



Impacts of eLearning on the Cognitive Learning of Senior Nursing Students Concerning Central Venous Catheter

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Abstract

Background: Central venous catheter (CVC) is of extreme importance especially in critical care units. To perform confident CVCs, nursing students should acquire an appropriate theoretical and practical knowledge during their course of study. ELearning is one of the new methods of teaching in medical sciences. The aim of this study was to determine the effect of eLearning on the cognitive learning of senior nursing students concerning central venous catheter.

Methods: This is a quasi-experimental study with a one-group, pre-post-test design. The study was conducted in the 2015 - 2016 academic year. A total of 40 students (12 males and 28 females) in the 8th semester were selected through simple randomization sampling method from May to July 2016. Their knowledge about CVC was assessed before and after the intervention using a questionnaire that consisted of 20 areas. After the pre-test was administered, the learning content was presented to the students through the eLearning portal. The collected data were analyzed in SPSS software using paired t-test, independent t-test. The significance level was set at $P < 0.05$.

Results: Paired t-test showed a significant difference ($P = 0.001$) between the average scores of knowledge before and after intervention. There was no significant association between knowledge scores and age, gender, place of residence, grade point average, clinical experience, experience with CVC, and satisfaction with eLearning.

Conclusions: It seems that eLearning can increase students' knowledge about CVC. Thus, this method is recommended for teaching nursing courses.

Keywords: E-Learning, Offline, Cognitive Learning, Central Venous Catheter, Student

1. Background

The education system of any time period must respond to the educational needs of the time. Increasing access to appropriate virtual education infrastructure, particularly the development of the World Wide Web, has opened a new horizon to educational institutions and universities. The introduction of new information technologies into educational centers (from schools to universities) and even houses has dramatically changed teacher-learner relations. In this way, traditional patterns of learning have been revolutionized and users are faced with a sheer volume of information and knowledge (1). At present, many of the leading countries in the field of telecommunications and virtual education are creating virtual universities and classes or developing their traditional educational sys-

tems. The emergence of information community has challenged many of our hypotheses in the field of education. World wide web and the Internet have created innovative and revolutionary approaches in education. New information and communication technologies have changed cognitive learning methods and, in general, the way to live. They provide different ways for transmission and interaction of knowledge and information. These technologies can serve to strengthen or replace existing educational systems (2). Increasing advances in computational science and the advent and spread of informational networks, especially the Internet, have prepared policy-makers and executives of educational programs to overcome restrictions of time and space towards cognitive learning (3). Learning and learner's interest become boosted because of applying principles of web design and using a multimedia environ-

ment that allows data transfer in audio, video, text, and drawing formats. Flexibility in the content design, interactional nature, collaboration of members, individualization of training, and independent cognitive learning are among other benefits of cognitive eLearning. The teacher is no more the only source of knowledge transfer but has of the role of facilitator. Accordingly, many educational systems in recent decades have tried to log in and use the new technology with an aim to improve cognitive learning with minimum time (4).

In this regard, the emergence of the world wide web, the Internet, and Intranet have effected dramatic changes in education across the globe. Web-based networks have provided convenient access to cognitive learning environments everywhere in the form of home schools, even in deprived and distant regions; thereby, they have contributed to educational equity (5).

The extensive welcome to tele-education and cognitive eLearning implies that cognitive eLearning has been useful and distinctively advantageous to educational centers and organization members. Building on the most recent achievements of the time as well as information and telecommunication technologies, cognitive eLearning has created new approaches (6).

Cognitive eLearning is a new educational method based on information and communication technology and a type of distance learning which can focus on the person as an active learner and revolutionize all forms of education and cognitive learning in the 21st century. Thus, it can put an end to the challenge of social demand for education and the lack of adequate educational resources (7). Today, the term cognitive eLearning is one of the most frequently used terms which has entered into education along with information technology. Several universities have scheduled this type of education as part of their long-term plans with huge investments on it (8).

eLearning is the use of network technology to design, deliver, select, manage, and develop learning (9). According to Trondsen (10), eLearning is the application of computer and information technologies to create learning experience. However, in a general definition, cognitive eLearning is the use of network technology, eg, the Internet, to design, deliver content, and implement learning environment in order to achieve cognitive learning (11). Alexander Romiszowski considers cognitive eLearning as of four dimensions suggesting that cognitive eLearning can involve both individual activities and group activities.

In addition to the individualistic and group learning dimensions, cognitive eLearning can be in an online form (ie, simultaneous interaction between individuals and cognitive learning resources) and offline form (ie, non-simultaneous interaction using compact disks already pre-

pared or already downloaded materials from the Internet) (12). In fact, cognitive eLearning is composed of the two wide territories of information technology and education (13). Khan (14) bases the foundations of cognitive eLearning on web-based learning, Internet-based learning, and advanced learning. He regards it as education provided via electronic media such as the Internet, Intranet, Extranet, and hypertext.

Today, central venous catheter (CVC) is widely used on several patients in order for quick access to veins. An ideal venous way should be in easy access and be able to create a fast blood flow while also resistant against infections and thrombosis. CVs fulfill these requirements; therefore, internal jugular, subclavian and femoral vein catheterizations are useful methods for immediate, but temporary access to blood flow and can save the patient in emergencies (15-18). CVC is being increasingly applied in regular and special wards (19). The applications include direct measurement of central vein pressure, injection of intravenous drugs, blood and blood products, and blood sampling particularly for the measurement of mixed oxygen concentration, Partral nutrition, dialysis, cardiac pacemaker implantation, and creation of ideal vessels for patients with poor venous access (20). Nonetheless, their application may have mechanical and infectious complications (19).

eLearning can also provide private education (21). Research indicates that academic virtual learning can be an efficient system if the contents are prepared appropriately and assessment is achieved accurately. Brown compared learning in traditional and distant learning classes to conclude that eLearning facilitates learning where learners have better opportunities to participate in discussions (22). What is more pinpointed by researchers in the field of educational methods is that neither of the methods, media and educational resources can independently cover all the dimensions and purposes of education, but that appropriate, purpose-based methods can help the teacher in teaching and the learner in learning. Therefore, given the reports and situations described and the fact that there is paucity of research in this regard in Iran, this research aimed to investigate the effect of eLearning on cognitive learning knowledge of the last semester nursing students concerning central venous catheter.

2. Methods

This is a quasi-experimental, one-group, pre-post-test study. The study was conducted in the 2015 - 2016 academic year. A total of 40 students (12 males and 28 females) were selected through simple randomization sampling method from May to July 2016. The population included 8th semester students of nursing. Inclusion crite-

ria consisted of tendency to participate, 8th semester students who had passed critical nursing theoretical and apprenticeship courses; exclusion criterion was unwillingness to continue the study. Written permission was obtained from officials at Birjand University of Medical Sciences. Upon the provision of the required explanations about the study to the participants, they provided oral consent and attended a session where they got familiar with the way to use the computers and the portal available on them. Their questions and problems were dealt with.

After entering the official website of Birjand University of Medical Sciences using their username and passwords, the students received the educational contents (including items such as anatomy, indication, counter-indication, CVC potential complications, catheter penetration sites, etc.) for nursing apprenticeship, pediatrics II course. A researcher-made questionnaire was presented to the students as the pre-test which covered both a demographic characteristics form and 20 items on the position of CVC tip, patient Trendelenburg positions before leaving CVC, the purpose of CVC placement, accurate CVC performance indicators, CVC care, CVC washing and dressing, CVC effects on patients, care of the patient after CVC insertion, and CVC infection enhancing risk factors. When they completed it, the educational content was available to them for 2 weeks. After the computer training was finished, the post-test was administered.

The educational contents consisted of slide shows (including items such as anatomy, indication, counter-indication, CVC potential complications, catheter penetration sites, etc.) and educational movies about CVC placement and nursing care which, overall, measured the level of knowledge of the students. When scoring responses to the questions on the tests, a correct answer received score 1; an incorrect score received 0. If no answer was given, -1 was considered. The total score of any individual equated the sum of scores for all the items and ranged from 0 to 20.

The validity of the questionnaire was confirmed through content validity (0.82) upon approval of 10 experts (faculty members of Medicine School and Nursing and Midwifery School). Its reliability was confirmed by test-retest method whereby the questionnaire was given to 15 eighth term students of nursing at Islamic Azad University of Birjand. They completed it a week later again to find $r = 0.62$. The data were analyzed in SPSS (version 14) using paired t-test. This study was approved by the Ethics Committee of Birjand University of Medical Sciences (Code No. = IR.bums.REC.1394.385).

3. Results

This study consists of three parts of demographic questions, the original question, and short questions. Among the 40 students participating in the study, 12 were male and 28 were female; 27 resided in the dormitory and 13 lived elsewhere; 24 were single and 16 were married; 30 had experience of clinical work; 13 had experience of working with CVC; and 16 had previous studies concerning CVC. The greatest frequency ($n = 14$) was concerned with those with much interest in field of study, while the lowest ($n = 4$) was related to those with very much interest in their field (Table 1). Mean age of the participants was 22.9 ± 2.15 years, and the mean experience of clinical work was 5.2 ± 4.84 years.

Table 1. Frequency Distribution of Students in Terms of Demographic Characteristics

Variable	No. (%)
Clinical experience	Yes 29 (74.4)
	No 10 (25.6)
Experience with CVC	Yes 13 (33.3)
	No 26 (66.7)
Previous study about CVC	Yes 15 (38.5)
	No 24 (61.5)
Interest in nursing	Very much 3 (7.7)
	Much 14 (35.9)
	Moderate 5 (12.8)
	Little 13 (33.3)
	Very little 4 (10.3)

Knowledge level of 80% of them was low in pre-test. The post-test showed a moderate level of knowledge for the majority of them (65%) concerning CVC.

The students' mean score of knowledge about CVC was 8.4 at baseline which increased to 14.3 at the end of the study. Paired t-test showed that knowledge scores before and after the intervention have significant differences ($p = 0.000$) (Table 2).

Increased mean score of male students was 4.20 and that of female students was 6.2. According to independent t-test results, there was not any significant difference between the two genders in terms of pre-test and post-test score differences ($P = 0.39$) (Table 3).

Increased mean score of students with clinical work experience was 6.20 and that of students without clinical experience was 4.8. According to independent t-test results, there was not any significant difference between them in terms of pre-test and post-test score differences ($P = 0.23$) (Table 4).

Table 2. Comparison of Pre-Test and Post-Test Score Means of the Participants' Level of Knowledge

Variable	Pre-Test		Post-Test		Test Result
	SD ± Mean	Number	SD ± Mean	Number	Paired t-test
Cognitive learning concerning CVC	8.41 ± 2.57	39	14.30 ± 2.02	39	T = 11; Df = 38; P < 0.001 (Sig.)

Table 3. Comparison of Pre- and Post-Test Score Differences on Central Venous Catheter in Terms of Gender

	Gender					
	SD ± Mean	Male		Female		Total Number
		Number	SD ± Mean	Number	SD ± Mean	
Difference between pre-test and post-test	5.08 ± 4.20	12	6.25 ± 2.90	27	5.89 ± 3.34	39
Test result	T = 1.01; Df = 37; P = 0.32					

Table 4. Comparison of Pre- and Post-Test Score Differences on Central Venous Catheter in Terms of Clinical Work Experience

	Clinical Work Experience					
	Yes		No		Total	
	SD ± mean	Number	SD ± mean	Number	SD ± mean	Number
Difference between pre-test and post-test	6.27 ± 3.17	29	4.80 ± 3.76	10	5.89 ± 3.34	39
Test result	T = 1.21; Df = 37; P = 0.23					

Increased mean score of students with CV line experience was 6.5 and that of students without the experience was 5.5. According to independent t-test results, there was not any significant difference between the two in terms of pre-test and post-test score differences ($P = 0.41$) (Table 5).

4. Discussion and Conclusion

Electronic learning and education is a new paradigm and a product of information technology. This technology can help solve problems in communities arising from lack of equal access to educational centers, deficiency of economic facilities, and other expenses used on traditional education.

In the current study, the majority of the students (80%) were of low knowledge about CVC, meaning that these students require more education in this regard. After education, the majority of them (65%) had a moderate level of knowledge about CVC. In Mlinar's (23) study, the level of knowledge about CVC was low on the part of the nursing students.

However, in Sheresta's study (24), the nursing personnel had a moderate level of knowledge (50% - 75%) about CVC before education which also significantly increased after intervention. It seems that the difference between the current study and Sheresta's in this regard lies with

the higher experience level of the nursing personnel about CVC.

The results showed that the students' average knowledge scores about CVC increased from 8.4 ± 2.7 before the intervention to 14.3 ± 2.02 after the educational intervention. This finding is compatible with the results from Shrestha (24), Sheikh Abu Massoudi and Soltani Molla Yaghobi (25) and Natalie's (26), Mafyan et al. (27), Baba Tabar Darzi and Farshi (28) studies.

In Shrestha's (24) study, which was conducted on CVC care, the average scores were raised from 14.57 ± 2.37 to 16.80 ± 5.51 after the intervention. In Sheikh Abu Massoudi and Soltani Molla Yaghobi (25) study, the nursing students' mean scores of knowledge about cardiac dysrhythmia were respectively 3.29 ± 0.95 and 13.66 ± 1.55 before and after teaching in the eLearning group. Also, Natalie's study (26) reported an increase in average scores of the eLearning group from 52.3 ± 0.9 at baseline to 64.3 ± 0.9 after the intervention. It seems that eLearning, where the learner feels self-responsible to learn, yields a more profound cognitive learning such that in eLearning the purpose is building rather than acquiring knowledge. In fact, in this method, the learner learns how to learn.

The results also indicated that there was no significant correlation between knowledge score and the variables of age, gender, residence, grade point average, clini-

Table 5. Comparison of Pre- and Post-Test Score Differences on Central Venous Catheter in Terms of Experience with CV Line

	Experience with CV Line					
	Yes		No		Total	
	SD ± Mean	Number	SD ± Mean	Number	SD ± Mean	Number
Difference between pre-test and post-test	6.53 ± 3.09	13	5.57 ± 3.47	26	5.89 ± 3.34	39
Test result	T = 0.84; Df = 37; P = 0.41					

cal work experience, experience with CVC, and satisfaction with eLearning. This is in line with the findings of Natali's study (26) where there was not any association between age, experience, and knowledge.

The results indicate that the majority of the students had a moderate to high level of satisfaction (70.9%) with eLearning. In Zhang et al. (29) study, there was also a high satisfaction level with eLearning. This can be because of the tendency and skills of the majority of students to use eLearning. On the other hand, attendance in person-to-person classes may lead to tiredness and a pre-determined obligation of cognitive learning at a certain hour can hinder interest in learners.

Among strengths of this study was that the students were highly motivated to learn the contents under study and that this approach was economical both temporally and economically.

Among the limitations of the study, one can mention:

1. Access to the electronic portal was not available at certain hours.
2. Speed of the Internet was low at certain times.
3. Given the limitations of time and non-simultaneous provision of 8th semester courses in faculties of nursing and midwifery in Birjand and the neighboring city of Ghaen, it was not possible to conduct a two-group, pre-post-test study. It was not also possible to have a control group from among the 8th term students at Birjand University of Medical Sciences because it was not possible to control information leakage between the two groups. Thus, the study was performed in one, pre-post-test group.
4. To enhance motivation and to make the class environment more attractive in the electronic method requires time, provision of an interactional atmosphere, and practical integration of pictures and texts. This was somehow achieved although not ideally.

It seems that electronic education can enhance students' knowledge about central venous catheter. Thus, this method is recommended for teaching nursing courses.

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Footnotes

Authors' Contribution: Zahra Amouzeshi and Yahya Mohammadi conceived the study and developed the methods. Yahya Mohammadi and Zahra Amouzeshi collected the data. Ahmad Amouzeshi and Yahya Mohammadi analysed the data. Seddigheh Kianfar wrote the first draft of the manuscript. All of the authors contributed to the revision of the manuscript and have read and approved the final version.

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