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Evaluation of an E-Learning Training Package by Nurses of Various Designations for Developing Clinical Skills and Knowledge

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Abstract

Education helps nurses maintain, improve and broaden their professional knowledge to meet their obligations to provide ethical, safe and competent care. Globally, electronic learning (e-learning) has emerged in the last decade as a flexible mechanism to provide education for nurses. However, not enough is known about how nurses view e-learning as continuing education and whether the skills and knowledge gained are transferable to daily practice. A descriptive correlational design applying a non-experimental quantitative approach was employed to evaluate an e-learning training package used by nurses of various designations for developing clinical skills and knowledge at a private hospital in Perth, Western Australia. Data were collected via a survey method over 3 years. Findings suggest an e-learning training package effectiveness is mainly dependent on the implementation process, the way learning is packaged and sequenced, and the instructional design of the package. When the e-learning training package uses materials participants can apply with patients in the clinical setting, there is higher active engagement and application of content to practice. This study's findings reveal more flexible implementation approaches might be considered in the future, including blended learning.

Key words

Enrolled nurse: A person with appropriate educational preparation and competence for practice, who is registered under the Health Practitioner Regulation National Law (NMBA, 2017).

Nurse unit manager: The Nurse unit Manager is a nurse or midwife leader who is at the forefront of the health care system and its ever-changing and evolving organisational and management systems. The Nurse unit Manager is responsible for the ongoing day to day operational and clinical aspects of the ward/unit/service/program they manage combined with a focus on the provision of service provision of the employing health service (ANMF, 2019).

Registered nurse: Protected title for a person who has completed the prescribed education preparation, demonstrates competence to practise and is registered under the Health Practitioner Regulation National Law as a RN in Australia (ANMAC, 2024).

Staff development nurse: A registered nurse who is responsible for formulating educational tools that promote the appropriate training, education and professional development of new nurses and established nursing staff (All Nurses, 2014).

I INTRODUCTION

In Australia, nurses form the largest component of the health care workforce, providing health care to people across their lifespan (Australian Institute of Health and Welfare, 2022). The Australian Commission on Safety and Quality in Health Care identifies education as one of the pivotal tools required to protect the public from harm and improve the quality of health service provision (Australian Commission on Safety and Quality in Health Care, 2017). The need for ongoing education is critical, as it has a significant impact on positive outcomes such as increased patient satisfaction, reduced length of stay and reduced incidence of complications (Baumbusch et al., 2017). However, nurses' efforts to engage in their professional development can be hampered by lack of time, limited access to educational resources and cost concerns (Bindon, 2017; Katsikitis et al., 2013; Shahhosseini & Hamzehgardeshi, 2014; Stevens et al., 2021).

Globally, electronic learning (e-learning) has emerged in the last decade as a flexible mechanism to provide education for nurses in the knowledge, skill and attitudinal domains (D'Souza et al., 2014). 'E-learning' is the delivery of training via the internet or an organisation's intranet (Piskurich, 2015). There are two categories of e-learning: synchronous and asynchronous (Frith & Clark, 2013). In 'synchronous' e-learning, all learners are online at the same time and a facilitator is present via computer to lead the learning (Piskurich, 2015). In contrast, 'asynchronous' e-learning is largely undertaken alone and there is no instructor available in real time (Piskurich, 2015).

Nurses work different shifts; thus, scheduling three or four hours for class at the same time every week may be impossible. The use of asynchronous e-learning enables nurses to overcome barriers of continuing education such as time constraints (Green & Huntington, 2017). Thus, the ability to access learning materials electronically at their own convenience is extremely helpful to nurses (Frith & Clark, 2013). Other benefits of e-learning compared with face-to-face instruction include reduced costs (Stevens et al., 2021), the ability to network with colleagues in speciality areas without geographic limitations (Frith & Clark, 2013), consistency in the delivery of training and education (Stevens et al., 2021), and opportunities for learners to form critical thinking skills and take initiative and responsibility for their work (Kuimoval et al., 2016). Awareness of the flexible benefits of e-learning has resulted in many health service organisations implementing e-learning.

As with any technology, there are some drawbacks to e-learning. Specifically, in health care, the main drawback is that some topics can be only superficially addressed by health care professionals through e-learning, because the method does not enable discussion of issues with individuals so that they can truly grasp the subject matter (Erin, 2015).

Kanwal et al. (2017) identified that the effectiveness and efficiency of e-learning systems depends on learners' acceptance of e-learning. Learners' acceptance is influenced by factors such as attitude, demographics, organisational influence, social influence and the perceived usefulness and ease of use of e-learning systems. Singh and Hardaker (2014) identified management support, supportive information technology and communication among staff as important factors in the adoption of e-learning.

Lahti et al. (2014) investigated the influence of e-learning on the knowledge, skills and satisfaction of nurses and nursing students, compared with traditional education methods. Eleven studies were included in the review and the results indicated that e-learning was not a superior learning method compared with traditional learning methods. No statistical differences were found between learning outcomes in regard to knowledge levels and improving learners' skills. It was not possible to assess nurses' satisfaction levels in these studies reviewed because of missing statistical information. E-learning methods were still fairly new when the reviewed studies were undertaken; thus, the e-learning interventions may not have adequately responded to the participants' needs and experiences in clinical practice.

Much of the literature in this area indicates that e-learning is effective for short-term knowledge transfer and that some clinical skills can be taught using e-learning; however, this is dependent

on factors such as the quality of e-learning design, computer availability at work and nurses' computer knowledge.

That nurses' upskilling of knowledge and skills improves quality of care for patients is widely understood, and, globally, e-learning is now widely used in nurse education. However, there has been limited research examining nurses' evaluation of e-learning for developing clinical skills and knowledge. Further study in this area is required to understand the effectiveness of e-learning for developing nurses' clinical skills and knowledge better, thus ensuring quality care for patients. This study explored nurses' and management's responses to an e-learning training package that developed clinical skills and knowledge at a private hospital in Perth, Western Australia ('The Hospital'). Prior to introducing e-learning, nurse education in The Hospital was undertaken face-to-face and then by a hands-on approach. A shift from face-to-face and hands-on learning to e-learning raised concerns among nurses about the effectiveness of the e-learning training package for developing clinical skills and knowledge. This concern provided the impetus for this research.

The theoretical framework used in this study was the cognitive theory of multimedia by Mayer (2009), which focuses on how adults learn from multimedia. The cognitive theory of multimedia learning states knowledge construction is based on three principles: dual channel, limited capacity and active processing. People have separate channels for processing visual/pictorial material and auditory/verbal material. This is the 'dual-channel' principle. The 'limited capacity' principle indicates that people can actively process only a few pieces of information in each channel at one time. 'Active processing' learning occurs when people engage in appropriate cognitive processing during learning, such as attending to relevant material, organising the material into a coherent structure and integrating the material with what they already know. Meaningful learning occurs when the learner engages appropriately in selecting words and images, organises words and images mentally in coherent verbal and pictorial representations, and integrates the incoming verbal and pictorial representations with each other and with existing knowledge.

II AIMS

This study explored registered nurses' (RNs), enrolled nurses' (ENs), staff development nurses' (SDNs) and nursing unit managers' (NUMs) evaluations of an e-learning training package for developing clinical skills and knowledge at The Hospital. The study's specific aims were to investigate the following questions:

1. How did nurses of various designations evaluate an e-learning training package for developing clinical skills and knowledge?
2. What are the barriers to e-learning for nurses of various designations?
3. To what extent do the findings of this study have implications for the future delivery of training and education for nurses?

III METHODS

A Ethics Approval

Ethical clearance to undertake this study was obtained from the Human Research Ethics Committee at the University of Notre Dame in July 2016 (reference number 016112F). Written approval from the deputy director of nursing at The Hospital was granted for the research candidate to conduct this study.

B Research Methodology

Quantitative research methods were used to meet the needs and purposes of this study. The chosen design was a descriptive correlational design, which describes variables and the relationships that occur naturally among them. The study was conducted over 3 years.

C Study Context

The Hospital at which this study was conducted has been providing health care to residents for over 30 years. With 224 patient beds, it is one of the 11 largest private hospitals in Western Australia. In 2016, there were 340 RNs, 20 ENs, nine SDNs and nine NUMs employed at The Hospital. The e-learning training package used at The Hospital is ELMO Talent Management Software for developing clinical skills and knowledge. ELMO is Australia's and New Zealand's leading cloud-based talent management solutions provider. At The Hospital, ELMO, covers all annual mandatory training. Mandatory training—such as manual handling and cardiopulmonary resuscitation—also has a practical component. The e-learning training package was introduced to nurses at The Hospital with a brief overview that typically included information on login details, basic navigation principles and hospital requirements in terms of the assessment components. The e-learning training package user guide for The Hospital was made available in each ward for nurses.

D Participants

In order of nursing hierarchy at The Hospital, the nursing workforce comprises NUMs, SDNs, RNs and ENs. All RNs (n=340), ENs (n=20), SDNs (n=9) and NUMs (n=9) working in The Hospital staff were sent a questionnaire (see Appendix) through the e-learning website for The Hospital to obtain quantitative data. Inviting all nurses in The Hospital to complete the questionnaire helped avoid researcher bias. A minimum sample size of 127 nurses (or 30%) was deemed sufficient to measure responses to e-learning. In total, 237 RNs, 20 ENs, 9 SDNs and 9 NUMs responded to the questionnaire, giving a sample size of 275 participant responses. Two respondents were removed from the final data analysis because of incomplete data, resulting in 273 participant responses for data analysis.

The vast majority of the participants in this sample were females 92% (n=253) and 8% (n=22) of the participants were males. Data regarding the age of participants showed that their ages ranged between twenty and sixty-five years old. The largest percentage of participants 31.3% (n=86) were aged between 25 and 35 years old. Followed by 30.2% (n=83) participants aged between 36 and 45 years old; 22.2% (n=61) participants aged between 46 and 55 years old; 10.2% (n=28) participants aged between 56 and 65 years old; 5.5% (n=15) aged between 20 and 24 years old and .7% (n=2) were aged > 66 years old. The range of qualifications varied from Diploma in Enrolled Nursing, Bachelor of Nursing, Master of Nursing, PhD and Doctor of Nursing. A vast majority of the participants had completed the Bachelor of Nursing as the highest level of education 83.3% (n=229). Next level of education completed was ENs (Diploma in Enrolled Nursing 10.5% (n=29)) followed by Master of Nursing 5.5% (n=15); PhD 0.4% (n=1) and Doctor of Nursing .4% (n=1).

E Data Collection

Data were collected in this study by survey. The researcher designed a questionnaire to elicit the information used for analysis. The questionnaire sought RN, EN, SDN and NUM evaluations of an e-learning training package for developing clinical skills and knowledge. No testing of clinical skills was undertaken in this study. The questionnaire was administered in August 2016 to RNs, ENs, SDNs and NUMs at The Hospital.

The questionnaire focused on the participants' perception of their experiences, the effectiveness and overall design of the e-learning training package and any barriers to learning via this method. The questionnaire used a 5-point Likert scale, where the respondents indicated their degree of agreement or disagreement with a series of statements. Data were collected from survey responses uploaded to the e-learning site at The Hospital.

Among other aspects, the questionnaire asked participants to identify the design of the e-learning used at The Hospital—that is, whether it was visual/pictorial or auditory/verbal, according to Mayer's (2009) cognitive theory of multimedia learning. As previously discussed, this theory is

based on three principles: there are two separate channels (auditory and visual) for processing information; there is limited channel capacity; and learning is an active process of filtering, selecting, organising and integrating information (Mayer, 2009). Participants were also asked to identify if they were actively engaged in the learning.

A participant information sheet from the University of Notre Dame was attached to the questionnaire inviting nurses to take part, explaining the purpose and significance of the study and why nurses were chosen to participate. Implied consent was provided by the participants if they completed the questionnaire. The questionnaire was pilot tested once with 10 RNs to establish content validity. All 10 RNs had used the e-learning training package at The Hospital; therefore, they formed a homogeneous group. The 10 RNs were randomly selected from different speciality areas in The Hospital to avoid selection bias. The pilot test also enabled the researcher to determine the extent to which the results measured what they were intended to measure.

To demonstrate the questionnaire's validity, the researcher focused on face and content validity. Face validity was achieved by obtaining feedback from an expert in research questionnaire development at the University of Notre Dame and from the supervisors of this study, while content validity was achieved by piloting the survey.

To demonstrate reliability for the questionnaire, the focus was on internal consistency. To ensure consistency, the scale items were subjected to reliability tests using Cronbach's alpha as the measure. An alpha value of .7 or above was considered reliable (Santos, 1999), and meant that the set of items was internally consistent in measuring the intent of each factor. The reliability analysis for the experience with e-learning, e-learning effectiveness and e-learning barriers scales deemed these scales reliable for use in subsequent analysis since all Cronbach's alpha values were greater than .7. However, the scale for experience with training to use e-learning had an alpha value of less than .7, indicating these data should not be included in analyses.

F Data Analysis

Quantitative analysis was conducted using SPSS statistical software, version 23.

1 Fisher's Exact Test

Differences in group membership—that is, whether experience with e-learning differed by nurse designation—could be tested for statistical significance using Fisher's exact test (Smith et al., 2009). This test was used to establish whether a nurse's views on the e-learning training package for developing clinical skills and knowledge were associated with their designation in the workplace. The Likert scale responses for experience with e-learning, e-learning effectiveness and e-learning barriers were collapsed into fewer categories to maximise the chances of the large expected frequencies assumption being met. The categories of 'agree' and 'strongly agree' were collapsed into one category of 'agree', the categories of 'disagree' and 'strongly disagree' were collapsed into one category of 'disagree', the 'neutral' category was retained and the 'don't know' category was ignored. A 5% level of significance was used as the criterion for statistical significance, as is common when using Fisher's exact test in social science research (Katz, 2011).

2 Test of Normality

Prior to conducting statistical analyses, the assumptions of parametric statistics for continuous variables were assessed. The Shapiro–Wilk test was used to check for normality of the continuous variables at $\alpha = .001$, the test statistic. Depending on the outcome of this test, parametric or non-parametric statistics and techniques were used.

3 Kruskal–Wallis Test

The main multivariate analysis technique used to answer the research questions was the Kruskal–Wallis test. This test is suitable for comparing the median scores of two or more samples (Katz, 2011; Tabachnick & Fidell, 2007). This test was used to compare RN, EN, SDN and NUM evaluations of the e-learning training package for developing clinical skills and knowledge.

4 Correlation Analysis

Correlation analysis is a useful technique to test the strength and direction of association between a pair of variables. This technique was used to test the nature of association between nurses' views on the e-learning training package for developing clinical skills and knowledge, and the e-learning design and participants' demographics and meaningful learning with e-learning.

IV RESULTS

A Participants' Engagement with E-Learning

In total, 237 RNs, 20 ENs, 9 SDNs and 9 NUMs responded to the questionnaire. Most participants indicated that they had engaged with e-learning at The Hospital (98.9%, $n = 272$). More than half of the participants engaged in e-learning less than once per week (58.2%, $n = 159$). Most participants had also used other online resources at home in their own time for professional development (87.5%, $n = 239$). The participants who had not used another online resource comprised 12.4% ($n = 34$). Table 1 presents the participants' engagement with e-learning.

Table 1
Participants' Engagement with E-Learning

Item	Category	Frequency	%	Valid % ^a	Cumulative %
Have you engaged with electronic learning at this private hospital?	Yes	272	98.9	98.9	98.9
	No	3	1.1	1.1	100.0
	Total	275	100.0	100.0	
How many times a week do you engage in electronic learning?	Less than once/week	159	57.8	58.2	58.2
	1–2 times/week	94	34.2	34.4	92.7
	3–4 times/week	13	4.7	4.8	97.4
	5–6 times/week	2	0.7	0.7	98.2
	> 6 times/week	5	1.8	1.8	100.0
	Total	273	99.3	100.0	
	Missing	2	0.7		
Total		275	100.0		
Have you used other online learning training package for professional development?	Yes	239	86.9	87.5	87.5
	No	34	12.4	12.5	100.0
	Total	273	99.3	100.0	
	Missing	2	0.7		
Total		275	100.0		

^a Percentage after missing data are excluded from calculations.

Table 2 outlines the participants' use of other online training resources. The most commonly used online training resource was Google Search, followed by Wikipedia, The Hospital library resources via the intranet and the UpToDate resource. This information was collected via a multiple-response questions inviting participants to tick multiple boxes.

Table 2
Participants' Use of Other Online Training Resources

Online training package	Responses		% of cases ^b
	No.	% ^a	
Google Search	177	37.8	74.1
Wikipedia	62	13.2	25.9
UpToDate	36	7.7	15.1
The Hospital library resources via the intranet	60	12.8	25.1
Other	133	28.4	55.6
Total	468	100.0	195.8

Note. ^a Percentage of participants who chose that particular option. ^b Percentage of choice or particular box ticked of all choices or boxes ticked.

B Barriers Affecting Use of E-Learning by Nurses

Participants were asked to identify the most and least challenging barriers affecting their use of e-learning from a provided list. Table 3 shows the most challenging barriers affecting the use of e-learning at The Hospital. Participants listed time as the most challenging barrier to e-learning, followed by limited access to computers, then lack of management and technological support. The least challenging barrier was lack of training on the use of e-learning.

Table 3
Most Challenging Barriers to E-Learning

Valid	Frequency	%	Valid % ^a	Cumulative %
Lack of management support	12	4.4	4.4	4.4
Time	205	74.5	75.1	79.5
Lack of training on use of electronic learning	11	4.0	4.0	83.5
Limited access to computers	33	12.0	12.1	95.6
Technological support	12	4.4	4.4	100.0
Subtotal	273	99.3	100.0	
Missing	2	0.7		
Total	275	100.0		

^a Percentage after missing data are excluded from calculations.

Table 4 presents the least challenging barriers to e-learning at this private hospital.

Table 4
Least Challenging Barriers to E-Learning

Valid	Frequency	%	Valid % ^a	Cumulative %
Lack of management support	51	18.5	18.7	18.7
Time	31	11.3	11.4	30.0
Lack of training on use of electronic learning	84	30.5	30.8	60.8
Limited access to computers	53	19.3	19.4	80.2
Technological support	54	19.6	19.8	100.0
Total	273	99.3	100.0	
Missing	2	0.7		
Total	275	100.0		

^a Percentage after missing data are excluded from calculations.

C Design of E-Learning

Participants were asked what the design of e-learning at The Hospital was. Their responses are shown in Table 5.

Table 5
E-Learning Design

Was the e-learning:	Responses		% of participants
	N	%	
Visual/pictorial?	187	39.2	68.5
Auditory/verbal?	89	18.7	32.6
Lot of visual material at one time?	98	20.5	35.9
Lot of spoken words/sounds at once?	25	5.2	9.2
You are actively engaged in the learning?	78	16.4	28.6
Total	477	100.0	174.7

Most participants stated that e-learning was visual/pictorial (68.5%, $n = 187$). They also indicated that a large quantity of visual material was presented at one time (35.9%, $n = 98$). Further, 32.6% ($n = 89$) indicated that the e-learning design was auditory/verbal. A small percentage of participants (9.2%, $n = 25$) indicated that a large quantity of spoken words/sounds was presented at once. Finally, only 28.6% ($n = 78$) of participants indicated that they were actively engaged with the e-learning. This is less than one-third of the study sample.

D Meaningful Learning With E-Learning

The questionnaire asked participants if they had attained meaningful learning through the e-learning at this private hospital. Table 6 demonstrates that most participants (67%, $n = 183$) gained meaningful learning through e-learning. The remainder (33%, $n = 90$) indicated that they did not experience meaningful learning through e-learning.

Table 6
Participants' Experience of Meaningful Learning Through E-learning

Valid	Frequency	%	Valid % ^a	Cumulative %
Yes	183	66.5	67.0	67.0
No	90	32.7	33.0	100.0
Total	273	99.3	100.0	
Missing	2	0.7		
Total	275	100.0		

^a Percentage after missing data are excluded from calculations.

E Association Between Nurse Designation and Response to E-Learning Training for Developing Clinical Skills and Knowledge

1 Fisher's Exact Test

Two-sided Fisher's exact tests were used to identify statistically significant associations between nurse designations and their responses to the four items from the experience with e-learning scale, the six items from the e-learning effectiveness scale, and the five items from the e-learning barriers scale. There were no significant associations in any instance.

2 Kruskal–Wallis Test

A Kruskal–Wallis test was performed to establish whether evaluation of the e-learning training package for developing clinical skills and knowledge differed significantly according to nurse designation (see Table 7). There were no significant differences among the RNs, SDNs, ENs and NUMs for the experience with e-learning score ($p = .947$) or the e-learning effectiveness score ($p = .633$). However, the e-learning barriers score was significantly different among the different nurse designations ($p = .015$). SDNs had the highest barrier score (median = 3.4, interquartile range [IQR] = 0.7), followed by NUMs (median = 3, IQR = 0.9), RNs (median = 2.8, IQR = 1.2) and ENs (median = 2.6, IQR = 0.9). The results indicate that the SDNs perceived a higher level of barriers to e-learning than did the other groups.

Table 7
Kruskal–Wallis Test (Kruskal & Wallis, 1952)

Score	Registered Nurse (N=235)				Staff Development Nurse (N=9)				Enrolled Nurse (N=20)				Nurse Unit Manager (N=9)				Kruskal-Wallis Test	
	Mean	Median	SD	IQR	Mean	Median	SD	IQR	Mean	Median	SD	IQR	Mean	Median	SD	IQR	χ^2	Sig.
Experience with E-Learning	3	4	1	1	4	4	1	1	3	4	1	1	4	4	1	1	0.366	0.95
E-Learning Effectiveness	3	3	1	1	3	3	1	1	3	3	1	1	3	4	1	2	1.719	0.63
E-Learning Barriers	3	3	1	1	3	3	0	1	3	3	1	1	3	3	0	1	10.42	0.02

Note. IQR = interquartile range. Sig. = significance.

3 Correlation Analysis

A correlation analysis was performed to test for an association between participants' age and nursing experience (ordinal variables) and their experience with e-learning, e-learning effectiveness and e-learning barriers (see Table 8). The results indicate significant negative correlations of age and experience with e-learning, which means that younger participants had a more positive experience with e-learning than did older participants.

Table 8
Correlation Analysis

	Experience with e-learning	E-learning effectiveness	E-learning barriers	Age
E-learning effectiveness	.560**			
E-learning barriers	.278**	.220**		
Age	-.198**	-.095	-.047	
Years of nursing experience	-.086	-.045	-.060	.749**

**Correlation significant at the 0.01 level (two-tailed).

F Summary

Among participants, 93% were engaged with the e-learning training package, at frequencies ranging from less than once a week to three to four times a week. Around 88% had used other online training package. The main barriers to e-learning were time, followed by limited access to computers. Other barriers were less challenging. Only around two-thirds of the participants felt that they had experienced meaningful learning through e-learning. The enabling factors and barriers affecting e-learning at The Hospital were identified using Fisher's exact test. There were no significant differences in experience with e-learning and e-learning effectiveness among the RNs, ENs, SDNs and NUMs. However, e-learning barriers were found to be significantly different among the RNs, ENs, SDNs and NUMs, with senior staff (SDNs) indicating the highest number of barriers, followed by management (NUMs) then RNs and ENs.

Three themes were identified that could explain the way in which staff evaluated the e-learning training package. The first theme concerns the flexibility of e-learning training package in relation to time, place and space (the process of learning) and how learning is packaged and sequenced (the content of learning). The second theme concerns the instructional design of the e-learning

training package, particularly the way in which the textual, auditory and visual materials are brought together. The final theme focuses on the nature of the nursing workforce and the factors that both encourage and inhibit nurse engagement with the e-learning training package.

V DISCUSSION

Despite significant investment in its e-learning training package, The Hospital does not seem to be receiving the expected benefits in terms of staff engagement level. More than half of the participants ($n = 159$, 58.2%) indicated that they engaged in e-learning less than once per week. In other hospitals, the flexible attributes of e-learning have led to an increase in staff engagement. In contrast, engagement with the e-learning training package at The Hospital was relatively low, with staff citing lack of time as the major barrier. Thus, this study's findings are at odds with the health care literature (McGowan, 2015; Wong & Sixl-Daniell, 2015; Wu et al., 2018).

The three themes identified that could explain the way in which staff evaluated the e-learning were time, place and space (the process of learning) and how learning is packaged and sequenced (the content of learning), the instructional design of the e-learning training package and the nature of the nursing workforce. Following, these three themes are discussed and compared with the literature.

A Time

In the context of the current study, 'time' concerns the implementation of the e-learning training package and organisational structure at The Hospital. Montgomerie et al. (2016) identified time allocation, good technical delivery and support as having the greatest influence on their study participants' organisational learning success. As previously indicated, the e-learning training package was introduced to nurses at The Hospital with a brief overview, and information on the use of e-learning and the e-learning training package user guide were also provided to nurses. The findings reflect this: many participants ($n = 84$, 30.5%) indicated the least challenging barrier to e-learning completion was a lack of training in the use of e-learning.

After receiving training in using of the e-learning training package, the nurses were advised they could access the package either from work or home. However, despite being given this option, no work time was allocated for this. This may explain why participants rated 'time' as the most challenging barrier to e-learning ($n = 205$, 74.5%).

B Place and Space

'Limited access to computers' was rated the second most challenging barrier to e-learning completion. There are several reasons for this. There was no specific designated e-learning centre at The Hospital. Computers that nurses accessed to use the e-learning training package were located at the nursing station, an open area in the ward used by other staff. Distractions from other staff, patients and family members in this area made access to the training difficult. Further, while each ward also had three to five computers, these were used to access and update patient care information rather than reserved for access to the e-learning training package. Thus, nurses could only access these computers for e-learning when they were not in use for other purposes. In addition, on average, six to seven nurses were on a ward for each shift, depending on the number of inpatients. This limited computer access at work also contributed to nurses accessing the e-learning training package at home.

The Hospital did not factor in time spent on the e-learning training package at home; thus, nurses undertaking e-learning at home were not paid for the time involved. Nurses accessing the e-learning training package at home would also be distracted by family and social demands, and if there were no incentives to complete e-learning at home, e-learning engagement would be minimal. This is evident in the findings, with nearly 60% of participants engaging with e-learning less than once per week. The lack of allocated time to use the e-learning training package and limited access to computers at work resulted in poor engagement with the training.

To engage nurses with the e-learning training package, The Hospital sent emails via the package to notify users of training requirements. The nurses generally did keep up with these, perhaps because they were required by The Hospital to maintain 100% of their training through the package and thus had no choice but to complete their e-learning.

C E-Learning Content

Stevens et al. (2021) highlighted that when e-learning uses material that participants can take away and use with their patients in the clinical setting, there is higher engagement and application of content to practice. Likewise, Blackman et al. (2014) identified that nurses' capacity to learn is enhanced when the content is perceived as relevant, particularly if it is related to their everyday work. At The Hospital, the content of the e-learning training package was aimed at nurses applying knowledge to their real-world work. This aligned with the nurses' learning needs and would have enhanced the learners' interest because it was relevant to their work. However, the nurses did not have time to reflect on the information. This lack of time would affect knowledge construction and professional development, with the nurses potentially unable to fully process the information.

In addition, the e-learning training package did not ask learners to elaborate on the material, which could limit engagement, as indicated in the findings: more than half of the participants ($n = 159$, 57.8%) engaged in the e-learning training package less than once per week. Clark and Mayer (2016) identified that elaborating on material engages learners with an e-learning training package and fosters generative processing—this was not the case at The Hospital. According to Jonassen (1994), knowledge construction can be facilitated by providing real-world, case-based learning environments rather than predetermined instructional sequences. This fosters reflective practice and supports collaborative construction of knowledge through social negotiation.

Further, the focus of The Hospital's e-learning training package on knowledge construction meant that it did not promote the development of generic skills such as enhanced communication capabilities, problem-solving or team skills. In addition, the design of the package assumed that nurses would have basic computer skills, and nurses who did not were required to rapidly develop competence. For experienced computer users, the package would have posed no challenges, and they probably would not have learnt anything new from a technical perspective. However, for inexperienced computer users, simple procedures, such as using a mouse to open an additional window to view a text transcript of an audio, were usually problematic in this study. With good technical support and practice, skills in these areas would no doubt have improved. However, to receive good technical support, either from administrators, SDNs or NUMs, the nurses needed to use the e-learning training package at work, which was usually not the case at The Hospital, and the organisation did not offer technical support for use of the package at home. Practice in improving computer skills was probably negligible in most cases because the nurses' engagement with the e-learning training package occurred less than once per week.

In summary, although the e-learning training package had flexible characteristics—in that it was available 24/7—its implementation did not support flexibility at The Hospital. Following on from these results, findings in the literature about flexible learning in corporate contexts are therefore important to consider. Interestingly, the flexible attributes of e-learning generally increase staff engagement in corporate contexts. In contrast, engagement with the e-learning training package was relatively low at The Hospital, with lack of time seen as the major barrier. Thus, the flexible attributes of e-learning are possibly lost when time is not allocated for the task.

D Comparing the Results with the Literature

In the current study, the implementation of e-learning is consistent with cases in the literature. E-learning flexibility at The Hospital, and in the studies by Moule et al. (2010), Johnson et al. (2015), Chong et al. (2016) and Bindon (2017), was affected by the lack of time for e-learning, limited access to computers and the participants' family and social demands. Thus, an

organisational that allocates time for e-learning and ensures computer access at work would yield the desired level of flexibility with e-learning.

Factors that inhibit nurses' engagement with e-learning are reported as barriers to e-learning and are well documented in the literature. Moule et al. (2010) noted limited computer literacy, lack of computer confidence, technical challenges and access as barriers to e-learning. Green and Huntington (2017) reported lack of computers at work as a barrier to e-learning. Riley and Schmidt (2016) found that staff satisfaction and engagement in online learning increased when the education was linked to organisational priorities and when protected time was allocated for learning.

The literature suggests that blended learning is beneficial for both learners and institutions because it improves learning outcomes, allows flexibility, increases learners' satisfaction and delivers effective use of resources (Hainey et al., 2017; Keleekai et al., 2016; Magtibay et al., 2017). Williams et al. (2008) defined blended learning as the use of multiple methods to deliver learning, typically by using a combination of traditional face-to-face teaching and some online or distributed activities. Blended learning might be a useful implementation strategy at The Hospital to improve the effectiveness of and engagement with the e-learning training package. This could be provided by the flexible approach offered by blended learning in presenting content. Complex topics can be presented in an environment in which a facilitator, such as an SDN, teaches content and has discussions to ensure that nurses understand the topic. By using a variety of mediums and techniques in teaching, blended learning can cater to all adult learning styles and improve e-learning effectiveness.

E Instructional Design of E-Learning

The theme of the instructional design of the e-learning training package at The Hospital links to the theoretical framework—the cognitive theory of multimedia—and concerns particularly the way in which the textual, auditory and visual materials were brought together. Participants ($n = 187$, 68.5%) stated that the e-learning training package was visual/pictorial and that large quantities of visual material were presented at one time ($n = 98$, 20.5%). They also stated that it was auditory/verbal ($n = 89$, 18.7%) and that large quantities of spoken words/sounds were presented at once ($n = 25$, 5.2%). A presentation that contains both words and graphics is referred to as a 'multimedia presentation'. Multimedia learning accesses the capacity of a dual-channel processing system, with simultaneous visual and auditory input (Clark & Mayer, 2016).

People have dual channels—separate channels for processing visual/pictorial material and auditory/verbal material. The human mind operates with limited capacity, and people can actively process only a few pieces of information in each channel at one time. Visual and auditory information is held in the sensory memory for a very short period. Sounds and images are selected from this sensory input and held in the working memory. According to Mayer (2001), the working memory is where cognitive activity occurs. Mental models, both verbal and pictorial, are developed and integrated with prior knowledge that is held in the long-term memory. Active processing is where learning occurs when people engage in appropriate cognitive processing during learning, such as attending to relevant material, organising the material into a coherent structure and integrating the material with what they already know.

The study findings indicate the e-learning training package at The Hospital contained mostly videos with large quantities of visual material ($n = 98$, 20.5%) and spoken words/sounds ($n = 25$, 5.2%) presented at once. Nurses would process several visual materials and spoken words/sounds in their dual channels, causing confusion about which information was the most relevant. Thus, the e-learning package may have placed extraneous overload on the learners by containing mostly visual/pictorial material and presenting large quantities of visual material at one time. This was evident from the small number of participants ($n = 78$, 16.4%) who indicated that they were actively engaged with e-learning.

F Nature of the Nursing Workforce

The third theme focuses on the nature of the nursing workforce and the factors that encouraged and inhibited nurses' engagement with the e-learning training package at The Hospital. In order of nursing hierarchy, the nursing workforce comprised NUMs, SDNs, RNs and ENs at The Hospital. Participants' demographic details of the participants indicate that most were engaged in e-learning at least once each week irrespective of hierarchical level and employment status.

VI LIMITATIONS AND FUTURE DIRECTIONS

This research has two limitations. First, data collection was conducted at only a single point in time from a single hospital and the research considered only one e-learning training package. The study was also undertaken some years ago. Therefore, the findings cannot be generalised to other e-learning training package. Second, the findings would have been strengthened by inclusion of a qualitative component to directly assess the effectiveness of e-learning with respect to using the knowledge and skills in practical daily work.

Recommendations for future research include:

- testing different types of e-learning training package for their effectiveness to enable organisations to choose e-learning that best suits the needs of the learners and organisation
- testing whether blended learning is a more effective learning strategy for nurses
- examining whether self-report surveys are the best method to assess the effectiveness of e-learning
- undertaking more direct studies on the effect of hierarchical levels and effectiveness of e-learning
- testing whether removing barriers, such as time, improves e-learning flexibility and learner participation.

VII CONCLUSION

This study's findings reveal new information about e-learning. While workplace barriers do exist, e-learning still offers numerous benefits. The results demonstrate that e-learning can be a flexible mechanism for educating nurses, provided that the implementation process, content and design of the e-learning help nurses acquire new knowledge and skills. The recommendations identified might help address some of the concerns raised in this study. Ongoing education for nurses and support from NUMs and SDNs are fundamental for professional development. Thus, further research in this area, including research addressing the proposed recommendations, should be explored and completed.

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Appendix

E-learning Survey 2016

This survey is anonymous.

This survey will assist in gathering data for a research thesis. The researcher would be extremely grateful if you could complete this brief survey.

Questions with * are compulsory.

Please indicate your gender*

- ☐ Male
- ☐ Female

Please indicate your age group*

- ☐ 20–24
- ☐ 25–35
- ☐ 36–45
- ☐ 46–55
- ☐ 56–65
- ☐ >66

What is the highest level of nursing education you have completed?*

- ☐ Doctor of Nursing
- ☐ Master of Nursing
- ☐ Bachelor of Nursing
- ☐ PhD
- ☐ Diploma in Enrolled Nursing

What is your designation at your workplace? *

- ☐ Registered Nurse
- ☐ Staff Development Nurse
- ☐ Enrolled Nurse
- ☐ Nurse Unit Manager

How many years of experience in Nursing do you have?

- ☐ <5 yrs
- ☐ <5–9 yrs
- ☐ <10–14 yrs
- ☐ <15–19 yrs
- ☐ >20 yrs

Employment status?*

- ☐ Part-time
- ☐ Full-time
- ☐ Casual

Have you engaged with electronic learning at this private hospital? *

- ☐ Yes
- ☐ No—IF NO YOU CAN FINISH HERE—Thank You

How many times a week do you engage in electronic learning? *

- ☐ Less than once/week
- ☐ 1–2 times/week
- ☐ 3–4 times/week
- ☐ 5–6 times/week
- ☐ >6 times/week

Have you used other online learning training package for professional development?

- ☐ Yes
- ☐ No

Which other online learning training package have you used for professional development?
(Can choose more than one).

- ☐ Google Search
- ☐ Wikipedia
- ☐ UpToDate resource
- ☐ The Hospital library resources via the Intranet
- ☐ Other

Think about the experience you have had with electronic learning over the past 12 months and then indicate the extent to which you agree or disagree with the next series of questions. I think that electronic learning is intuitive to navigate.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Not sure

I think electronic learning is confusing in its design.*

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

I think electronic learning is graphically appealing. *

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

I think electronic learning is well designed.*

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

I think electronic learning is easy to follow.*

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

The following series of questions relate to your experience with training to use electronic learning. I was given training on how to use electronic learning.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

I was given enough time to engage with electronic learning.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

I was needing assistance when using electronic learning.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

I was confident in using electronic learning.*

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly agree
- ☐ Don't know

I was given support when I was struggling with electronic learning.*

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

The following series of questions relate to electronic learning and its effectiveness for developing clinical skills and clinical knowledge. Electronic learning helped me to develop new clinical skills.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

Electronic learning is an effective way to develop clinical skills.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

Electronic learning is an engaging way of developing clinical skills.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

Electronic learning helped me to develop new clinical knowledge.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

Electronic learning is an effective way to develop clinical knowledge.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

Electronic learning is an enjoyable way of developing clinical knowledge.*

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree
- ☐ Don't know

The following questions are on barriers (lack of management support, time, lack of training on use of e-learning, limited access to computers, technological support) that may affect learning with electronic learning. Please rate the barrier lack of management support in regard to completing your electronic learning.

- ☐ Highly unlikely
- ☐ Unlikely
- ☐ Neutral
- ☐ Likely
- ☐ Highly likely
- ☐ Don't know

Please rate the barrier time as to how it may affect your completion of electronic learning.

- ☐ Highly unlikely
- ☐ Unlikely
- ☐ Neutral
- ☐ Likely
- ☐ Highly likely
- ☐ Don't know

Please rate the barrier lack of training on use of electronic learning as to how it may affect your completion of electronic learning.

- ☐ Highly unlikely
- ☐ Unlikely
- ☐ Neutral
- ☐ Likely
- ☐ Highly likely
- ☐ Don't know

Please rate the barrier limited access to computers as to how it may affect your completion of electronic learning.

- ☐ Highly unlikely
- ☐ Unlikely
- ☐ Neutral
- ☐ Likely
- ☐ Highly likely

- Don't know

Please rate the barrier Technological Support as to how it may affect completion of your electronic learning.

- Highly unlikely
- Unlikely
- Neutral
- Likely
- Highly likely
- Don't know

What is the most challenging barrier?*

- Lack of management support
- Time
- Lack of training on use of electronic learning
- Limited access to computers
- Technological support

Which is the least challenging barrier?*

- Lack of management support
- Time
- Lack of training on use of electronic learning
- Limited access to computers
- Technological support

This series of questions relate to the design of electronic learning. Was electronic learning (can tick multiple answers—tick those you want to respond—yes)

- Visual-pictorial?
- Auditory-verbal?
- Lot of visual material presented at one time?
- Lot of spoken words/sounds presented at once?
- You are actively engaged in the learning?

Do you think you had meaningful learning with electronic learning?*

- Yes
- No