

COMPUTER-ASSISTED INSTRUCTION IN NURSING EDUCATION IN SOUTH AFRICA

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ABSTRACT

Nurse educators function in a post-industrial, information and communication technology driven world. They are required to equip student nurses with the competencies to render healthcare in technologically advanced healthcare settings. Modern developments in information-communication and educational technologies compel nurse educators to make a paradigm shift by redirecting the emphasis from traditional methods of instruction to computer-assisted instruction (CAI) and computer-based learning.

This study investigated the nature of student nurses' exposure to CAI and computer-based learning, the perceived benefits of this exposure, as well as the challenges encountered. A quantitative, non-experimental, univariate, descriptive survey research design was utilised. The respondents comprised 172 second year and 119 third year student nurses. Although the respondents preferred CAI to traditional modes of teaching, evidence of ineffective CAI was portrayed in the findings. It is recommended that various educational computer packages that support mastery of subject content and the development of higher cognitive skills be accessed and utilised.

KEYWORDS: Computer-assisted instruction (CAI), computer-based learning (CBL), multimedia computers, nursing education, personal digital assistant (PDA), student nurse

INTRODUCTION AND BACKGROUND INFORMATION

The nursing education system faces challenges in preparing students to live and work in an information, communication and technology driven world, which is characterised by constant innovations and revolutionary changes. The digital revolution has brought about transformation in the way people communicate, gain access to and process information.

Digital technologies are revolutionising the manner in which education is provided. It enables nurse educators to utilise information communication technologies in nursing

education to provide learning experiences that support students' optimal learning in spite of differences in learning styles (Kara, 2007:358). These technologies, also impact upon people's communication, including multi-purpose cellular phones, Internet expansion and WEB 2.0. Virtual chat-rooms, social technologies and networks such as wikis, podcasts and blogs are widely used in everyday life and education. Wikis are special-purpose websites that are used in collaborative learning by allowing groups of students to work on creating joint documents (John & Wheeler, 2008:128). Podcasts provide students with learning resources and blogs enable them to produce online learning reflective diaries (Clarke, 2008:1).

Facebook, being another way of social interaction, provides a platform for social interaction and information sharing (Goh, 2010:183). Personal digital assistant (PDA), an emerging form of technology used in clinical laboratory settings, is a hand held computer. PDA is used for multiple functions such as information storage, retrieval and input into electronic mails. It also has a variety of educational applications. It enhances students' access to information by enabling them to access textbooks and drug references. This type of technology can change the focus of learning from memorisation to accessing, interpreting and applying information. PDA can be carried in the student's pocket and is as such, always available to access needed information (De Young, 2009:249).

Technological advances change the ways in which people learn, as well as the student-educator relationship. The educator and the books are no longer the only sources of information. Learning is no longer confined to any particular place or time (Lin, 2007:817).

Scientific advances and technological innovations have changed the face of healthcare settings and healthcare delivery practices, which have become increasingly technology driven. Computers, computer networks and communication technologies enable healthcare providers and consumers to gain access to and disseminate information (De Young, 2009:248). Nurses are confronted with technologically sophisticated healthcare equipment for purposes of making diagnoses and rendering care.

The power of the digital systems to generate visual images of the body and detect diseases implies that the representation of new health technologies is important in describing the status of a person's health. Colourful computerised representations of genetic information, graphics of the virtual patient used for clinical training and ultrasound scans provide new insights into clinical disorders and patient care (Webster, 2006:4). Cardiac monitors, ventilators and other technological equipment are used in healthcare settings.

Nurses need to be competent to work in technologically advanced environments –they need to think in technological terms, and develop technological interests and skills. It is the task of nurse educators to create opportunities for student nurses to develop these competencies, offer relevant education and incorporate technology into the teaching

and learning processes. One of the major challenges is to design the educational system in general, and in particular the method of instruction in a manner that would enable graduates to function effectively in technologically advanced environments (Tomei, 2008:693).

Nursing education is in a transitional period in that it is responding to changes and challenges posed by the proliferation of technological innovations, knowledge generation and social changes (De Villiers, 2005:56). The emphasis in nursing education needs to shift from traditional instructional approaches to technology-based teaching and learning approaches to equip students to work in technologically advanced environments.

STATEMENT OF THE PROBLEM

While functioning in a nursing education setting, the researcher observed that the use of information-communication technologies was limited. Its applications appeared to be insufficient to ensure congruence with contemporary technological and educational principles and methods of preparing students for the realities of modern healthcare contexts. These observations highlighted the necessity to investigate the nature of students' exposure to such teaching strategies and to identify students' challenges as well as the potential benefits of CAI and computer-based learning. A non-experimental, univariate and descriptive survey was conducted to answer the following question:

What is the nature of the undergraduate student nurses' exposure to computer-assisted instruction, how do they benefit from it and what challenges do they experience during computer-based learning?

RESEARCH OBJECTIVES

The research objectives were to describe student nurses' views on how CAI was applied at the participating nursing college, the benefits of CAI and computer-based learning as well as the challenges that the students encountered during computer-based learning.

DEFINITIONS OF KEY CONCEPTS

Computer-assisted instruction (CAI) is a term applied to some forms of e-learning, namely learning which is supported and delivered through the use of information communication technologies, while **computer-based learning** is the learning which ensues when students engage with material that is delivered and supported by means of a computer (Clarke, 2008:307).

Nursing education refers to the transmission of worthwhile bodies of accumulated nursing knowledge to student nurses (Uys & Gwele, 2005:14).

Student nurse refers to a person registered for the programme leading to registration as a nurse (general, psychiatric, community) and midwife (SANC 1985). For the purposes

of this study the said student should have been exposed to CAI and computer-based learning.

RESEARCH METHODOLOGY

Design

The study was a non-experimental, univariate and descriptive survey.

Population and sample

All second and third year student nurses following a 4-year diploma programme leading to registration as a nurse (general, psychiatric and community) and midwife at a nursing college in the Gauteng province, South Africa, participated in this study. The entire population was studied because it was of a manageable size, and data were collected in a localised setting, namely in an auditorium of the participating nursing college. The groups comprised 172 second year and 119 third year students.

The requirement was that these students should have been exposed to CAI and computer-based learning at the nursing college. The first- and fourth-year students were excluded because they did not meet this criterion. The participants were required to draw upon their experiences of CAI in order to complete the questionnaire.

The average age of the second year respondents' was 35 years. The majority of them (91.9%; n=158), were females, and 8.1%; n=14) were males. The average age of the third year respondents' was 32 years. The majority, namely 86.6% (n=103) were females and 12.6% (n=15) were males.

Research instrument

The questionnaire contained pre-developed closed-ended items and a rating scale with pre-determined response options. Both second and third year students responded to the same items. The items were derived from the literature reviewed. Section A elicited biographical data. Section B indicated how often students had been exposed to different types of computer software packages. Section C addressed the frequency with which students had been engaged in activities associated with CAI and computer-based learning. Section D investigated the perceived benefits that the students derived from CAI and computer-based learning, while section E addressed the challenges that the students encountered while engaging in computer-assisted learning. The item in section F enquired about the preferences of the respondents concerning CAI versus traditional teaching strategies.

The Cronbach's alpha scores for sections B–E exceeded 0.8, indicating that no item was eliminated from the questionnaire based on the reliability scores for individual items. Four experts in the field of nursing education assessed its face validity and content validity. Criteria for evaluating the questionnaire were provided. The criteria related to

technical soundness, item clarity and relevance of the items. Most of the recommended changes related to minor grammatical aspects. A statistician assessed the questionnaire to determine whether any irregularities existed that might impact negatively on data analysis. The statistician did not propose any amendments.

Data collection procedure

The nurse educators facilitated access to the respondents. The researcher personally distributed the questionnaires during the respondents' free class periods in the auditorium, which was used during students' free periods. Data collection therefore, did not disrupt teaching or learning. The respondents completed the questionnaires anonymously on the day of distribution. This took approximately 40 minutes. The researcher was available to answer questions or address problems. The researcher personally collected the completed questionnaires. Out of the 225 second year respondents, 172 (76.4%) returned duly completed questionnaires. Out of the 135 third year respondents, 119 (88.1%) completed and returned their questionnaires.

DATA ANALYSIS

Descriptive statistics were calculated using SPSS12.0 for Windows. Frequencies, medians, means and modes were calculated for specific items. The Mann-Whitney U-test was applied to determine whether there were any statistically significant differences between the responses of the second year respondents and those of the third year respondents with regard to each item in sections B to E.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Research and Ethics Committee of the Department of Health Studies of the University of South Africa. Written permission to conduct the study was granted by the Gauteng Department of Health and the principal of the nursing college concerned. Verbal permission from the nurse educators in charge of the second and third year respondents was obtained. Voluntary, informed consent was obtained from each respondent. Verbal information was given to the respondents regarding the purpose of the study and the importance of their participation. This information was also indicated in the cover letter accompanying each questionnaire. The respondents were assured that anonymity and confidentiality would be maintained. No personal details of the respondents were written on the questionnaire.

FINDINGS

Computer literacy

Out of the 166 second year respondents, 73 (42.4%) reported their exposures to computer literacy packages as "never" while 76 (44.2%) reported "monthly" exposures. Only 14

(8.1%) enjoyed weekly and three (1.7%) daily access. The 118 third year respondents' exposures were reportedly "never" (37.0%; n=44), "monthly" (52.1%; n=62), "weekly" (4.2%; n=5), and "daily" (5.9%; n=7). The median score for both groups was 2.0 (monthly). These results indicated under-utilisation of this learning resource.

The levels of computer literacy for both categories of respondents were consequently inadequate: 113 (65.7%) were reasonably computer literate, 44 (25.6%) were not computer literate and only 15 (8.7%) were proficient in the use of computers. The mode was 2.0. The respondents therefore had insufficient skills to utilise the learning opportunities effectively associated with CAI.

Engagement in computer-based learning

Referring to their preferences, 106 (61.6%) second year, and 89 (74.8%) third year respondents indicated that they preferred CAI to traditional teaching strategies. It is therefore important to strengthen the application of CAI at the college. The respondents indicated that they were mostly collaboratively engaged in computer-based learning at the media centre at the college. Most second year (63.4%; n=109), and third year respondents (72.3%; n=86) utilised the media centre at the college. Consequently, most respondents therefore relied on the college for computer access.

Respondents' exposures to different types of educational computer software and their engagement in activities associated with CAI

Table 1: Respondents' exposures to different types of computer-assisted instruction

Respondents' exposure to different types of educational computer software					
Activity	Year of study	Daily	Weekly	Monthly	Never
Reading skills	2 nd years (n=171)	3 (1.7%)	20 (11.6%)	96 (55.8%)	52 (30.2%)
	3 rd years (n=118)	2 (1.7%)	10 (8.4%)	82 (68.9%)	24 (20.2%)
Typing skills	2 nd years (n=169)	5 (2.9%)	21 (12.2%)	85 (49.4%)	58 (33.7%)
	3 rd years (n=119)	4 (3.4%)	11 (9.2%)	72 (60.5%)	32 (26.9%)
Computer literacy	2 nd years (n=166)	3 (1.7%)	14 (8.1%)	76 (44.2%)	73 (42.4%)
	3 rd years (n=118)	7 (5.9%)	5 (4.2%)	62 (52.1%)	44 (37.0%)
Text-based course content	2 nd years (n=163)	2 (1.2%)	12 (7.0%)	59 (34.3%)	90 (52.3%)
	3 rd years (n=117)	2 (1.7%)	7 (5.9%)	46 (38.7%)	62 (52.1%)
Multimedia course content	2 nd years (n=168)	2 (1.2%)	18 (10.5%)	48 (27.9%)	100 (58.1%)
	3 rd years (n=118)	4 (3.4%)	9 (7.6%)	39 (32.8%)	66 (55.5%)
Text-based with problem-solving scenarios	2 nd years (n=171)	2 (1.2%)	131 (6.4%)	44 (25.6%)	114 (66.3%)
	3 rd years (n=118)	4 (3.4%)	5 (4.2%)	50 (42.0%)	59 (49.6%)
Multimedia with problem-solving scenarios	2 nd years (n=172)	1 (0.6%)	13 (7.6%)	57 (33.1%)	101 (58.7%)
	3 rd years (n=119)	4 (3.4%)	5 (4.2%)	39 (32.8%)	71 (59.7%)
Clinical simulations requiring decision-making	2 nd years (n=170)	2 (1.2%)	11 (6.4%)	50 (29.1%)	108 (62.8%)
	3 rd years (n=119)	5 (4.2%)	2 (1.7%)	33 (27.7%)	79 (66.4%)
Game playing	2 nd years (n=172)	9 (5.2%)	21 (12.2%)	67 (39.0%)	75 (43.6%)
	3 rd years (n=118)	5 (4.2%)	17 (14.3%)	44 (37.0%)	52 (43.7%)

Activity		Daily	Weekly	Monthly	Never
Obtaining information from the Internet	2 nd years (n=172)	9 (5.2%)	28 (16.3%)	90 (52.3%)	45 (26.2%)
	3 rd years (n=119)	11(9.2%)	25 (21%)	53 (44.5%)	30 (25.2%)
Obtaining information from CD-ROM packages	2 nd years (n=170)	3 (1.7%)	16 (9.3%)	49 (28.5%)	102(59.3%)
	3 rd years (n=119)	7 (5.9%)	11 (9.2%)	38 (31.9%)	63 (52.9%)
Communicating with other students by email	2 nd years (n=172)	2 (1.2%)	10 (5.8%)	16 (9.3%)	144 (83.7%)
	3 rd years (n=118)	9 (7.6%)	10 (8.4%)	11 (9.2%)	88 (73.9%)
Communicating with my tutors by email	2 nd years (n=172)			1 (0.6%)	171 (99.4%)
	3 rd years (n=119)	1 (0.8%)	1 (0.8%)	2 (1.7%)	115 (96.6%)
Communicating with field experts by email	2 nd years (n=171)		1 (0.6%)	9 (5.2%)	106 (93.6%)
	3 rd years (n=172)	3 (2.5%)	4 (3.4%)	8 (6.7%)	103 (86.6%)
Participating in bulletin board discussions with other students	2 nd years (n=172)		3 (1.7%)	14 (8.1%)	115 (90.1%)
	3 rd years (n=118)	3 (2.5%)	2 (1.7%)	11 (9.2%)	103 (86.6%)
Participating in on-line chatting with other students	2 nd years (n=172)		3 (1.7%)	11 (6.4%)	156 (90.7%)
	3 rd years (n=118)	2 (1.7%)	4 (3.4%)	11 (9.2%)	101 (84.9%)
Participating in video-conferencing with other students	2 nd years (n=172)		1 (0.6%)	21 (12.2%)	115 (7.2%)
	3 rd years (n=119)	2 (1.7%)	1 (0.8%)	10 (8.4%)	106 (89.1%)
Participating in video-conferencing with my tutors	2 nd years (n=172)		1 (0.6%)	22 (12.8%)	149 (86.6%)
	3 rd years (n=119)	1 (0.8%)	2 (1.7%)	5 (4.2%)	111 (93.3%)
Exchanging information with other students by email	2 nd years (n=172)		6 (3.5%)	13 (7.6%)	153 (89%)
	3 rd years (n=119)	4 (3.4%)	3 (2.5%)	9 (7.6%)	103 (86.6%)
Exchanging information with my tutors by email	2 nd years (n=172)	1 (0.8%)	2 (1.2%)	3 (1.7%)	167 (97.1%)
	3 rd years (n=118)	1 (0.6%)	1 (0.8%)	1 (0.8%)	115 (96.6%)
Participating in electronic chatting for educational purposes	2 nd years (n=171)	5 (4.2%)	6 (3.5%)	18(10.5%)	146 (84.9%)
	3 rd years (n=119)	1 (0.6%)	1 (0.8%)	20(16.8%)	93 (78.2%)
Doing courses following an on-line learning approach	2 nd years (n=170)	4 (3.4%)	7 (4.1%)	28(16.3%)	134 (77.9%)
	3 rd years (n=119)		6 (5%)	12(10.1%)	97 (81.5%)

The Mann-Whitney U-test indicated that there were no significant differences in exposure to different types of computer software between second and third year students' responses to the items reflected in table 1, namely reading skills ($p=0.279$), typing skills ($p=0.459$), computer literacy ($p= 0.787$), text-based course content ($p= 0.787$), multimedia course content ($p=0.615$), text-based with problem solving scenarios ($p=0.189$) and multimedia with problem solving scenarios ($p=0.257$). With regard to respondents' engagement in activities associated with CAI, the Mann-Whitney U-test indicated that there were no significant differences between the second and third year student nurses' responses to the following items: obtaining information from the Internet ($p= 0.234$), obtaining information from CD-ROM packages ($p=0.179$), e-mail communicating with tutors ($p= 0.856$), participation in bulletin board discussions with other students ($p= 0.318$), participation in online chatting with other students ($p=0.176$), participation in video-conferencing with other students ($p=0.681$), participation in video conferencing with tutors ($p=0.085$), doing courses following an online learning approach ($p= 0.729$), exchanging information with other students by email ($p= 0.488$), exchanging information with tutors by email ($p=0.864$) and participating in electronic chatting for educational purposes ($p=0.114$)

Table 2: Benefits and challenges of computer assisted instruction

Benefits	Year of study	Strongly agree	Agree	Disagree	Strongly disagree
Enhancing my motivation to learn	2 nd years (n=169)	29 (17%)	72 (42%)	50 (32%)	15 (8.7%)
	3 rd years (n=116)	29 (24.4%)	63 (52.9%)	13 (10.9%)	11 (9.2%)
Enabling me to establish my own pace for learning	2 nd years (n=172)	38 (22.1%)	81 (47.1%)	39 (22.7%)	14 (8.1%)
	3 rd years (n=118)	21 (17.6%)	54 (45.4%)	27 (2.3%)	16 (13.4%)
Enabling me to discontinue learning when my concentration wavers	2 nd years (n=172)	42 (24.4%)	92 (53.5%)	23 (13.4%)	12 (7%)
	3 rd years (n=118)	18 (15.1%)	46 (38.7%)	35 (29.4%)	19 (16%)
Giving me a sense of being in control of my learning	2 nd years (n=170)	42 (24.4%)	83 (48.3%)	31 (18%)	14 (8.1%)
	3 rd years (n=119)	29 (24.4%)	63 (52.9%)	16 (13.4%)	11 (9.2%)
Enabling me to repeatedly study sections of the learning material until I gain understanding	2 nd years (n=171)	46 (26.7%)	81 (47.1%)	27 (15.7%)	17 (10%)
	3 rd years (n=116)	30 (25.2%)	59 (49.6%)	13 (10.9%)	14 (11.8%)
Enabling me to achieve my learning objectives by using the Internet to obtain information	2 nd years (n=172)	52 (30.2%)	74 (43%)	34 (19.8%)	12 (7%)
	3 rd years (n=119)	44 (37.0%)	56 (47.1%)	10 (8.4%)	9 (7.6%)
Enabling me to store information	2 nd years (n=170)	70 (40.7%)	77 (44.8%)	18 (10.5%)	6 (3.5%)
	3 rd years (n=118)	47 (39.5%)	55 (46.2%)	9 (7.6%)	7 (5.9%)
Enabling me to retrieve stored information	2 nd years (n=171)	66 (38.4%)	83 (48.3%)	17 (9.9%)	4 (2.3%)
	3 rd years (n=118)	51 (42.9%)	51 (42.9%)	8 (6.7%)	8 (6.7%)
Challenges		Strongly agree	Agree	Disagree	Strongly disagree
I feel insecure during the learning process	2 nd years (n=171)	17 (9.9%)	24 (14.0%)	50 (29.1%)	80 (46.5%)
	3 rd years (n = 119)	16 (13.4%)	14 (11.8%)	43 (36.1%)	46 (38.7%)
The computer equipment in the media centre is unreliable	2 nd years (n=171)	29 (16.9%)	34 (19.8%)	51 (29.7%)	57 (33.1%)
	3 rd years (n = 119)	23 (26.1%)	23 (19.3%)	40 (33.6%)	25 (21.0%)
Technical assistance in the media centre is insufficient	2 nd years (n=172)	35 (20.3%)	34 (20.0%)	58 (34.0%)	4 (26.2%)
	3 rd years (n = 117)	33 (27.7%)	26 (21.8%)	35 (29.4%)	23 (19.3%)
CAI makes me lose interest in learning	2 nd years (n=171)	13 (7.6%)	12 (7.0%)	52 (30.2%)	94 (54.7%)
	3 rd years (n = 118)	8 (6.7%)	2 (1.7%)	35 (29.4%)	7 (61.3%)
The facilitator is not proficient in CAI	2 nd years (n=170)	15 (8.7%)	22 (12.8%)	39 (22.7%)	94 (54.7%)
	3 rd years (n = 116)	14 (11.8%)	17 (14.3%)	23 (19.3%)	62 (52.1%)
My concentration span goes down	2 nd years (n=172)	13 (7.6%)	13 (7.6%)	60 (34.9%)	86 (50.0%)
	3 rd years (n = 117)	11 (9.2%)	6 (5.0%)	48 (40.3%)	52 (43.7%)
I struggle to achieve my learning objectives through multimedia course content computer packages	2 nd years (n=172)	34 (19.8%)	38 (22.1%)	72 (41.9%)	28 (16.3%)
	3 rd years (n = 118)	28 (23.5%)	18 (15.1%)	52 (43.7%)	20 (16.8%)
Personal contact with other students is too limited	2 nd years (n=172)	37 (21.5%)	33 (19.2%)	54 (31.4%)	48 (27.9%)
	3 rd years (n = 119)	22 (18.5%)	25 (21.0%)	38 (31.9%)	34 (28.6%)
Personal contact with my facilitators is too limited	2 nd years (n=171)	43 (25.0%)	28 (16.3%)	57 (33.1%)	43 (25.0%)
	3 rd years (n = 119)	26 (21.8%)	23 (19.3%)	40 (33.6%)	30 (25.2%)
A facilitator is not available when I need assistance	3 rd years (n = 119)	23 (19.3%)	22 (18.5%)	46 (38.7%)	28 (23.5%)
	3 rd years (n = 119)	23 (19.3%)	22 (18.5%)	46 (38.7%)	28 (23.5%)

The Mann-Whitney U-test indicated that there were no significant differences in the benefits of CAI between the responses obtained from second and third year respondents to the items reflected in table 2. These items were: enhancing my motivation to learn ($p=0.94$), enabling me to establish my own pace of learning ($p=0.186$), giving me a sense of being in control of my learning ($p= 0.751$), enabling me to repeatedly study sections of the learning material until I gain understanding ($p=0.971$), enabling me to achieve my learning objectives by using the Internet to obtain information ($p=0.073$), enabling

me to store information ($p=0.966$) and enabling me to retrieve information ($p= 0.780$). There was a significant difference on the item enabling me to discontinue learning when their concentration wavers. The second year respondents were more inclined to agree than the third year respondents ($p=0,030$).

The Mann-Whitney U-test indicated that there were no significant differences in the challenges of CAI between the responses of the second and third year respondents to the items depicted in table 2. These items were: I feel insecure during the learning process ($p=0.244$), technical assistance in the media centre is insufficient ($p=0.477$), CAI makes me lose interest in learning ($p=0.174$), the facilitator is not proficient in CAI ($p=0.534$), my concentration span goes down ($p=0.454$), I struggle to achieve my learning objectives through multimedia course content computer packages ($p=0.931$), personal contact with other students is too limited ($p=0.931$), personal contact with my facilitators is too limited ($p= 0.812$) and a facilitator is not available when I need assistance ($p=0.204$).

Preferences

Of the second year respondents 61.6% ($n=106$), were less in favour of CAI as opposed to traditional teaching strategies than the third year respondents 74.8% ($n=89$). However, the many missing values might indicate uncertainty about their preferences.

DISCUSSION OF THE RESULTS

The utilisation of information-communication technologies for the purposes of CAI and computer-based learning was still in its infancy at the nursing college. Although students preferred CAI to traditional modes of teaching, access to information-communication technologies was inadequate. This was due to limited access, which was mainly restricted to the media centre at the college. As a result of their inadequate levels of computer literacy, many students encountered difficulties in operating the equipment and software packages, and in keeping up to date with technological developments.

Technical assistance appeared to be insufficient to assist students who found it difficult to operate the equipment and software packages.

Professional educational packages, which develop students' knowledge and higher cognitive skills were generally unutilised or underutilised. Although reading, typing, and computer literacy packages were also underutilised, they were more frequently utilised than the professional educational packages. The use of educational software did not produce an adequate level of achievement of learning objectives. Many students found it difficult to achieve their learning objectives when utilising these learning resources.

The unavailability of a learning facilitator, and possible lack of proficiency on the part of the facilitator, further contributed to the students' problems. The Internet was

reasonably well utilised to obtain information, especially among third year respondents. CD-ROM packages were utilised for this purpose by some students.

The research results also revealed that information-communication technologies enabled respondents to store and retrieve information. It should be noted, however, that storing and retrieving information for educational purposes are some of the many educational applications of information-communication technologies. The educators might have failed to effectively implement the principles of constructivism. They failed to establish a flexible learning climate in terms of study time and pace. The educators also failed to establish an interdependent, collaborative learning climate. The respondents inadequately utilised and benefited from collaborative learning, electronic interaction and communication, and electronic information exchanges. Despite numerous challenges, the learners reportedly benefited from CAI.

CAI enhanced the respondents' learning –they were able to keep up-to-date with the latest developments in their disciplines. They benefited from the development of technical and cognitive skills. Affectively, they experienced excitement when they discovered new knowledge. Computer-based learning enhanced the respondents' experiences of satisfaction. Because the respondents were independent, motivated and actively involved, a basis for constructivist learning had been established on a limited scale. Third year respondents, in particular, benefited from increased learner control and were able to learn from their mistakes.

CONCLUSION

This article established a baseline for introducing CAI or building on existing initiatives to enhance computer-based learning at the nursing college. The research findings highlight the potential problems that should be avoided and the benefits that could be optimised.

Most students could only access computer facilities at the college. Such utilisation proved to be ineffective if there was no resource person to offer assistance and guidance. Many students lacked basic typing, computer and reading skills. These skills could be enhanced through using appropriate computer programmes and such use should be encouraged. More effective utilisation of CAI could benefit the students in numerous ways in their quest for lifelong learning, rather than for passing tests and examinations only.

RECOMMENDATIONS

Exposure to resources and activities which support computer-based learning should be improved. Strategies should be developed to ensure that CAI is based on sound educational principles.

It is recommended that access to various educational computer packages, which support the mastery of subject content and the development of higher cognitive skills, be ensured. Educators should ensure that the utilisation of the above packages occurs within the context of a broad educational strategy. This implies the application of the principles of constructivism and problem-based learning. The establishment of in-service education programmes to improve nurse educators' computer literacy and facilitation skills, which underpin effective CAI, is recommended. The principles of constructivism, CAI and computer-based learning should be included in the curriculum for nurse educators' training.

There is a need to improve students' exposure to information-communication technologies. Basic skills that would improve the students' abilities to master the prescribed curriculum content need to be developed through computer packages that improve reading skills, typing skills and computer literacy. Technical support and learning facilitation structures should be established and maintained, and a facilitator should be present in the centre to assist students who require help.

LIMITATIONS OF THE STUDY

Questionnaires were completed only by second and third year student nurses at one participating nursing college. Consequently, the results might not be generalisable beyond the respondents. Situations might differ vastly at different colleges.

No triangulation of data sources took place. Observations of students' actual utilisation of the college's computer facilities would have yielded data to be compared with the data from the students' questionnaires.

No information was obtained from tutors. Such information could have yielded a different perspective on the phenomenon of CAI at a nursing college.

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