Comparative study of virtual and traditional teaching methods on the theoretical course of ECG in medical students of emergency department

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Abstract

Introduction: The emergency ward is one of the most important parts of the hospital, where people's activities can have many effects on the performance of other wards of the hospital and the satisfaction of patients. Changing lifestyle and transformation of cyberspace into one of the pillars of modern life has had a great impact on learning and teaching methods. To compare the level of theoretical emergency learning in medical students with two virtual and traditional methods.

Materials and Methods: This quasi-experimental study was conducted on 88 medical students who started their emergency rotation in two hospitals of Guilan University of Medical sciences in 2021. Both groups participated in the same exam before and after the basics of electrocardiogram (ECG), normal ECG, types of blocks, diagnosis of MI and arrhythmias education. After collecting the information from the questionnaires, the data analysis was performed via SPSS software with a significant $P<0.05$.

Results: Out of 88 students, 56.8% were female, and 43.2% were male. The mean and median knowledge score before and after education was statistically significant in two groups ($P<0.001$). The virtual group represented a higher average score of knowledge than the traditional group. The student' grade point average affected the result of the score after education ($P=0.019$, $\beta =0.234$).

Conclusion: The use of virtual education methods in combination with traditional methods might help to improve the learning process and knowledge of medical students in emergency department.

Keywords: Clinical education, WhatsApp, Emergency course, Medical students

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Introduction

Clinical education is important for medical students' curriculum (1). Medical students learn in theory and bedside in hospitals. Based on the curriculum, students enter the different clinical departments and pass their education periods in the form of traditional classes of theory and clinical rounds (2).

Correct treatment in the emergency ward has an effect on the satisfaction of patients and the function of another ward of the hospital (3). The admission of people in the hospital often happens in the emergency ward for their needs and urgent care, so understanding their problems in this ward is essential (4). In addition, in the emergency ward, the student faces a large volume of clients with different clinical complaints, stable and unstable problems, and a wide range of acute and chronic diseases, so it is necessary to receive related training to deal with them (5). During this part of the medical student's curriculum, under the supervision of emergency medicine faculty members, they will learn how to take a history, examine and perform diagnostic and therapeutic procedures (6). Generally, they learn the main approach for treatment in an emergency situation, pay attention to the patient's main complaint, and acquire necessary abilities to face common referrals.

Clinical learning in general medicine is divided into two parts. In physiopathology, students focus on learning about the diagnosis and pathology of diseases. In the internship and intership, courses focus on the management and treatment of the disease (7). Hospital-based clerkship is a good opportunity for medical students to learn treat patients by combining theoretical and clinical knowledge in the hospital environment under the supervision of professors (6). The Covid-19 pandemic provided an opportunity for professors to make better use of virtual education and teach virtually where the presence of students in the hospital is not required (8,9).

In the learning process, teaching and learning are interdependent. Effective teaching can increase the quality of learning in students (10). Introducing new approaches and attitudes to education, including blended learning (BL), can be essential in resolving this issue. BL introduced as a learning method includes traditional and a variety of methods with specific technologies. BL is a combination of different methods of communication with technologies such as electronic learning (e-learning), e-performance support, and knowledge management practices for providing education (11,12). BL was first formally introduced by Marsh in 2003. Some consider BL as a combination of traditional and e-learning methods. Researchers showed that it as a suitable approach to achieve the desired learning goals by using appropriate technology and tailored to learning styles (13). Nowadays, virtual e-learning is considered the most advanced educational method that uses advanced technologies through electronic services (14,15).

The hospital environment is one of the most interactive work environments(16). The interactions between health workers with patients and themselves can lead to learning and experience of human resources (17). So, learning is the way to create student work and improve efficiency in an organization like a hospital. Since an organization can achieve its goals through capable employees, and it might enhance through learning. In addition, the prevalence of heart patients in the emergency ward is noticeable. It is necessary for students to learn the basics of electrocardiogram (ECG), normal ECG, types of blocks, diagnosis of MI and arrhythmia in order to examine heart patients who go to the emergency ward of the hospital. Therefore, due to the high importance of learning and achieving the best method of ECG education, we conducted a study to compare virtual and traditional education of theoretical knowledge of ECG in medical students of the emergency ward.

Materials and Methods

Data collecting

This quasi-experimental study was approved by the Ethics Committees of Guilan University of Medical Sciences (number: IR.GUMS.REC.1399.548). The inclusion criteria were: 1- Medical students of Guilan University of Medical Sciences who have passed the pre-internship exam. 2- Signing the consent form to participate in the study. Participating are 88 medical students in their 6th educational years. The sample size was designed with 5% error probability, 95% reliability and 0.5 relative frequency based on the results of the

study by Shaw et al(18). The medical students started their emergency medicine rotation in Poursina and Razi hospitals, in the second semester 2020-2021.

Based on the study design, these medical students divided randomly in two traditional and virtual education groups. The basics of electrocardiogram (ECG), normal ECG, types of blocks, diagnosis of MI and arrhythmia were taught in traditional and virtual classes for two traditional and virtual groups of interns in the emergency ward. The first group (traditional education=44), which included students that entered the emergency unit in three consecutive courses, was first given personal and educational information. Then, they were taught in a classroom, where students sat together for one session and attended an ECG analysis class. Several ECGs were provided to the students and explained in groups by solving problems. For the second group (virtual: n=44), which was the students of next three educational courses (one month after traditional group), the educational materials and slides related to the ECG were provided in the WhatsApp group (a messaging application).

The research tool was a questionnaire that designed for this research. Questionnaire questions were designed as multiple choice based on the diagnosis of normal ECG and emergency heart diseases. The faculty members of medical schools in Guilan University of Medical Sciences designed this two-part questionnaire. The first part of questionnaire included medical student's demographic such as age, gender, grade point average of previous years of students. The second part of questionnaire was consisted fifteen questions about student knowledge related to normal ECG, types of blocks, diagnosis of MI and arrhythmia. Before and three days after the education, the students of each group were tested via the same questionnaire.

The content validity of questionnaire was approved via the opinions of a panel of 10 experts of faculty members. Using Lawshe rule of content validity; all items had a value more than 0.62. Also all questions had a Content Validity Index (CVI) of 90% or higher. The maximum score of student awareness was between 0 to 8. The scores below 33.3% were considered poor, between 33.3% to 66.6% as average, and scores above 66.6% as excellent knowledge category.

Statistical analysis

The data were analyzed using SPSS. The mean, standard deviation (SD), minimum and maximum with a 95% confidence interval (CI) used to determine the learning rate of medical students in the two educational groups. We used the frequency and percentage to determine of learning status (poor, moderate, good). Paired T-test was done to compare the scores before and after the test, and Independent T-test was done to compare the score changes. Analysis of covariance was used to determine the difference of two groups by controlling the variables of grade point average, previous score, gender, and age group. Also, the Chi-square test was used to compare the performance of learning status with a significant level of $P < 0.05$.

Results

Data from demographic part of questionnaire revealed that the medical students had an age range of 24-26 years (mean 24.5 ± 0.66), 43.2% of males (n= 38), 56.8% females (n = 50). There was no significant difference in the frequency distribution of gender (P=0.667) and age (P=0.131) between two studied groups with Chi Square test. Because the number of medical students introduced to the ward is determined directly by the medical school, all students were included in the study. The mean students' grade point average (GPA) was 15.1 ± 4.35 in traditional and 15.1 ± 34.27 in virtual groups. Independent t test revealed that there were not statistically significant differences between the mean of GPA in the medical students of two groups (P=0.808).

Mann Whitney U Test was used for comparison of knowledge score before and after three days of education in two groups (Figure 1). A statistically significant differences was found between groups (P= 0.001) and in each group (P<0.001). The virtual group, either before or after education, illustrated a higher mean knowledge score. In both virtual groups and traditional education, education had a significant effect on the knowledge (P<0.001). The incremental changes in the traditional group (27.1 ± 48.1) were slightly more than in the virtual group (19.1 ± 18.1), but this difference was not statistically significant (P=0.168). However, a significant difference was seen in the percentage of learning score changes in the traditional

method compared to the virtual group (P=0.041) (Table1).
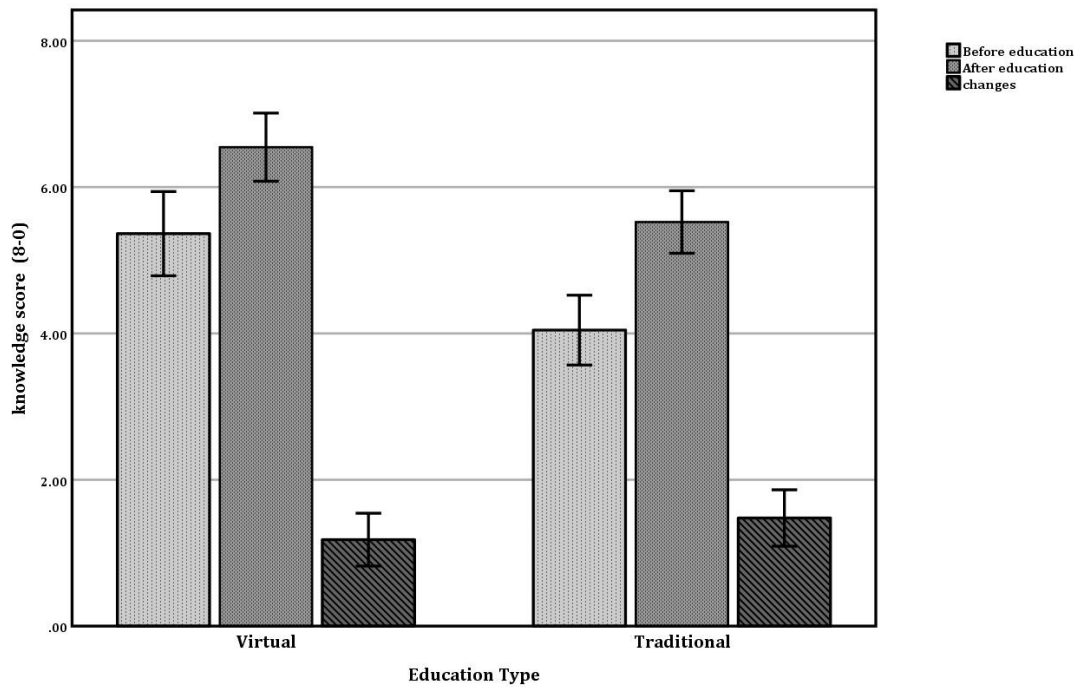
Figure 1. Comparing the average knowledge score before and after three days of education, and its changes in virtual and traditional methods.

Table 1. Comparison of knowledge score before and three days after education and its changes in the two studied groups.

		Education Type			
		Virtual	Traditional	Total	P value
Score before education	Mean±SD	5.36±189	4.05±1.57	4.70±1.85	0.001*
	Median	5.50	4.00	5.00	
	Percentile 25	4.00	3.00	3.00	
	Percentile 75	7.00	5.00	6.00	
Score three days after education	Mean±SD	6.55±1.53	5.52±1.41	6.03±1.55	<0.001*
	Median	7.00	5.00	6.00	
	Percentile 25	6.00	5.00	5.00	
	Percentile 75	8.00	6.00	7.00	
P value		<0.001**	<0.001**	<0.001**	
Scores changes	Mean±SD	1.18±1.19	1.48±1.27	1.33±1.23	0.168
	Median	1.00	2.00	1.00	
	Percentile 25	0.00	1.00	0.50	
	Percentile 75	2.00	2.00	2.00	
Percentage of Score	Mean±SD	37.57±78.69	54.30±72.36	45.93±75.62	

Changes	Median	20.00	40.00	25.00	
	Percentile 25	0.00	18.45	7.14	0.041*
	Percentile 75	40.00	66.67	60.00	

SD: standard deviation, *: significant with Mann Whitney U Test, ** significant with Wilcoxon Test.

The frequency distribution of knowledge status before and after education between two groups was statistically significant, P<0.001 and P<0.004, respectively. The virtual group had a better score before and three days after the education than the other group. In general, in both groups, the knowledge status has had significant positive changes, so that in the virtual group, the percentage of good status has increased from 34.1% to 54.5%; this increase was in the traditional group from 6.8% to 22.7% (P<0.001). In addition, 82% of students had good clinical skills, and this percentage did not represent a statistically significant difference between the two study groups (P<0.999) (Table2).

Table 2. Comparison of knowledge score before and three days after education and its changes in the two studied groups.

		Education Type			
		Virtual Score(SD)	**Traditional** Score(SD)	**Total** Score(SD)	**P value**
Status of knowledge before education	Weak	7(15.9%)	19(43.2%)	26(29.5%)	<0.001*
	Average	22(50%)	22(50%)	44(50%)	
	Good	15(34.1%)	3(6.8%)	18(20.5%)	
	Mean Rank	53.5	35.5	-	
Status of knowledge after education	Weak	2(4.5%)	3(6.8%)	5(5.7%)	0.004*
	Average	18(40.9%)	31(70.5%)	49(55.7%)	
	Good	24(54.5%)	10(22.7%)	34(38.6%)	
	Mean Rank	51.41	37.59	-	
P value		<0.001**	<0.001**	<0.001**	

SD: standard deviation, *: significant with Mann Whitney U Test, ** significant with Wilcoxon Test.

According to the results of this study, 81.8% of the students of the virtual and traditional group had good clinical skills and there was no statistically significant difference in the two groups(P=0.999). The results showed the difference in the before-education scores of the students in the two groups was statistically significant, to prevent the effect of this score on the research results, the covariance analysis was used to measure the effectiveness of the education methods by adjusting the effects of the gender, the before education score and the GPA. The results of covariance analysis showed that after controlling the covariate variables (before education score, GPA, and gender), that did not affect the educational groups (p=/119, β=0.373, Partial Eta Squared = 0.029) (Table3).

Table 3. Results of analysis of covariance the effect of educational methods on learning after adjusting for the effects of previous grade, GPA and student gender.

Parameter	B	Standard error	Sig.	95% Confidence Interval		Partial Eta Squared	Observed Power [b]
				Lower Bound	Upper Bound		
Intercept	-0.076	1.374	0.956	-2.808	2.657	0.000	0.050
[Group=1.00]	0.373	0.273	0.119	-0.098	0.844	0.029	0.343
[Group=2.00]	0 [a]	0.0	0.0	0.0	0.0	0.0	0.0
[Group=1.00]	-0.181	-0.217	0.406	-0.612	0.250	0.008	0.131
[Group=2.00]	0 [a]	0.0	0.0	0.0	0.0	0.0	0.0
Learning score-0	0.512	0.074	0.000	0.365	0.658	0.368	1.000
GPA	0.234	0.097	0.019	0.040	0.428	0.065	0.660

a: This parameter is set to zero because it is redundant, b: Computed using alpha = 0.005.

The students' GPA had statistically significant effects on their score after education (P=0.019, β =0.234) with the effect Partial Eta Squared of 0.065 (based on the division of the effective coefficient of Partial Eta Squared, the values coefficient greater than 0.14 is remarkable). The percentage of knowledge score changes in male students had a statistically significant difference between the virtual and traditional methods. Men of the traditional group had a higher percentage change, 55% compared to 17% (P=0.026). This percentage was not statistically significant in females, 33% compared to 20% (P= 0.391). There were not statistically significant differences between the two genders by type of education and GPA (Table 4).

Table 4. Comparison of the percentage of knowledge score changes in the two studied groups in terms of GPA and student gender.

			Education Type			
			Virtual	Traditional	Total	P value
GPA	≤15	Percentage of scores changes	Mean±SD 52.63±10.8.25	77.46±95.24	64.76±101.67	0.097*
			Median 20.00	50.00	25.00	
			Percentile 25 14.29	20.00	14.29	
			Percentile 75 50.00	100.00	66.67	
	15<	Percentage of scores changes	Mean±SD 22.52±22.00	33.15±31.75	27.95±27.64	0.209
			Median 18.33	33.33	33.33	
			Percentile 25 0.00	0.00	0.00	
			Percentile 75 40.00	60.00	40.00	
	P value		0.0595**	0.130	0.171	
Gender	Male	Percentage of scores changes	Mean±SD 41.93±110.43	49.07±39.02	45.31±83.21	0.026*
			Median 17.14	55.00	29.17	
			Percentile 25 0.00	25.00	0.00	
			Percentile 75 36.67	66.67	66.67	
	Female	Percentage of scores changes	Mean±SD 33.94±38.36	57.91±89.09	46.41±69.91	0.391
			Median 20.00	33.33	25.00	
			Percentile 25 14.29	14.29	14.29	
			Percentile 75 45.00	66.67	50.00	
	P value		0.393	0.421	0.946	

SD: standard deviation, *: significant with Mann Whitney U Test, ** significant with Wilcoxon Test.

Discussion

The last few decades have seen a shift from traditional medical education to online education, virtual networks or e-learning (19). Distance or online education has been used as an important educational feature in different countries in the past years (20,21) and according to statistics, almost 30% of students of USA have used distance education courses during their bachelor's degree (22), but in reality this type of

education in medical education not widely used in some country.

In this study, the experiences of clinical medical students in e-learning were conducted through social media training via WhatsApp application, which is a new approach to teaching in the medical school of Guilan University of Medical Sciences during the COVID-19 pandemic. According to the results, the post test scores of medical students have increased significantly in both groups. It seems that education alone is effective at the level of knowledge of clinical medical students. Of note, the knowledge's score of clinical medical students who participated in virtual groups was higher than those who received a traditional education (face to face). In the current study, it was shown that changes in knowledge scores in male students were more in the virtual group compared to the traditional one.

Contrary to our study, researchers showed that the score of using the first principle of education in the traditional educational group was increased significantly from the virtual educational group (23). Of note, learning is a personal characteristic, and people have own progress in learning according to their abilities, so it seems that there is a difference in the score of the first principle of education in e-learning and traditional education group. Koenigs et al., stated that students' attitudes toward the learning environment affect behaviors and the quality of learning outcomes (24). Also, other researchers found that if the first principle of education is used in e-learning, that could motivate learners (25). Other study showed that e-learning could facilitate the learning process (26). According to similar studies the result of present study suggested the blended method as the most effective one to improve learning quality (27).

Researchers represented that the traditional teaching method is reliable for achieving educational goals. The new generation of medical students have access to high standards and valuable digital resources. New teaching methods and e-learning alone are not a solution for teaching skills. So, the traditional learning method mixed with e-learning may help student learning process (28) and the digital valuable resources can be well used as a combined learning strategy. Because virtual education has provided a new environment for

learning and reduces traditional educational limitations such as time and place limitations (29). Therefore, the virtual training method might be useful for people who do not have enough time for face-to-face training.

Indeed, Wu et al. results showed a significant difference in the score of students in the theoretical courses. The results of their study indicate that the kind of virtual education, the use of interactive animations due to the activities involving students in education have a better impact on the understanding of the scientific content, and promote their knowledge (30). Other researchers suggested that e-learning environments may use as part of blended learning and improve of clinical skills quality (31). In contrast to our results, some studies revealed that there was no significant difference in the mean of total scores before education between the virtual and traditional groups (32). It is expected that virtual education can partially replace the traditional method of providing theoretical knowledge but not clinical knowledge and skills (33). In this era, there is a great emphasis on life time learning and effective education. Social networks and E-learning resources in medical education facilitate the learning process for medical professionals, so the effective use of these technologies in medical education might help achieve valuable results (34,35). The availability, the independency of time, and the place of e-learning have led to its widespread use by students. It noted that the pervasiveness of e-learning requires contexts and infrastructures, the preparation of which requires time, money, and extra planning (35).

Conclusions

According to the results of this study, the average and mean score of knowledge in the medical students who participated in WhatsApp groups was significantly higher than others who had received traditional training. It seems that the virtual education method in combination with the traditional may improve the learning process in medical students. It seems that e-learning has a significant role in learning theoretical courses in the future, but it may not be an entire replacement for practical and face-to-face learning. So, it suggests that a combined approach (traditional and e-learning) will be the most appropriate method for future medical education.

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