Original Article

Comparative study of virtual and traditional teaching methods on the interpretation of cardiac dysrhythmia in nursing students

Hosein Habibzadeh, Alireza Rahmani, Bahlol Rahimi[1],
Soheila Ahangarzadeh Rezai, Nader Aghakhani, Fariba Hosseinzadegan

Abstract:

INTRODUCTION: Due to the importance of correct interpretation of electrocardiogram (ECG) in the quality of healthcare delivery, new educational methods are increasingly being implemented and evaluated. In this regard, the purpose of this study was to compare the traditional and virtual teaching methods on the interpretation of cardiac dysrhythmia in nursing students.

METHODS: The present study is a quasi-experimental research with pretest and posttest design. Sixty nursing students in the seventh semester from schools of nursing in Urmia and Khoy cities were randomly assigned to two virtual and traditional education groups. Students' knowledge was measured by a researcher-made 30-item test.

RESULTS: The mean and standard deviation of the students' scores in the traditional education group was 11.20 ± 4.41 and 14.40 ± 4.62 and in the virtual group was 11.30 ± 2.74 and 18.43 ± 4.68, pre- and post-training, respectively. Paired t-test showed a significant difference between the mean score of pretest and posttest in both types of training ($P < 0.001$). According to the results of independent sample t-test, there were no significant differences between the two groups before the training ($P > 0.05$). However, in the posttraining period, there were significant differences between traditional and virtual education groups ($P < 0.001$).

CONCLUSION: Considering the results of this study, which shows the positive effects of virtual education method on nursing students' knowledge about cardiac dysrhythmia, this method can be used as an alternative or complementary method to the traditional education.

Keywords:

Cardiac dysrhythmia, e-learning, electrocardiography, nursing students, traditional education, virtual education

Departments of Nursing and ¹Health Information Technology, Urmia University of Medical Sciences, Urmia, Iran

Address for correspondence:
Dr. Fariba Hosseinzadegan, Department of Nursing, Urmia University of Medical Sciences, Urmia, Iran.
E-mail: f.hossein zadegan62@gmail.com

Introduction

Electrocardiogram (ECG) is one of the most useful medical examinations whose aim is to diagnose and evaluate heart disorders by waveform recording through electrical potential changes between the two points generated during the electrical activity of the heart. The ECG is a low-cost, easy, fast, and safe examination that provides valuable information for healthcare professionals and thus is an important diagnostic tool for patient's health.[1]

ECG interpretation is an important clinical skill that helps for quick diagnosis of life-threatening disorders.[2] However, incorrect interpretation of an ECG can lead to inappropriate clinical decisions with serious adverse outcomes, especially in arrhythmias and myocardial infarction.[3]

ECG interpretation is a complex task that is performed by many health professionals, including doctors of all specialties, nurses, physiologists, and paramedics.[4] Considering that nurses are among the first people who can play a key role in identifying cardiac rhythm disorders, so correct reading of the ECG is considered as one of the important duties and competences of nurses.[5] A nurse is responsible for both technical aspects of monitoring (such as electrode placement, alarm parameter setting) and clinical decision-making based on the information obtained from the monitor. Nurses should have enough knowledge to carry out these responsibilities so that they can maximize the quality of care and patient outcomes.[6] Nurses should be able to quickly and correctly detect and interpret ECG abnormalities and intervene in a timely manner.[7]

ECG monitoring and interpretation skills are gained through medical education and enhanced by experience.[8] It is clear that the analysis and interpretation of the ECG are difficult and require significant training.[3] The teaching of interpretation of the ECG is an essential part of medical education.[9] There are no established standard methods for teaching ECG interpretation or presenting ECG findings that are evidence based. In fact, review of the literature shows that the time allocation, faculty training, and teaching methods for ECG interpretation are significantly different.[10] Conventionally, to teach this topic, lecture method that is an expert-centered approach is used.[9] The lecture method, given the possibility of training a large number of learners at once, is an effective and cost-efficient method. On the other hand, this method facilitates passive learning because students have little opportunity for interactive discussion with a lecturer.[11-13]

Interpretation of the ECG can also be acquired by self-directed learning (SDL), which includes independent study of textbooks and other study materials.[14] Computer-assisted instruction (CAI) has been used as a method for ECG teaching since the 1960s.[15] Computer-assisted learning involves any teaching method that uses a digital platform as an SDL technique that includes both online and offline learning opportunities.[16] Although CAI is a broad term that includes both online and offline modalities, in newer terminology, specifically referring to online learning methods includes terms such as "web-based learning," "web-based training," and "e-learning."[17-20] According to Alavi and Leidner, e-learning is the virtual learning field in which the interaction among the learner, teachers, and classmates and educational equipment are all different from the traditional method because in virtual environments electronic technology tools are used as an instrument for supporting and improving the learning process.[21]

CAI or web-based learning typically provides the learner with text, images, and other multimedia materials to study. Other educational features, such as practice and test fields (for example, online multiple-choice questions with quick feedback), can be provided by the digital platform.[16,22,23] The advantages of multimedia education are flexible classroom time, increased student's autonomy, freedom to do more in-depth training, and less time for the course preparation. The high cost, the need for technical specialists in electronic media, and the lack of social interactions among learners are cited by the disadvantages of this method.[24] The development of multimedia technology and audiovisual systems results in learners' freedom from the time and place restrictions of traditional learning. Learners experience more flexibility in learning and can regulate their self-learning speed to make learning easier.[25]

Studies on the effects of e-learning on education of nursing students showed that students indicated higher satisfaction, active involvement in learning, easy access, and willing to use this educational technology;[26,27] there are various reports about the influence of this method in teaching cardiac dysrhythmia as well as the interpretation of the ECG. Perfeito *et al.* reported nonsignificant difference comparing the methods of multimedia teaching and speech,[28] and on the other hand, Lee *et al.* applied videotapes to teach ventricular fibrillation in their study, the results indicated that this method had an immediate effect similar to the conventional lecture method and even had better results.[29] According to Mohammadi *et al.*, both lecture and multimedia software teaching methods have been effective in learning the cardiac dysrhythmia for nursing students. However, there is a greater impact on students' knowledge durability after 2 months of teaching using multimedia software in comparison with the lecture method.[30] The results of a study by Aminizadeh *et al.* examining the use of both virtual and traditional teaching methods indicated that the scores obtained in items such as cardiopulmonary resuscitation as well as equipment and transfer courses in virtual education were higher than traditional method, but there was no significant difference in the triage item.[31]

Considering that the subjects related to cardiac dysrhythmia and ECG interpretations are associated with some weaknesses in nursing field, desirable knowledge in this area is of great importance to provide quality and safe services. In addition, considering that different educational methods have different effects in this regard, this study is carried out with the aim of comparison of the interpretation of cardiac dysrhythmia in nursing students trained by traditional and virtual teaching methods.

Methods

This quasi-experimental study was performed as pre- and post-test. According to the related literature,[30] that the mean and standard deviation of students' knowledge score in relation to cardiac arrhythmias in the traditional education group was 13.41 ± 2.77 and in the multimedia training group was 15.87 ± 3.52. With 95% confidence and 80% probability, 27 samples were selected in each group, and considering 10% of sample loss, 30 people in each group and 60 people were selected in total as the sample of the study. The inclusion criteria for this study are as follows: nursing students in their seventh semester who were passing coronary care internship course clinically. Unwilling to participate in the study was considered as an exclusion criterion.

$$n = \frac{(z_{1-\alpha} + z_{1-\beta})^2 \times (s_1^2 + s_2^2)}{d^2}$$

To prevent possible bias of the intervention effect, cities of Urmia and Khoy were randomly assigned to traditional or virtual education groups. For random selection, A and B cards are scrambled and the managers of the nursing group of Urmia and Khoy each selected the desired paper. The A card was considered in the traditional education group and B card was placed in the virtual education group. Ultimately, Urmia is placed in the virtual education group and Khoy is selected in the traditional education group. The total number of undergraduate nursing students in Khoy was 30, but the number of undergraduate nursing students in Urmia was 42. To select 30 of them and minimize the effects of other variables, random number method was applied to assign 30 students as the study sample.

After obtaining permission from the Ethics Committee of Urmia University of Medical Sciences, the researcher referred to relevant centers to collect data. After explaining the goals of the study to eligible students to enter the study and ensuring that they will participate in the study, a pretest of cardiac dysrhythmia was performed on both groups. After the implementation of educational intervention, the questionnaire was completed by students as a posttest. In both groups, students spent 3 weeks in the cardiac internship course for 6 days and 6 h each day. Both groups are taught some subjects related to cardiac dysrhythmia, interpretation of the ECG, causes of dysrhythmia, and their therapeutic options.

In the virtual training group, in addition to the educational CD (containing the topics of cardiac dysrhythmia in the form of graphic images such as text, image, audio, and video), supplementary information (such as books and related files and answers to student questions) are provided to students through the internet (email and virtual network group). In this method, a coordination meeting and training session on how to use the content and contact the relevant teacher was held before the beginning of the course. During 3 weeks of internship, students were able to use the materials in the virtual network group and could share their content via e-mail and virtual network. After the completion of the above-mentioned course, the group in the virtual network was revoked. Preparing the educational materials, making them available on the internet, answering participants' questions, and eventually conducting the posttest were the role of trainers in this course. In the traditional education group, lecture, question and answer, and discussion methods were used. In this method, trainer presented the content to the participants, answered their questions, managed class discussions, and conducted a posttest examination. At the end of the courses, the educational resources were fully available to the students. Finally, both educational groups were interviewed about their preferential education in the future.

Data collecting tool was a researcher-made questionnaire. The first part of the questionnaire included demographic data such as age, gender, marital status, as well as questions about Internet connection and the average time of using the Internet, and the second part included 30 multiple-choice questions related to cardiac dysrhythmia. The correct answer scored 1, otherwise zero was considered for incorrect answer.

Content validity was used to determine the validity of the tool in this research. The questionnaire was delivered to 10 academic members of the Faculty of Nursing and Midwifery of Urmia University of Medical Sciences. Considering their corrective suggestions, the changes were finalized and approved. To determine the reliability, the questionnaire was completed by 20 nursing students and its reliability was obtained using Cronbach's alpha of 0.87.

Data were analyzed by SPSS version 21 (IBM Corp., Armonk, NY, USA) using descriptive and analytical tests (independent *t*-test and paired *t*-test). The statistical significance level in this study was considered to be 0.05.

Results

The mean age of the students in the traditional education group was 23.033 ± 1.325 and in the virtual education group was 22.600 ± 0.932, which did not show significant differences. Twenty-four (80%) students of the traditional education group and twenty-nine (96.7%) in the virtual education group were single. In the virtual education

group, 16 (53.3%) people had access to the Internet via mobile data, and the average duration of using the Internet in this group was 4.833 ± 1.549 h. Both at the educational methods were the preferred methods to educate the students [Table 1]. The mean and standard deviation of students' scores in the traditional education group before training was 11.200 ± 4.413 and after training was 14.400 ± 4.628 and in the training group before training was 11.300 ± 2.743 and after training was 18.433 ± 4.680. Paired *t*-test showed a significant difference between the mean scores obtained from the pre- and post-tests in both types of training ($P < 0.001$). There were no significant differences between two groups before and after the training ($P > 0.05$). However, in the posttraining phase, there was a significant difference between the traditional and virtual groups ($P < 0.001$) [Table 2].

Discussion

This is a study with the aim of comparison of two traditional and virtual teaching methods for identifying and employing effective and efficient methods for interpreting dysrhythmia in nursing students. The results of this quasi-experimental study indicated that both traditional and virtual methods have increased students' knowledge about cardiac dysrhythmia, but the virtual education method has had a greater impact. In the results, it must be mentioned that both groups indicated no significant difference in the level of knowledge in the pre-intervention stage, which is consistent with the findings of many other previous studies such as the study of Mohammadi *et al.*,[30] Baghaei *et al.*,[32] and

Table 1: Distribution of relative and absolute frequencies of the variables

Variables	Traditional, *n* (%)	Virtual, *n* (%)
Martial statues		
Single	24 (80)	29 (96.7)
Married	6 (20)	1 (3.3)
Internet access		
Mobile data	-	16 (53.3)
ADSL	-	13 (43.3)
Other	-	1 (3.3)
Preferred method		
Traditional	7 (23.3)	2 (6.7)
Virtual	8 (26.7)	10 (33.3)
Both	15 (50)	18 (60)

ADSL=Asymmetric Digital Subscriber Line

Table 2: Comparison of mean scores of nursing students in both virtual and traditional education groups before and after training (intervention)

Group	*n*	Pretest	Posttest	Paired *t*-rest	*P*
Traditional	30	11.200±4.413	14.400±4.628	−4.465	0.000
Virtual	30	11.300±2.743	18.433±4.680	−9.179	0.000
Independent *t*		−0.105	−3.356		
P		0.916	0.001		

Granero *et al.*[8] Reviewing the research population of this study and its related literature, it can be accepted that nursing students in the pre-intervention phase did not have much knowledge about the subject. In addition, lack of any difference between the two groups was an indication of similarity between the two groups of virtual and traditional education in the present study and above-mentioned ones. We immediately observed significant differences between both traditional and virtual groups' knowledge at the postintervention period, indicating the effectiveness of both methods; there was a significant difference with the pre-intervention stage, indicating the effect of both methods on increasing the students' knowledge. This result is consistent with the results of numerous studies such as the studies of Horiuchi *et al.*,[33] Jeffries *et al.*,[34] Sheikh AbuMasoudi and Soltani MollaYaghobi,[35] Mohammadi *et al.*,[30] as well as Baghaei *et al.*,[32] which indicated the effectiveness of both methods in promotion of the level of knowledge of learners. The results of these researches indicated the positive effect of both methods. Lack of any significant difference as well as similarity of the results of the two groups in the postintervention phase can become a cause for educational systems to apply the virtual education method in health sciences as the virtual training method has several advantages, such as providing reliable and reusable content, flexibility, and nongeographical constraints.[36] In addition, in e-learning, less learning time, increasing academic success, and learners' satisfaction are among the other benefits.[37,38] E-learning was also effective in enhancing decision-making skills and critical thinking of medical students.[39] In the present study, the comparison of the scores of the two groups in the postintervention phase revealed a significant difference between the two groups. The virtual method could increase students' knowledge regarding cardiac dysrhythmia more than the traditional method. The results of this study are correspond to those of Chang and Hsu[40] and Granero-Molina *et al.*,[8] which indicated a significant difference after intervention in virtual method, while the results of the study by Badanara *et al.* indicated the effectiveness of the traditional method,[41] which is incompatible with the results of this study. Although various studies report the success of the virtual education method, it should also be noted that this type of training for independent and self-governing students who are more intended to these learning strategies is more effective naturally. Considering a number of factors such as learning needs, student preferences, and educational orientations, it is important to apply virtual education method.[33] Of course, considering the complexities of virtual education, more clinical trials need to be performed.

In this study, the participants had the opportunity to online communication with their trainer on social networks; the questions and answers raised by the

students and the trainer were visible to other students and could be used by everyone. The advantages of this method have been confirmed in previous studies.[42,43] There are important effects on better learning and success of educational method by establishing such an active engagement among the instructors and students, which has had a great effect on better teaching and learning, and can eliminate one of the unfavorable consequences of virtual education such as less interaction or even lack of it among the instructors and learners and so on. Lack of a follow-up program which indicates the effects of this educational method on durability of the students' knowledge is one of the limitations of this study, limiting the study to a specific group of the students, challenges with the possibility of generalization of the results to other health professions. Furthermore, it is impossible for patients to evaluate the outcomes of this method. Therefore, it is recommended to do more practical researches in the future considering the limitations of this study.

Conclusion

The globalization of electronic devices in the world and the limitations of traditional education have made researchers to evaluate virtual learning methods. The results of this study indicated the positive significant effect of virtual education on nursing students' knowledge about cardiac dysrhythmia. Considering the plenty of advantages of the virtual teaching method such as being student-oriented, flexibility, lack of time and space limitation, coverage of a large number of learners, higher accessibility, and attractiveness, it is recommended as a preferred method. Therefore, this approach can be used as an alternative or complementary to traditional education. In addition, considering the positive effects of virtual social networking on learners' academic achievement, they can also be used as a powerful tool for creating learning environments based on most constructive approaches.

Conflicts of interest
There are no conflicts of interest.

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