Article

Nursing Students' Perceptions and Expectations Regarding the Use of Technology in Nursing Education

Alexis Harerimana
https://orcid.org/0000-0002-5954-5254
University of KwaZulu-Natal, South Africa
haralexis@yahoo.fr

Ntombifikile Gloria Mtshali
https://orcid.org/0000-0002-4096-8193
University of KwaZulu-Natal, South Africa
mtshalin3@ukzn.ac.za

Abstract

Technological innovations are changing the face of nursing education, with teachers being expected to integrate best teaching practices in the classroom and to ensure that nursing students are motivated and engaged. Taking into consideration students' needs is essential to provide successful integration of the technology in teaching and learning. This paper aims to explore nursing students' perceptions and expectations regarding the use of technology in nursing education. A descriptive quantitative research design was used, and the study was conducted at a selected university in South Africa. A total of 150 nursing students completed the questionnaires, with the data being analysed descriptively using SPSS version 25. The nursing students reported that educators used technology to deliver course instructions (96.7%), and encouraged students to use it for creative or critical thinking tasks (95.3%). They were encouraged by their educators to use their own technology devices (94.7%) and online platforms (94.7%). More undergraduate students perceived that nurse educators used technology at school (15.63 ± 2.54) than postgraduate students (14.41 ± 3.07) (U =1341.00, p = .044). Overall, 77.3 per cent of the nursing students expected the use of technology in teaching, mainly Moodle (88.7%), search tools (75.3%), podcasts and videocasts (66.7%), EndNote (62.7%), and Turnitin (48.7%). The majority of the students (82.1%) from the lower academic levels (first and second year) had a high expectation of the use of technology compared to 71.2 per cent of the higher levels (third and fourth year). The use of technology in teaching requires nurse educators to have adequate skills to make it a powerful tool for teaching and learning. Much more effort should be put in motivating students to use various technological tools, and ensuring that they have adequate skills, particularly at the entry level.

Keywords: ICT; technology; nurse educators; nursing students; nursing education

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Background

Technological innovations are changing the face of nursing education, with educators being expected to integrate best teaching practices and to ensure that the students are motivated and engaged (Thomas, Reyes, and Blumling 2014). Taking into consideration students' needs is important to establish how the technology should be used, and this should be balanced with appropriate learning styles to achieve the best outcomes (Thomas, Reyes, and Blumling 2014). A study conducted by Ghavifekr and Rosdy (2015) on "the effectiveness of information and communication technology in education" indicated that nursing students lack the confidence to use the technology on their arrival at university, although there is a progressive increase during the first year. The same authors argued that information and communication technology (ICT) skills development has generally been incidental, and despite it being necessary for nurses education, there is no explicit indication of nursing informatics integration into teaching (Ghavifekr and Rosdy 2015). It is essential for the newly enrolled nursing students to develop ICT competencies to engage with the technology-mediated learning environment, and cannot be assumed to have been part of their previous educational experience (Ghavifekr and Rosdy 2015).

The benefits brought by technology make it an ideal tool to prepare the future generation of nurses (Rahman 2015). A technology-mediated learning environment, particularly online education, is cost-effective, flexible, and allows access to multiple resources beyond the classroom settings, this being important in nursing education owing to the clinical placements of the students (Harerimana et al. 2016; Xu 2016). Technology is reported to facilitate student-centred learning approaches, and to enhance their attention and motivation (Owusu-Agyeman and Larbi-Siaw 2018; Xu 2016). Furthermore, it facilitates teaching beyond the classroom, without being restricted by time and location, promoting self-directed, inquiry-based, collaborative, and lifelong learning, critical thinking, and integrating theory into practice, which are essential to the nursing profession (Harerimana and Mtshali 2017; Murad 2017; Ndawo 2016).

In the education of healthcare professionals, technology is used to deliver instructions to students and to ensure that there are timely collaboration and communication among and between them, as well as with their educators (Tuominen, Stolt, and Salminen 2014). A study conducted by Borboa et al. (2017) found that nursing students used several aspects of technology, such as emails, to access online course materials or syllabus, assignments, tests and quizzes, announcements, podcasts, and forum discussions.

In a study conducted by Williamson and Muckle (2018), nursing students perceived that technology could improve their performance, facilitate learning, increase access to resources, and improve communication. Nurse educators should provide learning activities that encourage collaboration and self-directed learning, and are expected to help students to use mobile devices, such as laptops, tablets and smartphones, for communication, academic work, and to access electronic resources. This is essential to

make students more independent and to prevent them from relying only on the on-campus ICT capabilities (Al-Hariri and Al-Hattami 2017; Lee et al. 2018).

In the United States of America (USA), technology is widely used in schools to foster global competitiveness, and is used in line with innovative teaching strategies (McKnight et al. 2016). In Australia, Canada and Denmark, the technology has been integrated into nursing education, with an emphasis on including informatics' competencies in the curriculum (Cummings, Borycki, and Madsen 2015). The literature indicates that Denmark has successfully integrated technology in the undergraduate curriculum, while it is still in the early stages in Australia and Canada (Chauvette and Paul 2016; Cummings, Borycki, and Madsen 2015).

In Africa, many countries introduced technology in higher education, although it is still in embryonic stages in nursing education. In Malawi, the Mzuzu University is consulting with the Nurses and Midwifery Council of Malawi to integrate the technology into the undergraduate and postgraduate nursing curriculum (O'Connor et al. 2016). In Rwanda, e-learning was introduced into nursing education in 2012, with the aim of using innovative technologies to widen access to nursing education for the working nurses, upgrade the level of nurses and midwives, and fast-track the development of competent nurses and midwives to respond to the country's health needs (Harerimana and Mtshali 2017; Harerimana et al. 2016).

While the impact of technology in the education of healthcare professionals is recognised, the literature reveals that efforts have been placed on training physicians, with limited emphasis on dentistry, pharmacy and nursing training (Frehywot et al. 2013). In South Africa, the lack of proper integration of technology in nursing education has resulted in nursing institutions lagging behind other higher education programmes (Maharaj 2015).

A study conducted by Puckree, Maharaj, and Mshunquane (2015) on the use of technology by academic staff in South African nursing institutions found that there are limited ICT skills among the faculty and that the majority of staff could manage only a few applications. The same authors indicated that the majority of the nurse educators (60%) did not use technology to teach students, with some using videos, simulations and PowerPoint presentations.

Cummings et al. (2016) stated that one of the critical challenges in integrating technology, particularly nursing informatics in undergraduate education, is ensuring that nurse educators have the necessary skills and confidence to use the technology for teaching and learning purposes. Cummings et al. (2016) observed that although nurse educators were prepared to use the technology as part of their instruction, they were not equally distributed across the nursing programmes (Cummings et al. 2016).

Developing the competencies of nursing faculty and students, together with integrating key ICT competencies in the nursing curriculum should be a priority in many developing countries, as technology-based teaching and learning is being increasingly used to accommodate innovative teaching approaches (Bvumbwe and Mtshali 2018; Maharaj 2015; Mulaudzi et al. 2014). In a technology-mediated learning environment, teachers play essential roles in promoting its use in classrooms (McKnight et al. 2016). Nurse educators are the drivers of the successful integration of ICT in programmes, and need to ensure that nursing students have the necessary skills and are motivated to learn in a technology-driven context (Ndawo 2016).

While the use of technology in teaching brings promises to nursing education, several challenges have been reported to hinder its effective implementation, including poor internet speed, inadequate ICT literacy, and a lack of motivation from the students and faculty (Bello et al. 2017; Harerimana et al. 2016). Furthermore, there is a lack of ICT support and specialised training to use technology for many faculties and students, which is an obstacle to teaching and learning in higher education (Ghavifekr et al. 2016; Puckree, Maharaj, and Mshunquane 2015). The literature also indicates that there is resistance to change for academics to the new technologies, as they do not perceive their benefits to education (Ghavifekr et al. 2016; Moerschell 2009; Westberry et al. 2015).

Nursing students expect teachers to be at the forefront of technological innovations that engage them in learning and prepare them for their future career (Hallila et al. 2014; Marzilli et al. 2014). In educating healthcare professionals, it is important to ensure that nursing students and faculties have the necessary ICT skills, and are motivated to use the cutting-edge technologies (Ludwig, Nagel, and Lewis 2017; Vargo-Warran 2016). Teaching institutions should ensure that nursing students and the faculty receive adequate training and mentorship in online teaching and learning, with special attention to use Moodle (Modular Object Oriented Dynamic Learning), emails, social media, reference materials, and word-processing applications, which are essential in the technology-driven learning environment (Ainsley and Brown 2009; Fernández-Alemán et al. 2014; Masouras 2016).

In order to explore the use of technology in nursing education, the research questions were:

- What are nursing students' perceptions of the use of technology by nurse educators?
- What are nursing students' expectations about the use of technology by nurse educators?

Methodology

A descriptive quantitative research design with a cross-sectional survey was used, with the study being conducted at a selected university in South Africa. The student

population consisted of 600 nursing students from the undergraduate and postgraduate programmes, with a sample size of 235 being calculated based on the confidence interval of 95 per cent and the margin of error of 5 per cent. Proportional stratified sampling, followed by simple random sampling, was used to select the participants based on the programme and year of study. A total of 150 nursing students completed the research instrument successfully, with 121 from the undergraduate and 29 from the postgraduate programmes, which represented a response rate of 63.82 per cent. According to Fincham (2008, 1), "response rates of 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 per cent after analysing 1 607 studies conducted between 2000 and 2005 that were published in peer review journals. Thus the response rate noted in this study is acceptable in quantitative studies.

The data were collected from March to September 2018 using a structured questionnaire. It contained three sections; the first section contained the socio-demographic details (programme and level of the study) of the students. The second section contained six questions related to the students' perception of the use of technology by educators on a six-point Likert scale. The third section consisted of 13 items indicating the students' expectations on how nurse educators should use technology on a five-point Likert scale.

The content validity of the research instrument was confirmed by ensuring that the items in the instruments were related to the concepts of using ICT in education, and were in line with the purpose and research objectives. The reliability of the research instrument was established through the test and retest process, with Cronbach's alpha being .856, which was above the .70 level of acceptability as stated by Cortina (1993).

The data were analysed descriptively using frequencies, percentages, minimum and maximum scores, mean and standard deviations, and a median. An overall score was calculated for the students' perceptions of the use of technology by the teachers, and for their expectations of how teachers should use technology. Statistical tests were performed using the Kruskal-Wallis test (K), the Mann-Whitney (*U*) test and the chi-square test (χ^2) to establish the association between the socio-demographics data and the perceptions and expected use of technology. A Spearman correlation was also conducted to establish the relationship between the students' perceptions of the use of technology and their expectations, with a significance level being determined by a p value < .05.

The study began after obtaining ethical approval from the Humanities and Social Sciences Research Ethics Committee of the University of KwaZulu-Natal (HSS/0028/018PD), and gatekeepers' permissions from the University of KwaZulu-Natal, and the School of Nursing and Public Health. Participation in this study was

voluntary, and a consent form and information leaflets were provided to the participants before completing the questionnaires.

Findings

Of the 235 students invited to participate, 150 responded and were included for analysis.

Of the 150 respondents, 80.7 per cent (n = 121) were from the undergraduate programme, of whom 28.9 per cent (n = 35) were in their first year, 19.8 per cent (n = 24) in their second year, 19 per cent (n = 23) in their third year, and 32.2 per cent (n = 39) in their fourth year. The chi-square test indicated that there was a statistically significant association between the level and programme of study ($\chi^2 = 21.210$, $p = .001$). Of the 19.3 per cent (n = 29) who were from the postgraduate programme, 65.5 per cent (n = 19) were in their first year, 20.7 per cent (n = 6) in their second year, and 13.8 per cent (n = 4) in their third year. Of the combined student number of 150, 36 per cent (n = 54) were in their first year, 20 per cent (n = 30) in their second year, 18 per cent (n = 27) in their third year, and 26 per cent (n = 39) in their fourth year.

Nursing Students' Perceptions of how Educators Use Technology

The second section of the instrument contained six questions related to the students' perception of the use of technology by educators on a six-point Likert scale. All six items had a median of four, and some variations in their mean and standard deviations. The students perceived that technology was used by educators to deliver instructions (3.77 ± 1.19), to maintain students' attention (3.77 ± 1.19), and to make connections to the learning process through audio or video material (3.64 ± 1.36). Furthermore, it was noted that educators encouraged students to use online platforms to communicate or collaborate (4.20 ± 1.42), to use technology for creative or critical thinking tasks (3.90 ± 1.33), and to use their own technology devices (3.46 ± 1.35) (see Table 1).

Table 1: Nursing students' perceptions of technology usage by educators

	None n (%)	Very few n (%)	Some n (%)	Most	Almost all n (%)	All n (%)	Mean and SD	Median
Educators use technology to								
deliver course instructions	5 (3.3)	18 (12.0)	31 (20.7	60 (40.0)	24 (16.0)	12 (8.0)	3.77 ± 1.19	4.00
maintain students' attention	7 (4.7)	21 (14.0)	31 (20.7)	51 (34.0)	29 (19.3)	11 (7.3)	3.71 ± 1.26	4.00
make connections to the learning material audio or video	10 (6.7)	23 (15.3)	31 (20.7)	46 (30.7)	26 (17.3)	14 (9.3)	3.64 ± 1.36	4.00
Educators encourage students to								
use their own technology devices to deepen their learning	8 (5.3)	38 (25.3)	26 (17.3)	45 (30.0)	21 (14.0)	12 (8.0)	3.46 ± 1.35	4.00
use online platforms to communicate with themselves or other students in/outside the school	8 (5.3)	15 (10.0)	18 (12.0)	36 (24.0)	44 (29.3)	29 (19.3)	4.20 ± 1.42	4.00
use technology for creative or critical thinking tasks	7 (4.7)	15 (10.0)	33 (22.0)	45 (30.0)	30 (20.0)	20 (13.3)	3.90 ± 1.33	4.00

Nursing students reported that educators use technology for various academic purposes (see Table 2). The responses to the three questions related to the way educators use technology were all above 85 per cent: the educators deliver course instructions, maintain the students' interest, and make connections. Regarding the three questions related to what educators encouraged students to use technology for, the responses were all above 85 per cent and reported that educators encourage students to use technology.

A chi-square test indicated that there was a statistically significant association between the level of the study and using technology to maintain students' attention ($\chi^2 = 9.599$, $p = .022$), making connections to learning materials such as audio and videos ($\chi^2 = 8.265$, $p = .041$), and encouraging students to use online platforms to communicate or collaborate with the teachers or other students in or outside the school ($\chi^2 = 11.510$, $p = .011$). Furthermore, slightly more undergraduate students (96.7%) were encouraged by their educators to use their own technology devices compared to postgraduate students (86.2%), the differences being significant ($\chi^2 = 5.096$, $p = .024$) (see Table 2).

Table 2: Nursing students' perceptions of technology usage by educators and students' demographics (n = 150)

Variables		Level of the study Year %				Total	Chi-square test		Programme		Total	Chi-square test	
		1st	2nd	3rd	4th		χ^2	*p* value	Under grad	Post grad		χ^2	*p* value
Educators use technology to:													
deliver course instructions	No	7.4	3.3	0	0	3.3	3.718	.239	3.3	3.4	3.3	.001	.664
	Yes	92.6	96.7	100	100	96.7			96.7	96.6	96.7		
maintain students' attention	No	11.1	0	0	2.6	4.7	9.599	.022*	5.0	3.4	4.7	.129	.594
	Yes	88.9	100	100	97.4	95.3			95.0	96.6	95.3		
make connections to the learning materials (audio or video)	No	13.0	0	7.4	2.6	6.7	8.265	.041*	5.0	13.8	6.7	2.464	.210
	Yes	87.0	100	92.6	97.4	93.3			95.0	86.2	93.3		
Educators encourage students to:													
use their own technology devices to deepen their learning experience	No	9.3	3.3		5.1	5.3	4.601	.348	3.3	13.8	5.3	5.096	.024*
	Yes	90.7	96.7	100	94.9	94.7			96.7	86.2	94.7		
use online platforms to communicate with themselves or other students in/outside the school	No	13.0	0	0	2.6	5.3	11.510	.011*	5.0	6.9	5.3	.174	.481
	Yes	87.0	100	100	97.4	94.7			95.0	93.1	94.7		
use technology for creative or critical thinking tasks	No	7.4	0	7.4	2.6	4.7	4.497	.324	4.1	6.9	4.7	.365	.621
	Yes	92.6	100	92.6	97.4	95.3			95.9	93.1	95.3		

*p-value is significant at < .05

Overall, 78 per cent of the respondents had positive perceptions of the use technology at school, with 81.8 per cent of the undergraduate students having positive perceptions (23.26 ± 6.09; median = 24; mean rank = 79.29) compared to 62.1 per cent of the postgraduate students (20.34 ± 6.70; median = 20; mean rank = 59.67), this being statistically significant (U = 1295.500, p = .029). In the level of the study, 78.6 per cent of the students from lower levels (first and second years) had positive perceptions compared to 77.3 per cent of the higher levels (third and fourth years). The median score indicated that the lower academic level of the students, namely the first year (median = 24) and second year (median = 24), perceived that nurse educators use technology at school more than that perceived by students of higher levels, namely third

year (median = 22), and fourth year (median = 22). Those differences had no statistical significance (K = 1.615, p = .656) (see Table 3).

Table 3: Nursing students' perceptions of technology use by educators (n = 150)

Variables	N	Min	Max	Mean ± SD	95% C.I for Mean		Median	Mean rank	Test	
					Lower bound	Upper bound			Value	*p*-value
Level of the study										
1st year	54	6	36	21.92 ± 6.66	20.10	23.74	24.00	72.74	K = 1.615	.656
2nd year	30	11	36	23.96 ± 6.24	21.63	26.29	24.00	83.73		
3rd year	27	12	36	23.11 ± 6.82	20.40	25.81	22.00	77.13		
4th year	39	12	35	22.51 ± 5.45	20.74	24.28	22.00	71.86		
Total	150	6	36	22.70 ± 6.30	21.68	23.71	23.50			
Programme of the study										
Undergraduate	121	6	36	23.26 ± 6.09	22.16	24.36	24.00	79.29	*U* = 1295.50	.029*
Postgraduate	29	6	36	20.34 ± 6.70	17.79	22.89	20.00	59.67		
Total	150	6	36	22.70 ± 6.30	21.68	23.71	23.50			

*p-value is significant at < .05

Nursing Students' Expectations of the Use of Technology by Educators

The third section of the instrument consisted of 13 items indicating students' expectations on how nurse educators should use technology on a five-point Likert scale. It was found that seven of the 13 items were top rated, with a median of four for each, and some variations with the mean and standard deviations, as indicated in Table 4. There were five least rated items with a median of three for each.

Overall, the majority of the nursing students had high expectations for nurse educators to use Moodle (88.7%), search tools (75.3%), published electronic resources (70.7%), and early-alert systems designed to catch potential academic trouble as soon as possible (70%). Less than 50 per cent of the nursing students indicated that they highly expected teachers to use Turnitin to detect plagiarism, to use free, web-based content to supplement course-related materials, to provide basic ICT literacy with digital devices, and to use social media, simulations or educational games (Table 5).

Table 4: Areas in which nursing students expect educators to use technology for academic purposes (n = 150)

Variables	Never n (%)	Rarely n (%)	Occasionally n (%)	Freq. n (%)	Very freq. n (%)	Mean and SD	Median
Learning management system (Moodle)	2 (1.3)	2 (1.3)	13 (8.7)	61 (40.7)	72 (48.0)	4.32 ± .79	4
Reference management software such as Endnote	8 (5.3)	10 (6.7)	38 (25.3)	51 (34.0)	43 (28.7)	3.74 ± 1.10	4
Turnitin to detect plagiarism	28 (18.7)	12 (8.0)	37 (24.7)	39 (26.0)	34 (22.7)	3.26 ± 1.39	3
Podcasts and videocasts (record lectures for later use or review)	9 (6.0)	12 (8.0)	29 (19.3)	55 (36.7)	45 (30.0)	3.76 ± 1.14	4
Social media as a teaching and learning tool	21 (14.0)	22 (14.7)	47 (31.3)	36 (24.0)	24 (16.0)	3.13 ± 1.25	3
Simulations or educational games	23 (15.3)	25 (16.7)	51 (34.0)	29 (19.3)	22 (14.7)	3.01 ± 1.25	3
Free, web-based content to supplement course-related materials	11 (7.3)	17 (11.3)	50 (33.3)	46 (30.7)	26 (17.3)	3.39 ± 1.12	3
Online tools to communicate or collaborate	8 (5.3)	11 (7.3)	35 (23.3)	63 (42.0)	33 (22.0)	3.68 ± 1.06	4
Search tools to find references or other information online for class work	3 (2.0)	6 (4.0)	28 (18.7)	72 (48.0)	41 (27.3)	3.94 ± .89	4
Published electronic resources (e.g. quizzes, assignments, homework, practical problems)	3 (2.0)	8 (5.3)	33 (22.0)	60 (40.0)	46 (30.7)	3.92 ± .95	4
Early-alert systems designed to catch potential academic trouble timeously	7 (4.7)	8 (5.3)	30 (20.0)	58 (38.7)	47 (31.3)	3.86 ± 1.06	4

Variables	Never n (%)	Rarely n (%)	Occasionally n (%)	Freq. n (%)	Very freq. n (%)	Mean and SD	Median
Software to create videos or multimedia resources	13 (8.7)	17 (11.3)	49 (32.7)	42 (28.0)	29 (19.3)(	3.38 ± 1.17	3
Basic ICT literacy with digital devices	18 (12.0)	17 (11.3)	51 (34.0)	36 (24.0)	28 (18.7)	3.26 ± 1.23	3

Table 5: Nursing students' expectations on how educators use the technology and demographics (n = 150)

Variables	Level of expectation	Total response	Study programme		Test	Level of the study				Test
		N (%)	Undergrad n (%)	Postgrad. n (%)	Chi-square	1st year n (%)	2nd year n (%)	3rd year n (%)	4th year n (%)	Chi-square
Learning management system (Moodle)	Low	17(11.3)	12(9.9)	5(17.2)	χ^2=1.249	5(9.3)	6(20.0)	2(7.4)	4(10.3)	χ^2=2.933
	High	133(88.7)	109(90.1)	24 (82.8)	*p*=.325	49(90.7)	24(80.0)	25(92.6)	35(89.7)	*p*=.402
Reference management software such as Endnote	Low	56(37.3)	51(42.1)	5(17.2)	χ^2=6.203	19(35.2)	11(36.7)	8(29.6)	18(46.2)	χ^2=2.094
	High	94(62.7)	**70(57.9)**	**24(82.8)**	*p*=.013*	35(64.8)	19(63.3)	19(70.4)	21(53.8)	*p*=.553
Turnitin to detect plagiarism	Low	77(51.3)	67(55.4)	10(34.5)	χ^2=4.086	24(44.4)	13(43.3)	15(55.6)	25(64.1)	χ^2=4.532
	High	73(48.7)	**54(44.6)**	**19(65.5)**	*p*=.043*	30(55.6)	17(56.7)	12(44.4)	14(35.9)	*p*=.211
Podcasts and videocasts (record lectures for later use or review)	Low	50(33.6)	43(35.5)	7(24.1)	χ^2=1.368	19(35.2)	9(30.0)	10(37.0)	12(30.8)	χ^2=.515
	High	100(67.3)	78(64.5)	22(75.9)	*p*=.280	35(64.8)	21(70.0)	17(63.0)	27(69.2)	*p*=.915
Social media as a teaching and learning tool	Low	90(60)	73(60.3)	17(58.6)	χ^2=.028	33(61.1)	18(60.0)	16(59.3)	23(59.0)	χ^2=.051
	High	60(40)	48(39.7)	12(41.4)	*p*=.866	21(38.9)	12(40.0)	11(40.7)	16(41.0)	*p*=.997
Simulations or educational games	Low	99(66)	78(64.5)	21(72.4)	χ^2=.659	36(66.7)	21(70.0)	21(77.8)	21(53.8)	χ^2=4.461
	High	51(34)	43(35.5)	8(27.6)	*p*=.515	18(33.3)	9(30.0)	6(22.2)	18(46.2)	*p*=.216
Free, web-based content to supplement course-related materials	Low	78(52)	67(55.4)	11(37.9)	χ^2=2.851	25(46.3)	18(60.0)	15(55.6)	20(51.3)	χ^2=1.618
	High	72(48)	54(44.6)	18(62.1)	*p*=.091	29(53.7)	12(40.0)	12(44.4)	19(48.7)	*p*=.664
Online collaboration tools to communicate or collaborate	Low	54(36)	49(40.5)	5(17.2)	χ^2=5.491	15(27.8)	14(46.7)	8(29.6)	17(43.6)	χ^2=4.517
	High	96(64)	**72(59.5)**	**24(82.8)**	*p*=.019*	39(72.2)	16(53.3)	19(70.4)	22(56.4)	*p*=.211
Search tools to find references or other information online for class work	Low	37(24.7)	32(26.4)	5(17.2)	χ^2=1.067	9(16.7)	9(30.0)	6(22.2)	13(33.3)	χ^2=3.982
	High	113(75.3)	89(73.6)	24(82.8)	*p*=.302	45(83.3)	21(70.0)	21(77.8)	26(66.7)	*p*=.263
Published electronic resources (e.g. quizzes, homework, practical problems)	Low	44(29.3)	34(28.1)	10(34.5)	χ2=.460	15(27.8)	11(36.7)	6(22.2)	12(30.8)	χ2=1.539
	High	106(70.7)	87(71.9)	19(65.5)	*p*=.498	39(72.2)	19(63.3)	21(77.8)	27(69.2)	*p*=.673
Early-alert systems designed to catch potential academic trouble timeously	Low	45(30)	37(30.6)	8(27.6)	χ2=.100	14(25.9)	11(36.7)	6(22.2)	14(35.9)	χ2=2.485
	High	105(70)	84(69.4)	21(72.4)	*p*=.752	40(74.1)	19(63.3)	21(77.8)	25(64.1)	*p*=.478

Variables	Level of expectation	Total response	Study programme		Test	Level of the study				Test
		N (%)	Undergrad n (%)	Postgrad. n (%)	Chi-square	1st year n (%)	2nd year n (%)	3rd year n (%)	4th year n (%)	Chi-square
Software to create videos or multimedia resources	Low	79(52.7)	61(50.4)	18(62.1)	$\chi 2$=1.275	29(53.7)	20(66.7)	10(37.0)	20(51.3)	$\chi 2$=5.058
	High	71(47.3)	60(49.6)	11(37.9)	*p*=.259	25(46.3)	10(33.3)	17(63.0)	19(48.7)	*p*=.168
Basic ICT literacy with digital devices	Low	86(57.3)	70(57.9)	16(55.2)	$\chi 2$=.069	27(50.0)	23(76.7)	11(40.7)	25(64.1)	$\chi 2$=9.540
	High	64(42.7)	51(42.1)	13(44.8)	*p*=.793	27(50.0)	7(23.3)	**16(59.3)**	**14(35.9)**	*p*=.023*

*p-value is significant at < .05

The chi-square test indicated that the programme of the study was significantly associated with the expectation to use reference management software, such as Endnote, with a more significant percentage of postgraduate students (82.8%) compared to only 57.9 per cent of the undergraduate students ($\chi^2 = 6.203$, $p = .013$). Similarly, more postgraduate students (65.5%) had a high expectation to use Turnitin compared to undergraduate students (44.6%) ($\chi^2 = 4.086$, $p = .043$). Furthermore, postgraduate students expected more of the use of online collaboration tools to communicate or collaborate (82.8%) compared to undergraduates (59.5%) ($\chi^2 = 5.491$, $p = .019$). Within the level of education, there were variations in students' expectations, and a significant association was established with training students in basic ICT literacy with digital devices with the first year (50%) and the third year (59%) students expecting more from nurse educators than the second year (23.3%) and fourth year (35.9%) ($\chi^2 = 9.540$; $p = .023$) students (Table 5).

The overall score of nursing students' expectations of nurse educators to use technology was calculated after computing the 13 items. The minimum score was 18, and the maximum was 65. The mean score and standard deviation were 46.68 ± 9.01, the median was 46.50, and the mode was 46. Overall, 77.3 per cent of nursing students expected their educators to use technology in their teaching more frequently, with 82.8 per cent of the postgraduate nursing students expecting their educators to use technology more frequently (47.86 ± 8.83; median = 48; mean rank = 81.17) compared to the 76 per cent of the undergraduate students (46.40 ± 9.07; median = 46; mean rank = 74.17). Overall, 82.1 per cent of the students from lower academic levels (first and second year) had high expectations of the use of technology with a combined mean score of 47.00 ± 9.07, compared to 71.2 per cent of the upper levels (third and fourth year) with a combined mean score of 46.28 ± 9.03. However, those differences were not statistically significant ($p > .05$) (Table 6).

Table 6: Nursing students' overall expectations of how frequently educators use technology

	n	Min	Max	Mean ± SD	95% CI for Mean		Median	Mean rank	Test	
					Lower bound	Upper bound			Value	*p*-value
Level of study										
1st year	54	28	65	48.01 ± 9.19	45.50	50.52	46.00	80.33	K = 2.238	.524
2nd year	30	18	61	45.16 ± 8.60	41.95	48.38	46.00	68.57		
3rd year	27	34	62	47.48 ± 8.62	44.06	50.89	48.00	80.37		
4th year	39	22	65	45.46 ± 9.32	42.43	48.48	47.00	70.77		
Total	150	18	65	46.68 ± 9.01	45.23	48.14	46.50			
Programme of study										
Undergraduate	121	18	65	46.40 ± 9.07	44.77	48.03	46.00	74.14	U = 1590	.433
Postgraduate	29	30	65	47.86 ± 8.83	44.50	51.22	48.00	81.17		
Total	150	18	65	46.68 ± 9.01	45.23	48.14	46.5			

p-value is significant at < .05

The Spearman's correlation was used to establish the relationship between nursing students' perceptions and expectations of the use of technology by their educators, which gave a statistically positive correlation [r_s = .211; *p* = 002]. A scatter plot (with 95% confidence interval) shows a positive trend of the students' perceptions of the use of technology at school in line with their expectations of the use of technology by their educators (R^2 linear = .064) (Figure 1).

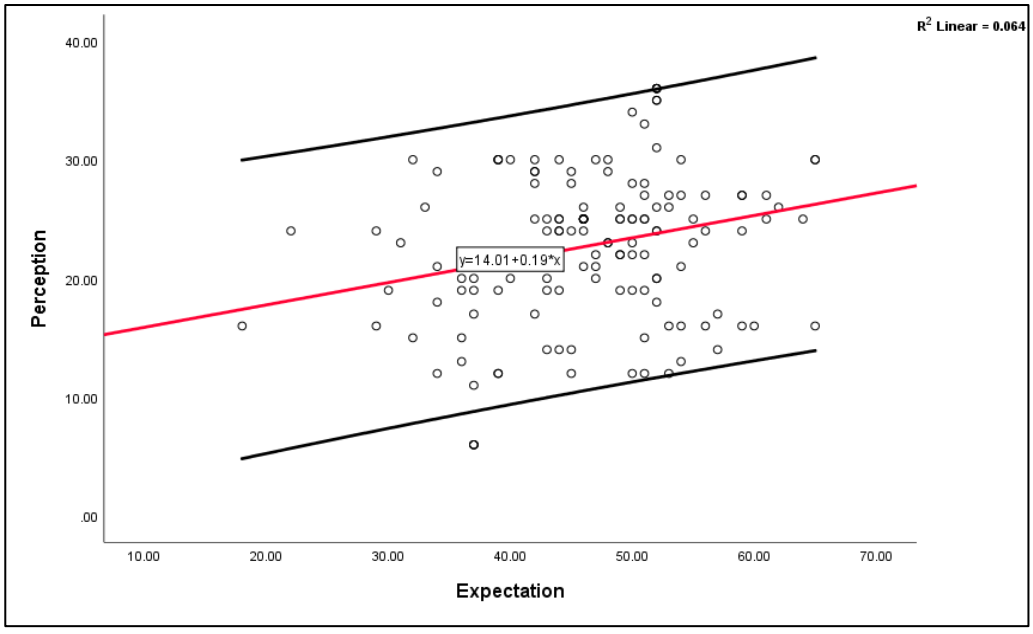

Figure 1: Scatter plot (with 95% confidence interval) for students' perception and expectations of the use of technology

Discussion

Preparing the future generation of nurses for the technology-driven working environment requires a paradigm shift in their training (Bouchaud, Brown, and Swan 2017). Nurse educators need to engage the students and empower them to use technology for learning purposes (McKnight et al. 2016); taking into consideration their needs and expectations is important. However, this should be balanced with adequate learning styles to achieve the best learning outcomes (Thomas, Reyes, and Blumling 2014). In this study, nursing students reported that teachers used technology for various purposes, including delivering course instructions (96.7%), maintaining students' attention (95.3%), and making connections to the learning material, such as audio or video (93.3%).

Regarding the nursing students' perceptions of the use of technology in nursing education, the students perceived that the teachers encouraged them to use their own technology devices (94.7%). They also encouraged students to use online platforms to communicate or collaborate with the teachers or other students in or outside the school (94.7%) and to use technology for creative or critical thinking tasks (95.3%).

In a study by Ghavifekr and Rosdy (2015), teachers used technology to make teaching more meaningful and to enhance the active engagement of the students. Similarly, Xu (2016) noted that in nursing education, technology is used to get the students' attention and to keep them motivated. The literature indicates that technology is used to deliver instructions either through the online platforms, or face-to-face class interactions (Enriquez et al. 2016; Xu 2016). In the current study, the majority of the students of the undergraduate programme and lower academic levels had positive perceptions of the use of technology at school. In a study conducted by Irinoye, Ayamolowo, and Tijnai (2016), the majority of undergraduate nursing students had positive perceptions of the use of ICT to support learning in nursing education. Building on the positive perceptions of nursing students is key to the use of ICT in nursing, and educators need to motivate students to use technology as a learning tool, which in return would have a positive impact on their academic performance (Austria 2017; Irinoye, Ayamolowo, and Tijnai 2016; Lee et al. 2016).

Identifying students' needs and effectively responding to them are the cornerstones to successfully integrating technology in nursing education (Edwards and O'Connor 2011). In this study, nursing students expected educators to focus much more on different areas of technology, including the use of Moodle, search tools, published electronic resources, podcasts and videocasts; online collaboration tools to communicate or collaborate, reference management software such as Endnote, and Turnitin to detect plagiarism. Overall, postgraduate nursing students had high expectations of the use of technology at school compared to undergraduate students. It is vital to strengthen the use of technology in nursing, particularly in the undergraduate programme, and to make ICT skills prerequisites to the nursing programme (Irinoye, Ayamolowo, and Tijnai 2016). All efforts should be geared towards making maximum

use of available technological resources to sustain the students' perceptions (Irinoye, Ayamolowo, and Tijnai 2016).

In this technological era, nursing students expect a teaching and learning environment that includes dynamic learning projects, streaming online video contents, and interactive and online involvement by the faculty (Phaneuf 2009). Nurse educators are expected to use technology to support teaching and learning, and if not they do not use technology in this way, upon graduation, nursing students might be unprepared to work in the technology-driven health environment (Merrill 2015). The literature indicates that the required competencies in nursing informatics include the use of computer hardware and specific programs, word-processing programs and spreadsheets, search engines and databases, citing sources, health information systems, and emails for communication and collaboration (Hobbs 2002; Masouras 2016; McNeil and Odom 2000).

Developing nursing students' competencies in ICT helps to improve their confidence and to avoid the frustration brought by technology (Edwards and O'Connor 2011; Wilkinson, Roberts, and While 2013). The findings from this study indicated that nursing students from lower levels (first year and second year) had positive perceptions and high expectations of the use of technology at school compared to nursing students of the upper levels (third and fourth year). In their study, Wilkinson, Roberts, and While (2013) found that nursing students had differing levels of confidence in their ICT skills upon arrival at university. Particular attention should be paid to developing students' skills at the entry level to enable them to use technology effectively for academic purposes, which in return may have a positive impact on their academic achievement.

Conclusion

The use of technology in nursing education is essential to prepare nursing students for work in a technology-driven health environment. In this study, nursing students reported that educators use technology for academic and communication purposes at schools, and that the educators encouraged them to use their own technology devices and online platforms for learning purposes. The findings indicated that nursing students from lower academic levels had high expectations of the use of technology. Hence, more efforts are needed and special consideration is required to develop nursing students' skills at the entry level to enable them to use technology effectively for academic purposes.

Students' needs and expectations in a technology-mediated learning environment should be taken into consideration by nurse educators, with an emphasis on developing their ICT skills and encouraging them to use computers and the Internet as tools for learning. Building nursing students' computer and internet literacy helps them to achieve their learning goals, with the skills required being essential for their future careers. Emerging technologies have and will continue to change the pedagogy and the delivery of nursing education, hence it is essential that nurse educators use innovative teaching approaches to shape the landscape of the nursing profession, which is increasingly being influenced by the extensive use of technology.

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