

Perceptions of the use of technology in a blended learning occupational health nursing programme in Durban, South Africa

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ABSTRACT

Blended learning refers to an educational strategy that combines face-to-face classroom instruction with on-line learning. This teaching strategy was introduced into an occupational health nursing (OHN) programme at the Durban University of Technology in 2011. Because computer literacy might be a challenge for mature nursing students, a programme evaluation using a mixed method design was conducted to assess perceptions of the blended learning programme. Both quantitative data from cohorts of first and second year OHN students and qualitative data from all of the lecturers teaching in the programme were collected. Computer anxiety was significantly higher for first-year students compared to second-year students ($p < 0.001$). Lecturers also indicated barriers to using on-line technology for teaching. Interventions need to be developed to decrease computer anxiety.

Keywords: programme evaluation, computer anxiety, nursing students

INTRODUCTION

South Africa, a country fractured by a colonial and apartheid past, values education as an important solution in addressing poverty. Computer literacy, even among college students, is variable, and many of the occupational health nursing students are older nurses who are returning for the undergraduate degree in occupational health nursing in order to increase their employment options. According to South African law, completion of a post-basic occupational health nursing specialisation is required in order to practice as an occupational health nurse (OHN).¹ The OHN specialisation programme is offered at fewer than 30% of the 23 universities in South Africa, including the Durban University of Technology (DUT). Nurses seeking this educational programme live in a vast geographical area, covering the whole of KwaZulu-Natal and other provinces. They have a number of roles outside the classroom, including full-time employment and family obligations; many are working in occupational health (OH) settings and, in numerous cases, are the only health professionals available to workers every day. Although motivated, they find it increasingly difficult to attend weekly face-to-face

sessions at the university. Some are self-employed and provide contract services in OH settings, and class attendance impacts financially on their businesses.²

Specialist OHNs are an integral part of the occupational health team and health services in the workplace are an important entry point for workers into the healthcare system which is based on a primary healthcare model. As the largest group of healthcare professionals in the workplace, OHNs are central to the delivery of healthcare services in the workplace. As South Africa transforms its health services through the re-engineering of the primary health care strategy, OHNs' relevance as specialist nurses in the health system increases, and strengthening of their knowledge, skills and attitudes through advanced nurse training increases in importance.

South Africa has a workforce of approximately 15 million, of which 8.54 million are in the formal non-agricultural sectors.³ OHNs are essential for ensuring the provision of worker health services, responding to the specific health needs of workers, improving the quality, effectiveness and community outreach on workers' health, and ensuring continuity of care and appropriate referral pathways for workers' health.⁴



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In response to the demand for the OHN qualification and the distance from where many potential students reside, to Durban, a blended learning approach, using e-learning, was adopted in 2011 by the Department of Nursing at DUT. Blended learning refers to a strategy in content delivery that combines face-to-face classroom instruction with on-line learning. To increase access, the programme format was changed from a weekly in-person format to biweekly face-to-face meetings on campus, and completion of assignments using technology during the alternate week.

Other than simply describing sample characteristics, the second most common empirical data analysis approach to study the use of blended learning is qualitative.⁵ This research extended that exploratory work by conducting a formal programme evaluation of the use of blended learning through both quantitative and qualitative methods in order to understand student and lecturer perceptions about experiences in the blended OHN programme.

Blended learning

Blended or hybrid learning combines e-learning and more traditional classroom-based methods of learning.⁶ Advantages include integration of the strengths of face-to-face and web-based learning activities through the use of both approaches throughout a course. The length of each learning mode varies according to the course design, and the balance depends on factors such as the instructional objectives, the characteristics of students, the condition of online resources, and the lecturer's experience. Blended learning draws on different learning designs and philosophies and the goal is to have the right "mix" for the situation in which learning takes place.

A systematic review was conducted to determine if a blended approach to teaching and learning in clinical settings had the potential to enhance clinical competencies of healthcare students. No description of the use of blended learning was found in a developing country context, perhaps due to challenges associated with technology access in areas with poor infrastructure. Nevertheless, the conclusion of the review was that blended learning improved student

competencies in reflective thinking, clinical skills, self-efficacy, and clinical reasoning.⁷

A study that explored accounting students' experiences of blended learning found that they experienced significant improvements in their performance and increased levels of independence, were more motivated to learn, and acquired a deeper understanding of the subject matter.⁸ A study in the United Kingdom, on the underlying factors influencing e-learning adoption in nursing education found that there were four different educator reactions to e-learning adoption: e-learning advocates, humanists, sceptics, and pragmatics.⁹ The authors argued that, when the status quo meets the needs of the individuals, and change causes frustration and costs in terms of time, some individuals choose not to adopt new technologies.⁹ Jokinen and Mäkkönen, describing the transition to a blended teaching platform in Finland, found that online learning was a challenge for nursing lecturers, although all had some experience with using technology.¹⁰ Although there appear to be substantially more benefits than constraints to e-learning, the recurring constraints identified in the literature persisted in significantly hindering the learning experience.¹¹

Orton and Nokes described the curriculum during the first year that the blended OHN programme was offered to DUT students.² Briefly, the OHN programme spans 16 months and uses problem-based learning strategies drawn from clinical OH practice. The technology-mediated learning is through the use of Blackboard 8, a learning management system that includes course management systems supporting interactive learning through different strategies, such as discussion boards.

The aim of the study described in this paper was to evaluate the effectiveness of, and the areas for improvement in, a blended educational programme for OHNs offered by DUT.

METHODS

The programme evaluation used the collaborative approach described by O'Sullivan.¹² According to this approach, key programme stakeholders are engaged actively throughout the evaluation process. The programme evaluator (Nokes) continuously engaged the OHN programme coordinator

(Orton) as the evaluation plan was developed and implemented. Person triangulation¹³ was used to collect cross-sectional data from two different types of people: current students and lecturers teaching in the OHN programme since the aim was to validate data through multiple perspectives on the phenomenon of blended learning as a teaching/learning strategy.

A mixed methods convergent design was used, as the intent was to merge concurrent quantitative and qualitative data to address the study aim.¹⁴ During 2014, quantitative data were collected from the year 1 and year 2 student cohorts and qualitative data were collected from all of the OHN programme lecturers.

Written informed consent was obtained from all of the participants. A research assistant, who was a graduate of the programme (Scott), collected all the data to ensure that students did not perceive any duress in sharing their perceptions about the programme. The data were coded and identifiers were removed.

The study was approved by the City University of New York Research Ethics Committee and the Durban University of Technology Research Ethics Committee (certificate number REC 53/13).

Data measurement instruments

The *Perceptions about the use of web-based learning*¹⁵ was used to measure current OHN student perceptions about the use of web-based learning, including Blackboard, in the OHN programme. This instrument used the Technology Acceptance Model¹⁶ as the theoretical foundation and measured six factors: motivation to use, computer anxiety, Internet self-efficacy, perceived usefulness, perceived ease of use, and behavioural intentions. Each of the 22-items was measured with a seven-point Likert scale, ranging from strongly disagree (1) to strongly agree (7). Items 19 through 22 were modified by substituting the word *education* for *in-service education*. For example, item 19 in the Chen and Tseng version states: "In the future I would use web-based e-learning systems to engage in in-service education." In the current version, it reads: "*In the future I would use web-based e-learning systems to engage in education.*"¹⁵ Cronbach's alpha for the 6-factors ranged from 0.87 to 0.93 in the junior high school teacher sample in Taiwan (N=402)¹⁵ and from 0.39 for the Motivation to use factor, to 0.94 for the Perceived ease of use factor in the DUT OHN sample. Due to the low reliability in this DUT OHN sample, data from the motivation to use factor were not analysed.

The demographic and work-related instrument measured person-related factors such as age and gender, and work-related items about nursing education preparation and OH work experience.

Qualitative data were collected using an adaptation of three interview questions used by Curran, et al.¹⁷ when they evaluated a medical education programme. The semi-structured interview questions were:

1. What do you feel should be achieved by this programme?
2. What would be indicators of success for this programme?
3. What do you feel are the strengths and weaknesses of this programme (structure, delivery aspects, assessment instruments and policies)?
4. Is there anything else you would like to share?

Data collection

Incoming OHN students are admitted in February of each year and the programme is completed 16 months later. Both first- and second-year student groups had access to Blackboard; information about the proposed research was posted two weeks before data collection. Data were collected in 2014 from first-year students before the lecturer gave instructions on how the technology would be used throughout the programme; data were collected as early as feasible after the start of year 2 from second-year students. On the agreed upon day, the two study instruments were distributed and collected by the research assistant; the entire data collection period for each cohort was approximately 45 minutes.

Qualitative data were collected by the same research assistant from the four lecturers teaching in the OHN programme. During the interviews, the research assistant directed the discussion around the online aspect of the

blended learning; staff were not probed about the face-to-face aspect of the course. Each interview lasted 30 to 90 minutes and was conducted in English.

Statistical analysis

Quantitative data were analysed using SPSS v22. Two-tailed Pearson product moment correlations were computed between the factors on the perceptions about the use of web-based learning scale and t-tests were used to compare the scores of first- and second-year students.

Qualitative data analysis

The lecturer interviews were recorded and transcribed verbatim by the research assistant. The transcribed interviews were analysed using the applied thematic analysis methodology described by Guest et al. to develop themes.¹⁸ Three of the researchers individually analysed the focus group transcripts for commonalities, which each person grouped into codes. The codes were not pre-determined, but emerged from inductive analysis of the transcripts. A codebook was created by assigning a definition to each

code; transcript data, consisting of quotes and dialogue exchanges that matched code definitions, were sorted into the appropriate group. To ensure reliability, all three researchers met to compare the transcripts with the codes to ensure that the code definitions and data were consistent, accurately reflected the meaning that emerged from the content of the full transcripts, and identified inconsistencies between transcripts and code definitions. During a prolonged meeting, all three researchers reached agreement on code definitions and refined the codebook, after which the researchers analysed the codebook and transcripts to identify themes.

RESULTS

The average age of the first-year students was 37 years (SD=6.0), and that for the second-year students was 42 years (SD=7.1). Twenty-seven of the 28 students in the first year cohort (96%) and 24 of 26 students in the second-year cohort (92%) participated. Most participants were female, Black African, had a diploma education in nursing as their highest qualification, post-basic qualification in nursing, and had worked in a private, industrial OH setting for at least one to three years (Table 1). All four lecturers were female; no additional demographic information was collected in order to ensure confidentiality.

There was a significant difference between the two student cohorts on time spent in the OH setting ($p=0.002$) in that second-year students worked significantly more hours in an OH setting compared to first-year students; 96% of students in both cohorts worked in KwaZulu-Natal province.

Means, standard deviations and ranges for the factors on the perceptions about the use of web-based learning scale are presented in Table 2. The highest mean score was for Internet self-efficacy (19.00 ± 3.05) and the lowest was for perceived ease of use (12.16 ± 3.40). Computer anxiety was significantly and inversely related to Internet self-efficacy ($r=-0.413$, $p=0.004$), perceived ease of use ($r=-0.328$, $p=0.025$), and behavioural intention to use ($r=-0.319$, $p=0.029$). Perceived usefulness was significantly and positively related to Internet self-efficacy ($r=0.481$, $p<0.001$), perceived ease of use ($r=0.576$, $p<0.001$) and behavioural intentions ($r=0.366$, $p=0.011$). The only significant difference between the two cohorts was that mean computer anxiety was significantly lower for second-year (10.28 ± 4.91) compared to first-year students (16.1 ± 4.90) ($p<0.001$).

A central theme emerged from the analysis of the qualitative data: blended learning is a valuable teaching and learning strategy. Four broad subcategories were identified as important to the lecturers' perceptions about blended learning: motivation to use Blackboard technology, Blackboard self-efficacy, perceived usefulness, and perceived ease of use. Table 3 presents the subcategories and the words from the participants to support each subcategory.

The lecturers believed that blended learning is a useful teaching strategy but the implementation of the technology-

Table 1. Demographic and OH work related survey

Item	Year 1 cohort		Year 2 cohort	
	n	%*	n	%*
Gender				
Male	3	11	4	17
Female	24	89	20	83
Race				
Black	19	70	15	63
Coloured	2	7	3	13
Asian	3	11	2	8
White	3	11	4	17
Basic nursing qualification				
Bachelors degree in nursing	10	37	3	12
Diploma in nursing	17	63	21	88
Post basic qualification in nursing				
Yes	17	63	15	63
Highest nursing qualification				
Diploma	20	74	21	88
Bachelors degree	7	26	3	12
Time spent in the occupational health setting weekly (hours) [‡]				
0 - 10	11	41	2	9
11 - 20	5	19	2	9
21 - 30	1	4	2	9
31+	10	37	17	74
Working in an occupational health setting				
Yes	20	74	23	96
If yes, length of time working in occupational health (years)				
< 1	3	15	0	0
1 - 3	10	50	12	52
4 - 10	5	25	9	39
> 10	2	10	2	9
Sector working in				
Private	15	75	15	65
Public	5	25	8	35
Works in industrial setting				
Yes	14	70	16	70

* Percentages have been rounded off

‡ 1 missing

Table 2. Perceptions about the use of web-based learning

Item #	Item	Factor	Cronbach Alpha	N	Mean	SD	Range
1	Web-based e-learning is less constrained by spatial limitations	Motivation to use	0.39	51	13.03	2.32	5.6-16.3
2	Web-based e-learning is not constrained by time						
3	I can fully control web-based e-learning progress						
4	I am worried that I do not know how to make the computer finish the things I want to do	Computer anxiety	0.86	50	13.75	5.68	3.2-22.8
5	I feel troubled regarding some work that can only be completed by using a computer						
6	When I face error messages on the computer, I do not know what to do						
7	I feel scared in terms of operating products related to computer and technology.						
8	I am confident that I can connect to the web pages I want to browse	Internet self-efficacy	0.77	49	19.00	3.05	9.7-22.7
9	I am confident that I can use the Internet to download the information I need						
10	I am confident that I can use the mouse to click on the web pages I need						
11	I am confident that I can use the search engine to search for information						
12	Advancing studies through using web-based e-learning systems can help my learning be more efficient	Perceived usefulness	0.93	50	18.85	4.03	3.2-22.8
13	Advancing studies through using web-based e-learning systems can help me acquire the information I want to acquire						
14	Advancing studies through using web-based e-learning systems can be helpful to my work or learning						
15	Advancing studies through using web-based e-learning systems can improve my learning ability						
16	It is easy for me to learn how to engage in advancing studies through using web-based e-learning systems	Perceived ease of use	0.94	50	12.16	3.40	2.3-16.3
17	It is easy for me to independently operate web-based e-learning course systems to advance						
18	It is easy to acquire knowledge by using web-based e-learning systems to advance studies						
19	In the future I would use web-based e-learning systems to engage in education	Behavioural intention	0.85	49	17.31	4.07	3.5-22.7
20	I am willing to use web-based e-learning systems to replace other methods of education						
21	If there are learning needs, I would choose web-based e-learning to engage in education						
22	On the whole, I would use the method of web-based e-learning for education						

based aspect of the blend is limited because of the challenges faced by the staff. Study participants felt motivated to use the technology and intended to adopt a blended approach to their particular subjects. This was illustrated by one staff member who said:

I have been to one of the courses – I am very curious to learn the Blackboard system – I hope I raised some issues and maybe even if it was just to motivate me (LC).

All of those interviewed expressed the intention to adopt the Blackboard technology:

We need to get pro-active, get the lessons and get our classroom organised and put all our programmes on there (LA).

Table 3. Results from qualitative data – overarching theme: blended learning is a valuable teaching and learning strategy

Subcategory	Interview data
Motivation to use Blackboard, technology	<p>I have been to one of the courses (LC)</p> <p>I am very curious to learn the Blackboard system (LC)</p> <p>I hope I raised some issues and maybe even if it just to motivate me (LC)</p> <p>How long can one sit on the computer, I have been on it this morning since early, my eyes are tired.</p> <p>I have been looking and searching (LA)</p> <p>I showed them how to log in and then I left them and I have had less problems this year (LD)</p> <p>We are all doing three things at the same time. If we attend management meetings, we don't use paper. So why not use technology in class (LD)</p> <p>This is a skill I would like to master (LC)</p> <p>I don't say it is any other person's fault but mine, I take full responsibility of being here at DUT for eighteen months and not training on Blackboard (LC)</p> <p>I must get someone to train me to do it... It is a nightmare. I think that is why we must give up on the training sessions. I take all the blame on myself and I must do something about it. This is a skill I would like to master (LC)</p> <p>We need to get pro-active, get the lessons and get our classroom organised and put all our programmes on there (LA)</p> <p>So maybe we should give some specs (LD)</p>
Blackboard self-efficacy	<p>Blackboard skills are also non-existent (LC)</p> <p>My knowledge of Blackboard is not good, I would say it is almost non-existent (LC)</p> <p>You as a lecturer must sit and practice those skills and up-load (LC)</p> <p>I just don't have the time to sit down and practice it (LC).</p> <p>For me personally I haven't got into the e-learning mode and phase. I know a little bit about it. I know a little bit about Blackboard. I have gone in to making myself a classroom. But that is where it has stopped (LA)</p> <p>if I need anything to be posted on Blackboard then I go to Penny and ask her to post it on Blackboard if there is anything the students need to read (LA)</p> <p>One of the weaknesses is that we as lecturers are not fully trained as well so we have our own limitations as to the use of WEBCT and this impacts on the delivery of the whole programme (LB).</p> <p>There needs to be training for the lecturers (LB)</p>
Perceived usefulness	<p>Yes, if it is a programme that can be run properly it should be we can grow our students' numbers and I think we can have better results but I think there is some groundwork to do (LC)</p> <p>Yes, I think it can work (LC)</p> <p>The face to face contact with the students is important (LA)</p> <p>Is research up on Blackboard? (PS) There are one or two slides. It is a limitation to the student and it is a big hole in my distributing of knowledge to them. There seems a lot of training to be done still... (LC)</p> <p>I think it is a good way of teaching, a good teaching strategy (LA)</p> <p>I don't think the workload would be less because you would still have the marking, you still got the one-to-one remedial so if a student is not doing well then you have to call the student in and remediate which is on-going (LA)</p> <p>You have to spend time on your computer to put in the lessons and also to retrieve what the students are feeding back to you. I don't think it will lessen the workload or the time (LA)</p> <p>What I am looking for is to be able to communicate with the students more and extend my teaching more because we do not see them that often. They come on alternate weeks so to make up for the time they do not come to classes then I see this as a form of expressing more matter to them and teaching (LB)</p>
Perceived ease of use	<p>Lots of in-service (training). They have called us quite often. If we have problems we can call them and they are easily accessible we go and see them and they come to us, we just give them a phone call and they are very helpful. I think it is the time factor for us to go there and to sit and to keep going for orientation and it's the time factor and workload we have (LA)</p> <p>I would say that we have not reached a point where the structure is excellent but we are getting there (LB)</p> <p>The problem is often the company firewalls. I tell them to come to DUT and they get in fine. So I tell them to go to the company and unblock the firewall (LD)</p>

Note: there were 4 lecturers (LA, LB, LC and LD)

The lecturers interviewed gave the impression of having low self-efficacy to use Blackboard which was illustrated by the following quote:

My knowledge of Blackboard is not good, I would say it is almost non-existent (LC).

Another said:

For me personally I haven't got into the e-learning mode and phase. I know a little bit about it. I know a little bit about Blackboard. I have gone in to making myself a classroom, but that is where it has stopped (LA).

All the staff agreed that blended learning is a

useful teaching and learning strategy:

I think it is a good way of teaching, a good teaching strategy (LA).

However, this was tinged with some qualifiers:

Yes, if it is a programme that can be run properly it should be we can grow our students numbers and I think we can have better results but I think there is some groundwork to do (LC).

The staff interviewed did not think that Blackboard was easy to use for a number of reasons, not least of which was the infrastructure supporting the use of Blackboard. The training support was readily available:

If we have problems we can call them and they are easily accessible we go and see them and they come to us, we just give them a phone call and they are very helpful (LA).

However, the availability of the technology, such as strong Internet connection, was limiting:

The problem is often the company firewalls. I tell them to come to DUT and they get in fine. So I tell them to go to the company and unblock the firewall (LD).

I would say that we have not reached a point where the structure is excellent but we are getting there (LB).

DISCUSSION

Blended learning is an important delivery method for the future, especially for post-graduate learners who need to be lifelong learners to keep up-to-date.¹⁹ The need to access reliable health-related information about emerging issues, such as Ebola and HIV/AIDS treatment, in a timely fashion, can be acute in settings where the OHN specialist might be the only healthcare provider. The reliability for five of the six factors on the perceptions about the use of web-based learning scale was good. Careful examination of the words used in the motivation to use factor points to a possible explanation for the low reliability for that scale. The research assistant reported that respondents had questions about phrases such as “constrained by spatial limitations”. Avoiding computers and areas where computers are present, preferring to use computers only briefly, and taking excessive precautions while using them, are behaviours seen in individuals who have computer anxiety.²⁰ Chen and Tseng measured computer anxiety in terms of the anxiety that the respondents had regarding computer learning and the information age.¹⁵ It is important to note that the only significant difference between the two student cohorts was on the computer anxiety factor (second-year students were significantly less anxious). Since computer anxiety is significantly related to Internet self-efficacy, perceived ease of use, and behavioural intention to use, the need for interventions to address computer anxiety is important.

CONCLUSIONS AND RECOMMENDATIONS

Blended learning, a useful teaching strategy, has the potential to advance the OHN specialisation programme at DUT through the numerous opportunities for collaborative learning that the online technology affords. However, the challenges faced by both lecturers and students need to be addressed through focused interventions to ensure the optimal use of this teaching/learning strategy. Computer anxiety appears to be the major issue and the OHN programme leader should address this through innovative interventions. For students, this could mean supported computer literacy woven into the OH programme, incorporating OH content so as to not over-burden students in what is already a tightly packed box of subject matter.

Although computer literacy is not a pre-requisite for the course in OH nursing, it is assumed that the students registering for the course have some degree of computer literacy, knowing it is offered via a blended approach. This year (2015), students have been interviewed as part of the selection process and are asked about access to computers and the Internet, e.g. if they have their own computers, and how they access the Internet (at work or at home) and whether this is through dial-up or cellular technology. The university could facilitate basic computer literacy through continuing education courses outside normal working hours which would allow mature, working students to acquire skills and enable increased confidence in computer usage.

Dedicated timetabling for web-based development needs to be facilitated for lecturers, all of whom expressed a desire to embrace the blended teaching/learning strategy. However, they all described competing demands which did not afford them the time to engage in developing “classrooms” and increasing their skills with the Blackboard technology.

Follow-up research on the student sample using a longitudinal study design is planned to determine if perceptions of the use of web-based learning change over time as students progress through the programme.

Further research is needed to identify the aetiology of the computer anxiety in order to develop targeted interventions.



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DECLARATIONS

None of the authors have any conflicts of interest.

LESSONS LEARNED

- Computer anxiety interferes with the use of e-learning technology for learning OHN content
- Both students and lecturers experience anxiety in using Blackboard technology
- Second-year students had less computer anxiety than first-year students

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