different learning styles (Hamada & Hassan, 2017; Hashemi, Azizinezhad, & Farokhi, 2012; Kim & Lombardino, 2017).

In the current study, nursing students reported to use the video/picture editing software tools, and such applications could be used in their presentation of projects that require pictures and videos. However, only 24.8% of undergraduate students and 10.3% of postgraduate students reported being skilful to use those applications. In the study conducted by Bright et al. (2015) it was found that nursing students positively perceived the importance to use videos and pictures as learning tools, however, their limited skills was a hindrance.

The use of video, audio and pictures in teaching increase the students' motivation and has a positive effect on the long-term memories (Bravo Ibarra, Amante García, Simó Guzmán, Enache, & Fernández Alarcón, 2011; Bright et al., 2015; Hsin & Cigas, 2013; Steffes & Duverger, 2012). In innovative teaching and learning, both teachers and students should be encouraged to use video/audio/pictures, which may be accessed online or available on DVD or CD.

Due to the nature of the nursing profession, nursing students are posted into various clinical settings such as communities (Ildarabadi, Moonaghi, Heydari, & Taghipour, 2013; WHO, 2010), and such placement requires them to conduct a needs assessment, data collection and analysis, designing and implementing projects that would respond to the significant issues identified (WHO, 2010). Clinical teaching strategies require nursing students to have basic skills in data analysis and dissemination. However, in this study, small percentages of both

undergraduate and postgraduate nursing students (16.5% and 24.1% respectively) reported to be skilled in using SPSS application for data analysis, and findings show that Excel was used by a significant number of students, and 62.1% of postgraduate students and 42.1% of undergraduate students reported to be skilled to use Excel for data analysis and creating plots.

Perry, Barak, Neumann, and Levy (2014) stress the importance of using computer-based programmes, such as SPSS for data analysis in medical education. Students need to learn statistics for a better understanding of the language used in the medical literature and as a tool to help them in decision making (Fielding, Poobalan, Prescott, Marais, & Aucott, 2015; Perry et al., 2014). A study conducted by Martin, Pierce, and Giri (2002) pointed out that it is important to make statistics relevant to undergraduate nurses. Introducing statistical packages to the education of health professionals assist students to understand better the statistics, which are essential for them to assimilate the work of others and use the software in their own research work (Boyle, Manea, & Karki, 2013; Marshall & Jonker, 2010). Students should be taught such statistical programmes early in their curriculum, and this should be reinforced throughout the course (Fielding et al., 2015).

Results indicated that nursing students used some web-based applications. It was found that 86% reported being skilled in creating, reading and sending emails, with postgraduate students reporting to be more skilled (93.1%) than undergraduate students (84.3%). The pervasive use of e-mails in education is associated with students' academic achievement, effective communication between the faculty and students and its positive impact on instructional delivery (Weiss & Hanson-Baldauf, 2008). A study conducted by Weiss and Hanson-Baldauf (2008), on the appropriate use of e-mails, found that the majority of students use e-mails for clarification about the assignment and lecture, building relationships and excuses for the missed classes or assignments. The same study indicated that students perceived that the appropriate use of e-mails has a positive impact on their learning, grade and relationships.

Nursing students from both undergraduate and postgraduate programme reported having adequate skills to use Moodle as an online learning management system (LMS) (81.3%); however, it was found that more undergraduate students (86.0%) reported being more skilled than postgraduate students (62.1%) in using Moodle. Furthermore, 74.7% of the students reported having skills to search for online resources, with 76% of undergraduate students compared to 69% of postgraduate students. A study conducted by Luo et al. (2017) on the use of Moodle in the education of health professionals' fount that 81.91% were very satisfied to use Moodle.

In the technological world, education is no longer limited to classroom teaching and learning, and the use of the online platform and online teaching is progressively gaining ground in higher education (Arkorful & Abaidoo, 2015; Costa, Alvelos, & Teixeira, 2012; Harerimana & Mtshali, 2017; Natalier & Clarke, 2015). The ability to use these platforms determine their better utilisation for learning purposes (Costa et al., 2012). Moodle is one of the online teaching and learning platforms which facilitate the creation of a course website, ensuring their access only to enrolled students. Moodle is used to create, organize and deliver course contents and other electronic documents, learning activities and assignments. Furthermore, students use Moodle for communication mainly through forum discussions and chats. The benefits brought by the ability to exchange information, despite the time and the location, is essential (Button, Harrington, & Belan, 2013; Costa et al., 2012; Harerimana & Mtshali, 2017; Harerimana et al., 2016), and the current study indicated that the majority of the students (74.7%) participated in an online forum discussion, either using Moodle or other online platforms.

In the digital era, learning instruction in nursing education is increasingly being delivered online through platforms such as Moodle, Open educational resources, Open Courseware (OCW) and Massive

Table 7
Type of the devices owned by the students and the overall level of the skills in information technologies.

		N	Min	Max	Mean &S. D	Mean Rank	Test Value	p.value
Desktop	No	117	24.00	79.00	50.62 ± 11.03	74.41	U = 1802.500	p = .561
	Yes	33	16.00	69.00	50.80 ± 12.17	79.38		
	Total	150	16.00	79.00	50.66 ± 11.25			
Laptop	No	32	16.00	62.00	43.91 ± 11.42	50.84	U = 1099.000	p = .001**
	Yes	118	19.00	79.00	52.49 ± 10.52	82.19		
	Total	150	16.00	79.00	50.66 ± 11.25			
Tablet	No	79	19.00	71.00	48.95 ± 10.23	68.59	U = 2258.500	p = .040*
	Yes	71	16.00	79.00	52.56 ± 12.07	83.19		
	Total	150	16.00	79.00	50.66 ± 11.25			
Smartphones	No	16	24.00	79.00	48.31 ± 14.38	65.34	U = 909.500	p = .322
	Yes	134	16.00	76.00	50.94 ± 10.85	76.71		
	Total	150	16.00	79.00	50.66 ± 11.25			

* p-value is significant at ≤0.05.

open online courses (MOOC), and students are expected to be self-directed (Swigart & Liang, 2016). Ensuring that students are equipped with the necessary skills in such learning management systems is essential for successful teaching in an online educational environment (Balázs, 2017).

Nursing students are expected to use software applications, which would allow them to detect the plagiarised work, and, in the current study, the use of Turnitin was explored. Thirty-eight per cent of students respectively from undergraduate and postgraduate programmes reported to have adequate skills. A study conducted by Kelley (2014) found that 42.5% of the students were required to submit their academic work to plagiarism detecting software. According to Buckley and Cowap (2013), the use of plagiarism detecting software, such as Turnitin, is essential for both undergraduate and postgraduate programmes. The ability of the software to produce the originality report saves time in providing evidence of plagiarism in both assignment and research projects (Buckley & Cowap, 2013). Providing students with formal training on plagiarism clearly improves their ability to discriminate plagiarism (Holt, Fagerheim, & Durham, 2014). It essential that measures should be put in place to prevent not only plagiarism but also the "Ghost-writing" that is increasingly becoming a major problem in education, where individuals might be hired to produce some pieces of work based on the pre-determined styles, none of the "original writing is attributed to the ghost-writer" (Singh & Remenyi, 2016, p. 2).

Although the overall use of ICT applications was not significantly associated with the programme of the study, it was found that postgraduate students were more skilled to use some applications than the undergraduate such as using Microsoft Word, PowerPoint, and emails. A study conducted by Tseng, Yi, and Yeh (2019) found that graduate students had an advanced level of soft skills such as communication and sharing with colleagues than undergraduate students.

The overall level of skills of the nursing students was significantly associated with the year of the study, with lower levels being less skilled than upper levels of the study. This finding indicates the importance of strengthening the skills of students from the first year, as they often enter tertiary education with limited knowledge in using electronic devices, particularly computers for academic purposes. In a study conducted by Woreta, Kebede, and Zegeye (2013), it was noted that 46% of the 1st year students could use computers. A study conducted by Irinoye, Ayandiran, Fakunle, and Mtshali (2013) found that there is low usage of computer technologies among nursing students, with 37.8% reporting that they had never had formal training in information technology. It is recommended to the teaching institutions to train students, and ensure that effective evaluation and monitoring of the acquisition of the skills is conducted.

Nursing students staying on campus rated themselves more competent (54.86 ± 9.73) than those staying off campus (48.23 ± 11.40) in using ICT applications for academic purposes. A study conducted by

Makori and Flora (2018) indicated that students are more dependent on the university's ICT facilities, although they are able to access them off campus, in areas such as internet cafés. A study conducted by Harerimana and Mtshali (2018), on the use of the internet as an academic tool, indicated that the majority of the students (69.7%) accessed the internet while on campus. Similarly, Osei-Asibey, Agyemang, and Boakye -Dankwah (2017) reported in their study that 80.4% of students accessed the internet while on campus either in computer laboratories, campus halls and hostels via Wi-Fi. The availability of computers and the internet on campus and collaborative learning among nursing students, particularly those staying in the same residences, might play an important role in strengthening their skills in ICT(Akgün & Akkoyunlu, 2013; Coopasami, Knight, & Pete, 2017).

The results of this study indicated that nursing students owned electronic devices, such as smartphones (89.3%), followed by laptops (78.7%), tablets (47.3%) and desktops (22%). Furthermore, it was noted that most of the postgraduate students had laptops (89%) and smartphones (96.6%) compared to undergraduate students (76%, and 87% respectively).

Similarly, in the study conducted by Coopasami et al. (2017), it was found that nursing students owned digital devices with the majority owning cell phones and laptops, and those devices were used mainly for communication and academic purposes. The mobile devices were the most owned by the students, and the ownership of these devices was associated with the perceived level of skills in using different ICT applications. In a study conducted by White (2018) found that nursing students used mobile devices for classrooms surveys, simulation and clinical practices for information searching purposes, and students were requested to purchase their devices with downloading capabilities.

Lee, Min, Oh, and Shim (2018) stated that the advanced features of technology devices such as smartphones, and tablets have changed the way they are used in the classroom and in the clinical environment. The use of mobile devices is reported to enhance the individualised interfaces, instant messaging and feedback, and real-time access to the information without being restricted by the time and the location (Buchvalter, 2017; Delcker, Honal, & Ifenthaler, 2018). In modern societies, the use of information communication technologies, such as computers and smartphones, are part of everyday life (Piszczek, Pichler, Turel, & Greenhaus, 2016). The use of digital devices allows access to current evidence-based resources among healthcare students (George, DeCristofaro, Murphy, & Sims, 2017). However, the use of digital technologies in nursing education is still at the embryonic stage, and not well implemented in nursing curricula (Lee et al., 2018).

Although the findings from this study indicated that nursing students possess adequate skills in using some ICT applications such as Word processor, PowerPoint, emails, and Moodle, both undergraduate and postgraduate students reported to have inadequate skills to use ICT applications essential for their academic activities such as the reference

manager, plagiarism detecting software; and data analysis software. The literature reveals that there are challenges experienced by nursing students on the use technology such as insufficient ICT literacy, and ability to access electronic resources (Harerimana et al., 2016; Havenga & Sengane, 2018).

In the fast advancing technological world, nurses and nursing students are required to be equipped with ICT skills in order to fully benefit from using technology in their practices (Mac Callum & Jeffrey, 2013; Wilkinson et al., 2013). The ICT competencies to be developed should include the use of computer hardware and specific programmes, word processors and spreadsheets, search engines and databases, citing sources, health information system and email for communication and collaboration (Masouras, 2016).

5. Conclusion

The use of technology in nursing education is essential to prepare future digital nurses. In this study, students reported using technology for communicating, accessing electronic resources through the internet and Moodle, writing documents, and using academic software such as EndNote, SPSS, and Turnitin. The findings from this study indicated that students have varied levels of skills for using ICT applications. It was found that the skills of the students increase with the year of the study and the number of years of using computers.

Ownership of electronic devices, such as laptops and tablets, was reported to influence the ability to use ICT applications for learning purposes. Inadequate skills of nursing students to use applications fundamental to academic life should be taken into consideration, particularly word processing applications, reference manager, data analysis software, and Plagiarism detecting software. It is pivotal to encourage students to use Moodle, as a learning management system, and motivate students to participate in online forum discussions and online training programmes.

Although nursing students reported having skills to use some ICT applications, emphasis should be placed on the integration of computer literacy in the nursing curriculum, with special attention to the 1st year students, as they have limited exposure to computers from high schools. On-going students' monitoring on the use of ICT should be mandatory across all modules, particularly through assignments, research proposals, research projects, learning portfolios, etc. Effective integration of ICT in the nursing curriculum would strengthen nursing students' skills in nursing informatics. Teaching nursing informatics, coupled with training of nursing students, is pivotal to prepare future nurses for the information technology-rich workplace.

Declaration of Competing Interest

The authors declare that there is no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijans.2019.100163.

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