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ORIGINAL ARTICLE

The Effect of Offline E-Learning on Cognitive Learning (Levels of Knowledge, Comprehension, and Application) of Fluid and Electrolyte Imbalances Course among Nursing Students

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Abstract

Introduction: The use of e-learning and computer-aided methods is rapidly on the rise in medical and nursing education. Therefore, given the conflicting findings and lack of systematic clinical trials on comparison of the effects of e-learning and traditional methods in nursing education, this study aimed to assess the effects of offline e-Learning on cognitive learning (levels of knowledge, comprehension, and application) in the Fluid and Electrolyte Imbalances course among nursing students.

Methods: This is a quasi-experimental study with a two-group, post-test-only design. A total of 52 third-semester nursing students were selected by convenience sampling method. Course contents were presented during 6 weeks by lecture and question and answer (Q & A) in the traditional learning group and by offline e-Learning in the second group. Afterwards, the students' cognitive learning (knowledge, comprehension, and application) was assessed using a 23-item questionnaire on Fluid and Electrolyte Imbalances course. The obtained data were analyzed in SPSS (version 16) using Mann-Whitney, t-test, Chi-square, Fisher's Exact Test, and analysis of two-way variance. The significant level was considered as $P < 0.05$.

Results: The mean score of cognitive learning was significantly higher in the traditional learning group (14.1±1.9) than in the e-learning group (12.4±2.2) ($P=0.006$). The difference was also significant in the domain of knowledge ($P<0.001$), but insignificant in comprehension ($P=0.097$) and application ($P=0.892$) domains.

Conclusions: According to the results, the method of teaching e-learning, alongside traditional teaching method is recommended.

Key Words: Cognitive learning; Nursing Students; e-Learning; Traditional learning

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Introduction

The use of e-learning and computer-aided methods is rapidly on the rise in medical and nursing education (1). E-learning is described as a dynamic, creative and rich method that can provide promising learning opportunities. Using e-learning, students are able to regulate learning according to their situation. Most e-learning programs can be used in times of need, and they can provide the possibility of private education (1-3).

The use of e-learning has several benefits to both students and teachers. Students are able to adjust their learning pace according to their circumstances given the fact that e-learning is usually available at any time and at any place. Self-directed learning provides the learners with the opportunity to choose content and tools appropriate to their interests, needs and skill levels. A major benefit of e-learning for the teacher is that teaching will be possible at any time and from any place. Online content can be updated. Online learning systems can be selected to determine the educational needs of learners as well as appropriate educational materials; they can also be used to achieve the desired learning outcomes (2-4).

The traditional lecture method is a teaching method that has received extensive criticism although it has proved efficient in provision of information, explanations and fostered enthusiasm for learning. Nonetheless, it is ineffective when the purpose involves the application of knowledge. A lecture course usually does not provide sufficient time for deeper learning activities. This is especially true when a large volume of information is received by students who are acting as passive recipients of information. However, learning outcomes in lecture (traditional) and e-learning methods have remained a controversial issue (5). For example, a systematic review and meta-analysis in 2014 showed that, overall, there was not a statistically significant difference between knowledge, skills and satisfaction of nurses or nursing students in the e-learning and traditional method groups (1). However, e-learning can be used as an alternative method of teaching (1). A meta-analysis conducted by Cook et al (2010) showed that e-learning can enhance students' control over the content, location and learning time. In addition, it can contribute to faster acquisition of knowledge and skills than the teacher-centered methods (lecture) (6). Nonetheless, in Reime's (2008) and Abdelaziz's (2011) studies, the lecture group obtained an overall higher mean score than the e-learning group (2-3).

Therefore, given the conflicting findings and lack of systematic clinical trials on comparison of the effects of e-learning and traditional methods in nursing education, this study aimed to assess the effects of electronic content presentation on cognitive learning (levels of knowledge, comprehension, and application) in the Fluid and Electrolyte Imbalances course among nursing students.

Methods

This quasi-experimental study consisted of a two-group, post-test-only design. Participants were selected through convenience sampling method from among third semester nursing students who were passing Fluid and Electrolyte Imbalances course at the nursing faculties of Birjand and Qaen. The participants were matched before the study in terms of academic semester, educational course of study, and the course content.

After the necessary explanations regarding the purpose of the study were presented to the participants, they provided consent for cooperation and were allocated into intervention (e-learning) and control (lecture and Q & A) groups. The protocol of the study was approved by the Institutional Ethics Committee under the identifier IR.BUMS.REC.1394.90. In the control group, the Fluid and Electrolyte Imbalances course was offered through lectures and Q & A during six weeks (two hours per week). At the end of the sixth week, the students took a written test.

In the intervention group, first, a briefing was offered on how to use the computer system and how to access the existing facilities. Their questions and ambiguities were fulfilled. After completing the registration form and getting a password from the Deputy of Education of Birjand University of Medical sciences, the Electronic Education branch, the students were allowed to log in and obtain the educational content (that included clips, slides and educational films) in six sessions. A nursing forum was available for offline connection with peers and the teacher. The students could also pose their questions to the teacher or peers via email. In addition, assignments were devised for students (including designing and answering questions and preparing clips and educational films). According to the progress of students and their needs, a face to face session was held to resolve the students' problems and answer their questions. At the end of the sixth

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week, a written test was given to the students. The course contents were similar in both groups.

To collect data, a demographic characteristics form with questions regarding age, marital status and employment, Grade point average (GPA), etc. as well as a researcher-made questionnaire of cognitive learning was used. The questionnaire of cognitive learning contained 23 multiple-choice items on levels of knowledge, comprehension, and application with 15, 6 and 2 items, respectively. A correct answer to multiple-choice questions received score 1, and a false answer to that question received zero. The overall cognitive learning score was between 0 and 23 equaling the sum of all scores on the scale. The validity of the questionnaire was confirmed by face validity.

The obtained data were analyzed in SPSS software (version 16) using Mann-Whitney test, t-test, Chi-square, Fisher's Exact Test, and analysis of two-way variance. The significance level was considered $P < 0.05$.

Results

In this study, 44.2 percent of students (n=23) were in the e-learning group and 55.8 percent (n=29) were in the traditional learning group. The two groups were homogeneous in terms of variables such as age, gender, marital status, employment and residence, but were dissimilar as for their GPA and interest in the field of nursing (Table 1).

Table: 1: Frequency distribution of gender, marital status, employment, residence, and interest in field of study of the participants per group

Variables		E-learning group	Traditional learning group	p-value
		N (%)	N (%)	
Age (year)		21.8±3*	20.7±1.3*	0.095**
GPA	<15	11 (47.8)	4 (13.8)	0.008***
	≥ 15	12 (52.2)	25 (86.2)	
Gender	Male	10 (43.5)	15 (51.7)	0.554****
	Female	13 (56.5)	14 (48.3)	
Marital status	Single	21 (91.3)	27 (93.1)	0.602*****
	Married	2 (8.7)	2 (6.9)	
Employment	Employed	1 (4.3)	2 (6.9)	0.588*****
	Unemployed	22 (95.7)	27 (93.1)	
Residence	Native	7 (30.4)	4 (13.8)	0.132*****
	Non-native	16 (69.6)	25 (86.2)	
Interest in field of study	Very little	1 (4.3)	1 (3.4)	P=0.020***
	A little	1 (4.3)	13.8 (4)	
	Moderate	6 (26.1)	13 (44.8)	
	Much	7 (30.4)	9 (31.0)	
	Very much	8 (34.8)	2 (6.9)	

* Mean±SD, ** T-Test, *** Mann-Whitney, **** Chi-square, ***** Fisher's Exact Test

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Table 2: Post-test mean scores and the three domains of knowledge, comprehension, and applications per group

Variable	E-learning group			Traditional learning group			p-value
	Mean±SD	Min	Max	Mean±SD	Min	Max	
Post-test score (Overall)	12.4±2.2	8	16	14.1±1.9	9	18	0.006*
Knowledge	7.8±2.1	4	12	10±1.7	5	13	0.001**
Comprehension	3.4±0.9	2	6	3±0.7	2	5	0.097*
Application	1.1±0.7	0	2	1.1±0.6	0	2	0.892*

* t-test, **Mann-Whitney

Table 3: Comparison of post-test mean scores according to group and GPA

GPA	E-learning group		Traditional group	
	Mean±SD	N	Mean±SD	N
<15	13.5±1.9	11	11.3±2.0	4
≥15	14.2±2.0	12	13.5±2.0	25
Two-way ANOVA:				
The total effect	F= 1.450	df=1	P< 0.001	
The effect of GPA	F=4.451	df=1	P=0.040	
The effect of Group	F=4.451	df=1	P=0.040	
The effect of GPA & Group	F=0.963	df=1	P=0.331	

The post-test mean score was higher in the traditional learning group than in the e-learning group where the difference was statistically significant. While the difference was significant between the intervention and control groups in terms of knowledge, they did not differ significantly in comprehension and application levels (Table 2).

Since the GPA was not homogenous in the groups, analysis of two-way variance was used to control the confounding effects of GPA on the post-test score (F(3,48)=0.059, p=0.331). Homogeneity of variances was evaluated by Levene's Test (P=0.981) (Table 3).

Discussion

According to the results of this study, cognitive learning was at a higher level in the traditional learning than in the e-learning group with the difference being statistically significant. This was in line with the results from Abdelaziz (2011) and Reime's (2008) studies (2-3). Among the reasons mentioned for low scores of e-learning in Abdelaziz's study (2011) include the difference in computer skills of individuals, Internet access in different environments (home, dormitory, Internet cafes), and different Internet bandwidths (2). In Browne's study (2004), there was no significant difference between the two groups (7). In a meta-analysis conducted in 2014, no difference was found between the two groups in terms of knowledge, satisfaction and skills of nursing (1). However, in Bhatti's study (2011), students in the e-learning group obtained higher scores in the domain of knowledge (8). In a study by Lee (2013), scores were greater in the e-learning group than in the lecture group although the difference was not significant (4). It should be noted that success in an e-learning training depends on proper designation of the learning content (9), and this could explain the results of the studies noted here.

The present study also showed a significant difference between the two groups as for the domain of knowledge where the traditional group obtained higher scores. Nonetheless, there was no difference between the groups in the two areas of comprehension and application despite the fact that scores for these two areas were higher in the e-learning group. A deeper learning is expected to happen in the e-learning method, since the overarching responsibility for learning is upon the learner him/herself, with emphasis on construction of knowledge and not necessarily on the acquisition of knowledge (9).

Ong's study (2006) showed that mean scores of computer self-efficacy, perceived usefulness, perceived ease of use, and behavioral intention to use e-learning were higher in men than in women (10). It is essential to note that e-learning may be perceived differently in men and women. In the

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present study, there was no significant difference between the two groups concerning gender and cognitive learning in general. Nevertheless, Reime's study (2008) showed that women gained higher scores in the lecture group (3).

It is important to note that the e-learning method does not cover all the needs of users (11). In this line, Ruiz (2006) emphasizes that e-learning should not replace the attending classroom and that it should be used only as a complement to other routine methods (12).

Among the limitations of this study, one can mention the offline virtual environment, lack of pretest administration, long-term influence of traditional methods on students, and lack of computer access for all the subjects.

Conclusions

Since a main purpose of education is to achieve different levels of cognitive learning, including knowledge, comprehension and application, blended teaching method (e-learning plus traditional) is recommended to achieve all three levels of cognitive learning.

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Conflict of interest

The authors declare no conflict of interest.

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