Nursing Section

A Multisite Survey of E-learning Readiness and Academic Performance among Nursing Students in Saudi Arabia

ADNAN INNAB[1], NAJI ALQAHTANI[2], GHAREEB BAHARI[3], ALKADI ALSHAMMARI[4], ALI KERARI[5], MOHAMMAD K ALHARBI[6]

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ABSTRACT

Introduction: Determining students' readiness for e-learning is critical to implementing more effective education and performance. Nursing education in Saudi Arabia continues to struggle with a shortage of technical tools to enable teaching and acquiring critical nursing skills.

Aim: To assess the level of e-learning readiness and academic performance and their association in nursing students and to determine the factors associated with e-learning readiness and academic performance.

Materials and Methods: A cross-sectional, multisite study was conducted on a convenience sample of nursing students (N=139) attending nursing programs from multiple public and private universities in Saudi Arabia. A structured questionnaire was used for data collection from May 2020 to August 2020. Multivariate analyses were run using Statistical Package for Social Sciences (SPSS).

Results: The mean age of the study participants was 27.3 ± 6.34 years. The total average of e-learning readiness was 4.16 (SD=0.54). Bivariate analyses showed that age was associated with both e-learning readiness (r=0.175, p=0.03) and academic performance (r=0.341, p<0.001). Employment status, level of education, and previous experience with e-learning displayed significant association with e-learning readiness (p<0.05). In multivariate analyses, only previous experience with e-learning had positive influence on students e-learning readiness (β=0.188, p<0.05). Technology access subscale (β=0.206, p<0.05) and level of education (β=0.323, p<0.05) had both positive impacts on students' academic performance.

Conclusion: The e-learning readiness score was high among the nursing students, especially if they were employed or had previous experience with it. Access to technology improved students' academic performance. The current e-learning mechanism may need some developments in order to meet students' different needs.

INTRODUCTION

Electronic learning (e-learning) has become an effective educational delivery method over the past two decades. This strategy is a useful tool for enhancing teaching and learning quality, thus improving academic performance [1]. The benefits of e-learning include increased accessibility of information, interactive learning, innovative teaching, self directed learning, enhanced data searches via hyperlinks, availability of help when needed, promotion of internet use, and building responsibility and self confidence [2,3]. It is also cost effective for organisations that adopt e-learning by reducing operation costs [4]. Although e-learning has become increasingly common in nursing education, the extent of its use varies across programs and countries [3,5]. In Saudi Arabia, for example, the government has promoted the use of technology in many aspects, including education, as one of the main objectives for the National Transformational Program, 'Vision 2030' [6]. The use of e-learning among Saudi students might help enhance their academic performance.

A number of researchers surveyed students to assess their perceptions toward e-learning in nursing education. Ramos-Morcillo AJ et al., conducted a study on nursing students from two public Spanish universities and discovered that they were hesitant to use e-learning [7]. Another study in Philippines found that nursing students lacked computer literacy and had negative attitudes about e-learning [8]. Since the shift to e-learning may complicate students' learning, assessing students' readiness to use e-learning would contribute to a rich education in academic contexts [1]. Further, it may be simple to deliver remote nursing information, but teaching necessary nursing skills online might be more complex.

Previous researchers have also looked into the impact of face-to-face and blended learning on nursing students' academic achievement

[9,10]. In a quasi-experimental study, the researchers assessed the influence of blended learning (hybrid e-learning with face-to-face) on the academic performance of nursing students [10]. There was a substantial difference between the experimental and control groups, implying that e-learning improves students' academic performance. However, because their sample was limited to individuals enrolled in a one-semester course, the generalisability of their findings may be limited. In another study, the researchers surveyed nursing students and concluded that nursing students believed that practical skills were best learned in practical settings [11].

Implementing e-learning may be difficult since it can be influenced by students' readiness to use it, e-content accessibility, previous e-learning experience, and learners' learning styles [12,13]. Learners' attitudes toward e-learning can influence their willingness to use it [1]. Students also need to be mentally and physically prepared to participate in online classes and achieve better performance. Determining students' readiness for e-learning is critical to implementing more effective education and performance. Research on such area in Saudi Arabia is lacking, which could lead to ineffective use of e-learning in nursing education. Thus, this study was conducted to determine factors associated with students' academic performance.

MATERIALS AND METHODS

A cross-sectional, multisite study was conducted on undergraduate and graduate nursing students attending different nursing programs in Saudi Arabia. The data were collected between May and August 2020. In Saudi Arabia, there are two types of education supervised by the Ministry of Education: public and private. The government subsidizes public education and students are entitled to free access to a variety of electronic applications used in education. In private education programs, however, most services, including

technological programs, require students to pay annual or quarterly fees [14,15].

The study protocol was approved by a Public University's Ethics Committee (#KSU-HE-20-187) and was conducted in accordance with the Declaration of Helsinki. The permission to use the instrument was obtained from the copyright holder. Informed consent was obtained from all the participants.

Inclusion and Exclusion criteria: The study was conducted on a convenience sample of nursing students from different nursing colleges undertaking their undergraduate and graduate educations. Nursing interns who have already graduated from the nursing program and no longer use e-learning for academic purposes were excluded. Administrators and faculty members were also excluded from the study because the final findings were primarily designed to benefit nursing students' learning and education.

Sample size calculation: The G*Power (Heinrich-Heine-Universität, Düsseldorf, Germany) tool was used to run a power analysis and estimate the required sample size. Under a significance level of 0.05, a power value of 0.80, an effect size of 0.15, and eight predictors, a minimum sample of 108 participants was needed to run statistical analyses [16].

Study Procedure

Data collection: The survey was a self-administered online questionnaire powered by an online secure platform. The web based survey was sent openly through social media websites (e.g., Twitter, Facebook, WhatsApp, and university emails). The survey link was also emailed to nurse instructors to share with students. To ensure that the surveys were filled by eligible participants, the invitation link displayed the inclusion criteria. Responses from participants who did not meet the inclusion criteria were excluded.

Measurement: The sample characteristics form contained five variables (age, gender, employment status, level of education, and previous experience with e-learning). Students' academic performance was measured using their self-reported current Grade Point Average (GPA). E-learning readiness was measured using the Arabic version of students' readiness for e-learning [16,17]. The original e-learning readiness was provided in English. However, it was translated into the Arabic Language as the participants of this study were Arabic speakers [16]. The translation was done using the forward and backward translation process. Two bilingual translators translated the instrument independently and then it was sent to nursing faculty members to assure the accuracy and validation of the instrument. The readability of the instrument was done through sending the surveys to 10 nursing students. After the translation, the Cronbach's alpha of the Arabic version of e-learning readiness scale ranged from 0.62 to 0.83 [16].

Readiness for e-learning scale: The scale was a self-assessment tool that measures students' readiness for e-learning. This instrument was originally developed by Watkins et al. and consisted of 27 items and six subscales (technology access, online skills and relationships, motivation, online audio/video, internet discussion, and importance to your success) [17]. Participants indicated their degree of agreement using a 5-point Likert scale response rated from 1 (strongly disagree) to 5 (strongly agree); the total scores ranged from 27 to 135, with higher scores indicating a higher level of readiness. Cronbach's alpha for the subscales ranged from 0.7 to 0.9 [17]. This self-assessment tool is reliable and valid and has been tested in different cultural groups [17,18].

STATISTICAL ANALYSIS

Collected data were analysed using SPSS (version 26) (IBM Corp., Armonk, NY, USA). Descriptive statistics and double-checking of the files were used to fix any issues associated with data entry imported from the online secure platform. Mean imputations were utilized to handle missing data, which provided less than

3% missing data. Frequencies and percentages were calculated to demonstrate sample characteristics. The study variables were described using central tendency and dispersion measures for each subscale. Pearson's product correlations were run to assess bivariate associations between continuous variables; age, e-learning readiness, and academic performance. Independent sample t-tests were conducted to explore the mean differences in e-learning readiness and academic performance by the sample characteristic. Finally, two multiple linear regression models were built to determine factors associated with e-learning readiness from the sample characteristics and the influence of e-learning readiness subscales on academic performance while controlling for the sample characteristics. Level of significance was set at p<0.05.

RESULTS

A total of 139 surveys were completed. The age of participants ranged from 18 to 42 years, with an average of 27.3 years (SD=6.34). The majority of the sample (N=88, 63.3%) were male, employed (N = 70, 50.36%), and enrolled in undergraduate nursing programs (N=78, 56.1%). The academic performance of sampled students was high, with an average of 4.1 (SD=0.60). The majority of the participants (N=101, 72.7%) had previous experience with e-learning [Table/Fig-1].

Variable (range)	n (%) or M±SD
Age (18-42 yrs)	27.3±6.34
Gender	
Male	88 (63.3)
Female	51 (36.7)
Employment status	
Employed	70 (50.36)
Not employed	69 (49.64)
Level of education	
Undergraduate	78 (56.1)
Graduate	61 (43.9)
GPA (2-5)	4.1±0.60
Previous experience with e-learning	
Yes	101 (72.7)
No	38 (27.3)

[Table/Fig-1]: Demographic characteristics of participants (N=139).
M: Mean; SD: Standard deviation; GPA: Grade point average

The total average of e-learning readiness was 4.16 (SD=0.54). The average score for all subscales was high; nevertheless, the average score for 'importance to your success' was highest (M = 4.42, SD=0.58). The lowest average score was for the motivation subscale (M=3.47, SD=1.08). More details on each subscale are shown [Table/Fig-2].

Subscales/Items	M	SD	Degree
Technology access	4.39	0.66	High
I have access to a computer with an internet connection	4.58	0.72	
I have access to a fairly new computer (e.g., enough RAM, speakers, CD-ROM)	4.07	1.21	
I have access to a computer with adequate software (e.g., Microsoft Word, Adobe Acrobat)	4.53	0.74	
Online skills and relationships	4.30	0.59	High
I have the basic skills to operate a computer (e.g., saving files, creating folders).	4.68	0.61	
I have the basic skills for finding my way around the Internet (e.g., using search engines, entering passwords).	4.65	0.63	
I can send an email with a file attached	4.71	0.52	
I think that I would be comfortable using a computer several times a week to participate in a course	3.96	1.15	

I think that I would be able to communicate effectively with others using online technologies (e.g., email, chat)	4.28	0.97	
I think that I would be able to express myself clearly through my writing (e.g., mood, emotions, and humor)	3.70	1.19	
I think that I would be able to use online tools (e.g., email, chat) to work on assignments with students who are in different time zones	4.35	0.88	
I think that I would be able to schedule time to provide timely responses to other students and/or the instructor	4.28	0.88	
I think that I would be able to ask questions and make comments in clear writing	4.16	0.96	
Motivation	3.47	1.08	Fair
I think that I would be able to remain motivated even though the instructor is not online at all times.	3.41	1.33	
I think that I would be able to complete my work even when there are online distractions (e.g., friends sending e-mails or websites to surf)	3.68	1.15	
I think that I would be able to complete my work even when there are distractions in my home (e.g., television, children, and such)	3.32	1.40	
Online audio/video	4.14	0.74	High
I think that I would be able to relate the content of short video clips (1-3 minutes typically) to the information I have read online or in books.	4.09	0.96	
I think that I would be able to take notes while watching a video on the computer	4.05	0.95	
I think that I would be able to understand course related information when it's presented in video formats.	4.28	0.79	
Internet discussions	4.20	0.65	High
I think that I would be able to carry on a conversation with others using the Internet (e.g., Internet chat, instant messenger)	4.50	0.63	
I think that I would be comfortable having several discussions taking place in the same online chat even though I may not be participating in all of them.	3.99	1.06	
I think that I would be able to follow along with an online conversation (e.g., Internet chat, instant messenger) while typing	4.14	0.94	
I sometimes prefer to have more time to prepare responses to a question	4.19	0.83	
Importance to your success	4.42	0.58	High
Regular contact with the instructor is important to my success in online coursework.	4.50	0.70	
Quick technical and administrative support is important to my success in online coursework	4.46	0.73	
Frequent participation throughout the learning process is important to my success in online coursework	4.36	0.86	
I feel that prior experiences with online technologies (e.g., email, Internet chat, online readings) are important to my success with online course	4.37	0.89	
The ability to immediately apply course materials is important to my success with online courses	4.43	0.75	
Total average	4.16	0.54	High

[Table/Fig-2]: Descriptive statistics of e-learning readiness items/subscales (N=139).
RAM: Random access memory, CD-ROM: Compact disc- read only memory

[Table/Fig-3] Displays the correlation matrix. There was a positive, significant relationship between students' age and e-learning readiness (r=0.175, p=0.03). Age was also positively, moderately correlated with academic performance (r=0.341, p<0.001). Regarding e-learning readiness subscales and their association with academic performance, only technology access subscale was moderately correlated with academic performance (r=0.257, p<0.01). Other associations are presented in the correlation matrix.

In addition, [Table/Fig-4] shows mean differences in e-learning readiness and academic performance by the sample characteristics. Among the sample characteristics, employment status (p=0.013), level of education (p=0.03), and previous experience with e-learning (p=0.03) displayed significant differences in e-learning readiness mean. Employment status (p<0.001) and level of education (p<0.001) had significant differences on students' academic performance.

In regression analyses [Table/Fig-5], only previous experience with e-learning explained 9% of variance in e-learning readiness (p<0.05) in the multiple linear regression analysis. Among the variables entered in the model, only previous experience with e-learning had positively influence on students e-learning readiness (β^b=0.188, p<0.05). In addition, the multiple linear regression analysis model explained 29.5% of the variance in academic performance (p<0.001). Among the six e-learning subscales, only technology access and online audio/video subscales were significantly influencing academic performance. Technology access subscale had a positive impact on students' academic performance (β^b=0.206, p<0.05). However, online audio/video negatively influenced their academic performance (β^b=-0.257, p<0.05). From the sample characteristics, only level of education was associated with academic performance (β^b=0.323, p<0.05).

DISCUSSION

An initial objective of the current study was to assess the level of readiness of nursing students from different levels in terms of e-learning readiness in academic settings. Overall, the study indicated that nursing students perceived e-learning to be an essential and motivational source for education and learning. Readiness for e-learning was reported to be an effective tool for students' success. However, inconsistent findings were reported in different countries, where it was found that nursing students did not prefer or lack the technological and equipment for e-learning [19-21]. Yet, the study findings were consistent with a previous study in Saudi Arabia. It was reported that Saudi female nursing students in a suburban university were ready for e-learning. Similar to the findings of this study, Ali WGM found that motivation for e-learning had the lowest average score among the variables [18]. However, the author reported the highest average score for technology, which contrasts with the findings of this study, where importance for success had the highest average score. This difference between this study and study done by Ali WGM might be due to differences in the sample. For instance, the sample of

Variable	1	2	3	4	5	6	7	8	9
1. Age	1								
2. Technology access subscale	0.163	1							
3. Online skills and relationships subscale	0.172*	0.614***	1						
4. Motivation subscale	0.049	0.261**	0.539***	1					
5. Online audio/video subscale	0.210*	0.355***	0.666***	0.549***	1				
6. Internet discussions subscale	0.119	0.312***	0.603***	0.602***	0.555***	1			
7. Importance to your success subscale	0.114	0.226**	0.490***	0.242**	0.538***	0.446***	1		
8. Total score of e-learning readiness	0.175*	0.588***	0.856***	0.781***	0.816***	0.789***	0.614***	1	
9. Academic performance	0.341***	0.257	0.114	-0.041	-0.042	0.083	0.078	0.081	1

[Table/Fig-3]: Correlation matrix for age, readiness to use e-learning subscales, total score of e-learning readiness, and academic performance.
Pearson's correlation was used; *p <0.05; **p <0.01; ***p <0.001

Variables		E-learning readiness			Academic performance		
		(22-66)			(2-5)		
		M (SD)	t or r	p	M (SD)	t or r	p
Gender	Male	4.21 (0.49)	1.690	0.093	4.20 (0.61)	1.612	0.109
	Female	4.06 (0.61)			4.04 (0.57)		
Employment status	Employed	4.27 (0.47)	2.507	0.013*	4.36 (0.57)	4.714	<0.001**
	Not employed	4.04 (0.59)			3.92 (0.54)		
Level of education	Undergraduate	4.07 (0.57)	2.142	0.034*	3.91 (0.56)	5.708	<0.001**
	Graduate	4.27 (0.48)			4.44 (0.51)		
Previous experience with e-learning	Yes	4.23 (0.51)	2.133	0.035*	4.10 (0.59)	1.500	0.136
	No	3.99 (0.59)			4.27 (0.62)		

[Table/Fig-4]: Mean differences in e-learning readiness and academic performance by sample characteristics.
Independent sample t-test was used; *p <0.05; **p <0.001

Independent variables	E-learning readiness			Academic performance		
	B^a	β^b	t	B^a	β^b	t
Age	0.003	0.036	0.250	-0.001	-0.013	-0.096
Gender (Male)†	-0.124	-0.112	-1.266	-0.164	-0.113	-1.629
Employment status (No)†	0.122	0.113	0.767	0.120	0.101	0.715
Level of education (Undergraduate)†	0.058	0.053	0.360	0.388*	0.323*	2.365*
Previous experience with e-learning (No)†	0.226*	0.188*	2.216*	-0.180	-0.134	-1.720
Academic performance	0.011	0.012	0.126			
Technology access subscale				0.185*	0.206*	2.044*
Online skills and relationships subscale				0.030	0.029	0.215
Motivation subscale				-0.040	-0.073	-0.690
Online audio/video subscale				-0.207*	-0.257*	-2.245*
Internet discussions subscale				0.102	0.111	1.028
Importance to your success subscale				0.069	0.068	1.028
Model summary	R^2=0.09, F (6, 132)=2.185, p=0.048*			R^2=0.295, F (11, 127)=4.824, p<0.001**		

[Table/Fig-5]: Multiple linear regression analysis of e-learning readiness and academic performance.
†Reference group; ^{a}B coefficient; ^{b}Beta standardised coefficient; *p <0.05; **p <0.001

this study included graduate students who were employed and might have perceived technology as one of the aspects required to be successful in the workplace.

In bivariate analyses, age was found in a significant association with both e-learning readiness and academic performance. In particular, older individuals were more ready to use technology and had higher academic performance than their younger colleagues. This is supported by Vaportzis E et al., findings of a qualitative study that reported older people to be eager to adopt new technology and were ready to use it [21]. However, other researchers found that younger people tend to use technology more than older, which can improve their skills, readiness, and approval of other e-learning technologies [22]. With regards to academic performance, though a significant relationship was reported between age and academic performance, this finding contradicts Imlach A-R et al., who demonstrated a completely different finding, highlighting the need for further conclusive research on this area [20].

The present study also showed that students who were employed, attending graduate level classes, or had previous experience with e-learning, had higher e-learning readiness scores than their counterparts. Employed students or graduate level students had also higher academic performance compared to non-employed or undergraduate students, respectively. For employed individuals, e-learning was more flexible and suitable with respect to time and location because it helps balance work, studying, and family tasks [23]. Previous experience with e-learning did not influence their academic performance despite that previous researchers reported that having previous experience with online platforms is crucial for positive learning outcomes [24].

In regression analysis, the relationships between sample characteristics and perceived e-learning readiness were examined. The results confirmed the bivariate association between previous experience with e-learning and e-learning readiness. Participants who had previous e-learning experience were more willing to use e-learning compared to their counterparts. They were also more committed to the e-learning strategy. A similar finding was reported in an Austrian study that measured the level of computer skills and the number of students having difficulty with, or opposed to, e-learning [22]. Unlike the present study, which targets nursing students with different academic levels, Link TM and Marz R included only first year medical students, which may limit the generalisability of their findings [22]. Future studies designed to familiarise both educators and students with the effectiveness of new developed educational tools are needed.

Technology access and online audio/video subscales were significantly influencing students' academic performance. The relationships were seen approximately moderate, which may be related to rapid shifting to online education. Access to technology was positively associated with students' academic performance. Prior studies in other countries indicated that technology accessibility such as computers and internet connection enhanced academic performance [23,25]. It is worth noting that the literature lacks studies that look at the impact of nursing students' access to technology on their academic performance and achievement, indicating that further research is needed in this field. However, the use of online audio/video in e-learning influenced students' academic performance negatively. Since e-learning implementation was sudden for nursing students in Saudi Arabia due to Coronavirus Disease-2019 (COVID-19), this could be related to the mere exposure effect. Therefore, educators should apply an internally hosted virtual classroom for courses in order to help students become familiar with technology and provide high-quality audio/video that can be linked to the content of classes. Based on that, more studies are needed to examine the impacts of using online audio/videos on nursing students' academic performance. In addition, level of education had also a positive impact on academic performance in bivariate and multivariate analyses. Graduate students had higher academic performance compared to undergraduate nursing students. This could be related to the difference in emotional intelligence, self control, and resilience in older students, in upper level of education, compared to undergraduate students [26].

Limitation(s)

This study had some limitations. First, there may be a risk of sampling bias due the convenience sampling method, which might have made the results specific to the sample on which the study was conducted. In addition, this study targeted public and private colleges, but without further specifications. Finally, due to a lack of data that adequately reflects the various academic contexts, the researchers of this study did not examine the amount of disparities between study locations. In order to achieve more thorough data, future researchers should measure the similarities and differences between different programs. Despite these limitations, the current study contributed to enriching knowledge about the factors associated with e-learning readiness among nursing students.

CONCLUSION(S)

In nursing, as in other specialties, online education makes courses available on digital platforms. This study showed that the total average of e-learning readiness was high. Many nursing students preferred e-learning, especially if they were employed or had previous experience with it. Being a graduate nursing student, employed and having previous experience with e-learning was significantly associated with e-learning readiness. Therefore, the current e-learning mechanism may need some developments in order to meet students' different needs. Intervention studies on the students, faculty, or institution levels to promote the overall experience of e-learning are recommended. Future studies can help measure the effectiveness of online education over time.

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PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Nursing Administration and Education, College of Nursing, King Saud University, Riyadh, Saudi Arabia.
2. Assistant Professor, Department of Nursing Administration and Education, College of Nursing, King Saud University, Riyadh, Saudi Arabia.
3. Assistant Professor, Department of Nursing Administration and Education, College of Nursing, King Saud University, Riyadh, Saudi Arabia.
4. Assistant Professor, Department of Community, Psychiatric, and Mental Health Nursing, College of Nursing, King Saud University, Riyadh, Saudi Arabia.
5. Assistant Professor, Department of Medical Surgical Nursing, College of Nursing, King Saud University, Riyadh, Saudi Arabia.
6. Assistant Professor, Department of Nursing Administration and Education, College of Nursing, King Saud University, Riyadh, Saudi Arabia.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Adnan Innab,
Assistant Professor, Department of Nursing Administration and Education
Department at College of Nursing, King Saud University, Riyadh, Saudi Arabia.
E-mail: ainnab@ksu.edu.sa

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