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The effectiveness of virtual interactive video in comparison with online classroom in the stroke topic of theoretical neurology in COVID-19 pandemic

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Abstract:

BACKGROUND: Sufficient interaction between the trainers and the trainees in medical education is always one of the biggest challenges for an educational system. This study was designed to evaluate the effect of virtual interactions within the educational content of stroke on the effectiveness of teaching for general medicine students during COVID-19 crisis.

MATERIALS AND METHODS: Eight medical students applying for stroke education were divided into two groups by simple random sampling (Rafsanjan Medical School, 2020). The first group participated in an online classroom via the Adobe Connect platform without virtual interaction. The second group used a video presentation containing interaction scenarios. The effectiveness evaluation of each type of educational content was done by comparison of the final exam scores and the results of an electronic satisfaction questionnaire in each group. Finally, using SPSS software version 18, the data were analyzed with independent samples *t*-test.

RESULTS: This study showed that the mean of the examination scores of the interactive virtual content group (6.14 ± 1.46) was significantly higher than the online class group (4.50 ± 1.50) ($P < 0.001$), and also the results of satisfaction assessment showed that this group was more satisfied with their educational content ($P = 0.005$).

CONCLUSION: Evaluation of the virtual stroke training effectiveness for general medical students shows that the educational approach of video with virtual interactions is an effective learning method in medical topics and can be considered as an efficacious educational model in online teaching.

Keywords:

COVID-19, medical education, stroke, virtual interaction

Introduction

COVID-19 influenced the medical education globally via locking down the universities and colleges. In this time, the virtual education and e-learning were key mediators for medical education and continued the teaching in a new format. The online classes and electronic courses had

many challenges and one of the important ones is inadequate interactions of teachers and learners.^[1,2]

Medical education is moving toward the active learning, with different teaching and learning techniques.^[3] Information and communication technology can be used as a powerful tool for improving the quality and efficiency of education.

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In the third millennium, e-learning is no longer just an alternative, it is a necessity, and should attract the attention of more and more educational designers and planners.^[4,5]

Virtualization is a very effective approach in the success of higher education institutions, and with the outbreak of the COVID-19 pandemic in December 2019, the importance of virtual education and e-learning has grown significantly. Virtual education needs a wide range of virtual interaction tools, computer software and hardware, and different learning management systems and has different challenges such as its quality and the student assessment.^[6,7]

Selecting or producing the appropriate tools and content in the educational system based on the cost of producing as well as the degree of improvement in the educational effectiveness achieved by that tool or content is a very important challenge to an educational system. Evaluating the effectiveness of e-learning approaches and methods for learners in a specific type of education, such as medical education, provides a clear feedback and leads to maximizing the effectiveness of education by decision-makers and education officials.^[8]

Interactive learning is the most important element of teaching methods, which considers the student needs and also leads to a self-directed learning among students. Studies showed more efficacious learning and greater satisfaction among learners who were trained with interactive methods. Moreover, during COVID-19 pandemic, the interactive online teaching seems necessary for better and effective retention of topics by the students.^[9,10]

Active learning in online education enhances the student engagement into the learning process and can be performed by different strategies such as online discussions, assignment design, and flipped learning.^[11] We used another method for performing the active learning for the students. In this study, what has been considered is the implementation of an interaction scenario in the video content of the stroke topic using standard virtual interactions available in Storyline software (Articulate Company version 360) such as slider, key, hotspots, input boxes, and checkboxes) for medical students.

This study evaluates the efficiency of interactive content and its impact on improving the quality of medical education in order to achieve more optimal solutions on providing the appropriate educational content for electronic training in Rafsanjan Medical School.

Materials and Methods

Study design and setting

In creating interactive content, virtual interaction scenarios were defined in a lesson video. In implementing the virtual interaction scenario, like the process in a multistage computer game, the educational video was presented to the students in the form of a multistage process and with the condition that the students respond to the virtual interaction in each stage. Entering each stage and watching the video of that stage are related to the student's reaction to the virtual interactions implemented in the previous stage. These virtual interactions were designed and produced with the aim of increasing students' focus on important curriculum goals in this topic. This scenario tries to provide easier and more enjoyable learning.

In preparing the interactive virtual content, first of all, the instructor presented the topic of stroke based on PowerPoint slides. Then, by adding images and related texts in the educational presentation, an explanatory video was produced simultaneously with the lecture in the video. In the next step to increase the students' focus on the important lessons presented in this educational video, the prepared video was divided into several sections with the interactive scenario.

In order to enter the next sections of the interactive video content for watching, giving the correct answers to the questions at the end of the previous section was necessary (one sample video uploaded in the supplementary files).

In the other group who were in virtual classroom, the students experienced this topic with the help of a lecture without virtual interactions and in an online classroom through Adobe Connect system. The possible questions of both groups of students were answered through the learning management system (Navid) by the course instructor.

Participants and sampling

In this study, which is an educational intervention, 80 medical students in the internship stage participated. This study was performed from August to September 2020 in the Rafsanjan University of Medical Sciences, School of Medicine. The subject of the study was a stroke from theoretical neurology.

In this method, students were randomly divided into two groups: one group received the training with interactive virtual content and the other group participated in an online classroom via Adobe Connect [Figure 1].

Data collection tool and technique

Finally, student assessment was performed via online multiple-choice questions exam in the electronic examination system. A questionnaire was completed by the students at the end of the examination in order to evaluate the teaching methods from the satisfaction points of view.

The electronic questionnaire was conducted using 20 multiple-choice questions. The questions were in the form of a 5-point Likert scale: strongly agree (score 4), agree (score 3), have no opinion (score 2), disagree (score 1), and strongly disagree (score 0). As a result, the satisfaction score for each student was calculated between 0 and 80. The related questionnaire was designed in an electronic poll system (EPOLL).

Validity and reliability of data collection tools

Validity

To determine the validity of questionnaires, the method of content validity was used. Five university professors were used to determine this validity. They were asked to comment on the necessity of each of the questions, and thus, the mean of the content validity ratio (CVR) of the teaching method acceptance questionnaire was 0.95 and the mean of the CVR of teaching method satisfaction questionnaire was 0.92.

Reliability

To determine the reliability of the questionnaire, the test-retest method was used so that the first ten questionnaires were distributed among ten people in the statistical population and were received after completion. After 10 days, the questionnaires were distributed again among the same people and collected after completion. Then, the correlation coefficient between the scores of the first and second stage of response was calculated as reliability. The reliability of the teaching method acceptance questionnaire was 0.81 and the satisfaction questionnaire was 0.86.^[12-14]

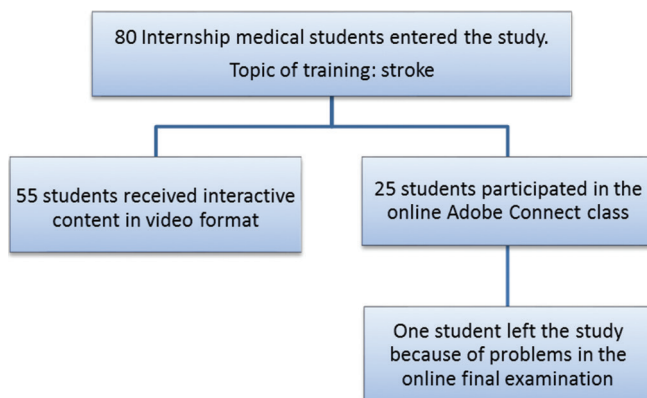


Figure 1: The groups of the study are presented in this diagram

Inclusion criteria

Inclusion criteria included students who were in the stroke course from theoretical neurology training and agreed to participate in the study.

Exclusion criteria

Exclusion criteria included absence in virtual classroom or lack of finishing watching the interactive content or failure to take the virtual exam at the end of the course.

Ethical consideration

Each medical student's information and exam score were confidential. The participants were allowed to withdraw from the study if they did not wish to do so. This study was approved by the ethical committee under the code of IR.RUMS.REC.1399.183.

Statistical analysis method

In analyzing the results, first using the Kolmogorov-Smirnov test, the hypothesis of normality of the test score variable in the two groups was examined and confirmed.

Finally, using SPSS software version 18 (SPSS Inc. Released 2009. PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc.), the mean of examination scores in the two groups was compared with independent samples *t*-test. In addition, the difference between the mean of student response time to the exam in the two groups was calculated. The questionnaire scores were also compared between the two groups. The significance level in all tests was considered 5%.

Results

Eighty students who had neurology courses entered the study and were divided into two groups. There was no significant difference between the two groups according to sex and total average scores.

The analysis of the mean of stroke examination score was obtained by independent sample *t*-test, which is described in Table 1. The result of independent *t*-test shows that the examination score of the interactive content group was significantly higher than the online class group ($P < 0.001$). Figure 2 (box plot) also shows the minimum, maximum, first, second (middle), and third quartiles for the exam scores of both groups. The

Table 1: Final scores of students in the stroke course in the studied group

Group	<i>n</i>	The least	The most	Average	SD	SE	<i>P</i> *
Virtual interactive	55	3	8	6.14	1.46	0.19	$t=-4.56$ Df=77
Online class	24	2	7	4.50	1.50	0.31	$P<0.001$

*Independent samples *t*-test. SD=Standard deviation, SE=Standard error

improvement of these indicators can be seen in the interactive content group.

Student satisfaction assessments are reported in Table 2. According to the result of independent *t*-test, the satisfaction level of the interactive video group was significantly higher than the online classroom (58.54 vs. 39.68, respectively) ($P = 0.005$).

Comparison of answering time to the exam questions in two groups showed that the average time spent answering the questions in the interactive virtual group was 1 min less than the time for answering the online class group (8.86 vs. 9.72, respectively). Based on the result of independent *t*-test, this difference was statistically significant ($P = 0.046$) [Table 2].

Comparison of the total average scores of students participating in the two groups was also performed [Table 2]. It was found that the mean of total average score in the two groups is exactly the same, and according to the results of the independent *t*-test, there was no statistically significant difference between the two groups (14.15 in the interactive method vs. 14.14 in the online classroom) ($P = 0.976$). Considering that the total average score is the same in the two groups, it can be concluded that this variable does not act as a confounder in terms of the stroke exam score comparison in the two groups.

In order to investigate the simultaneous effect of different demographic variables, response time, total average score, and intervention (interactive virtual content) on the exam score of the stroke, a multiple linear regression model was used. The existence of linearity between independent variables was investigated, and after confirming the related hypotheses, the results of the multiple regression model were reported as follows [Table 3].

According to the results of multiple linear regression, the effect of the group variable on the exam score of stroke was significant ($P < 0.001$) so that by adjusting the effect of other variables (total average score, gender, and response time), the exam score in the interactive virtual group is 1.52 more than the online group score. Gender and response time variables had no significant effect on exam score ($P > 0.05$), but the effect of total average on exam score was statistically significant ($P = 0.011$).

This means that by adjusting the effect of other variables by increasing each unit to the total average, the stroke exam score has increased by an average of 0.4. However, this does not mean that the difference in the mean score of the stroke between the two groups is affected by the total average because the two groups were randomly selected in exactly the same way that they have very little difference in terms of total average score [Table 2]. Furthermore,

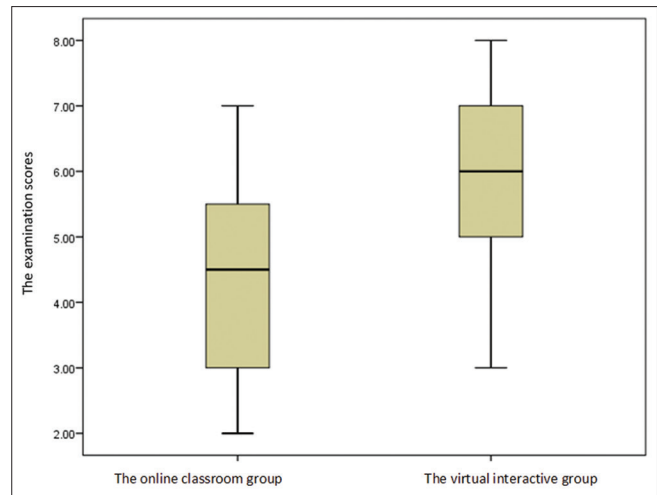


Figure 2: The box plot of the stroke examination scores in the group of online classrooms and in the group of virtual interactive video content

Table 2: Comparison of average satisfaction, total average scores, and duration of answering the exam questions in both groups of interactive virtual content and online classroom

Variables	Interactive virtual video			Online classroom			P*
	n	Average	SD	n	Average	SD	
Satisfaction	51	58.54	18.82	12	39.68	25.08	T=2.9 Df=61 P=0.005
Student grades	55	14.15	0.98	24	14.14	1.43	T=0.03 Df=77 P=0.976
Duration of answering exam questions	55	8.86	1.92	24	9.72	1.13	T=2.024 Df=77 P=0.046

*Independent samples *t*-test. SD=Standard deviation

according to the standard regression coefficients, it can be concluded that the group variable (intervention) had the greatest effect on the stroke exam score.

Discussion

According to the results of this study, medical students' satisfaction and acceptance level of the video containing virtual interactions is desirable. According to the findings, the virtual interaction scenarios in the educational video were effective and have improved the performance of students in the final stroke examination.

According to Tabatabai's study (2020), COVID-19 pandemic had a great and sometimes negative impact on education. Face-to-face education has moved toward the virtual education in many countries. In Iran, many medical schools have expanded their virtual education platforms. Virtual University of Medical Sciences has also played a supporting role in better promoting this type of education.^[15] In the

Table 3: Simultaneous effect of different variables on stroke score using multiple linear regression

Independent variable	The regression coefficient	Standard coefficient	SE	T	P	Tolerance	VIF
Constant	-2.96		2.574	-1.15	0.253		
Group (interactive virtual to online)	1.52	0.437	0.367	4.14	0.000	0.932	1.073
Total average	0.406	0.283	0.155	2.62	0.011	0.889	1.125
Gender (male to female)	0.416	0.124	0.370	1.12	0.264	0.854	1.171
Response time	-0.001	-0.001	0.110	-0.01	0.993	0.946	1.057

SE=Standard error, VIF=Variance inflation factor

duration of COVID-19 pandemic, finding the efficacious teaching methods in medical education is of great importance, and in this study, we investigate the effectiveness of a teaching approach in medical school.

Interactive videos are a useful method in teaching and learning. Hung *et al.* and Anwar *et al.* demonstrated that an interactive video improves the student performance in the exams as well as the level of understanding and information retention. Besides, they showed that interactive videos help the students to achieve an active learning and better examination scores. Afify study focused on the effectiveness of interactive digital videos and their length on cognitive achievements and learning retention, and suggested that stakeholders and educational planners may benefit from this e-learning environment. Afify study also revealed that student performance of the groups who received the interactive videos with medium length was better than the groups of students who watched the long videos.^[13,16,17] The current study in line with other studies exhibited that an interactive video content could improve student performance in the course final examination in comparison with an online classroom. According to the results of this study, the implementation of virtual interactions in the educational content using clear signals to introduce the important points of the lesson led to better student performance.

Verma *et al.* discussed the interactive teaching methods in medical education and showed that these approaches alter the role of teachers from being a provider of information to an educational process facilitator.^[9] In another study by Chen *et al.*, virtual trainings for dental students were conducted in the COVID-19 pandemic. In this study, the interactivity of the content was pointed out by the students and was more effective than a lecture alone, and learning in small groups and combining the synchronous and asynchronous components were suggested.^[18] Based on these studies, during coronavirus crisis, we aimed to evaluate an interactive method of teaching which led to a desirable level of student satisfaction and could be a beneficial model for e-learning.

Limitation and recommendation

Our study limitations were problems in connecting to the network during the final online exam and responding to

the online questionnaire, and our recommendation for this problem is having a backup network for replacement. The positive aspect of this study was introduction of a virtual interactive teaching model in the stroke course for medical students. The recommendation for future studies includes the assessment of virtual interactive video effects compared with traditional face-to-face classes, use of other software and tools for virtual interaction designing, and performing these teaching methods for other students in different schools and different years of entrance to university. Overall, the innovation of the current study was designing an interactive digital content based on a video on the stroke topic for medical students and comparing this approach with an online classroom, which provides a solution for e-learning challenges.

Conclusion

Our study showed that interactive teaching environment affects the students' learning outcomes and is accompanied by student's satisfaction and acceptance. The possible mechanisms for these achievements may be related to maximizing the learning process and simplification of complex topics. This teaching method could be suggested for future educational planning for other fields and other courses.

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Conflicts of interest

There are no conflicts of interest.

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