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# Effects of virtual and lecture-based instruction on learning, content retention, and satisfaction from these instruction methods among surgical technology students: A comparative study

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## Abstract:

**BACKGROUND:** There are various instructional methods worldwide and virtual instruction is one of them. This widely used method involves online instruction and e-learning. The present study compares the effects of lecture-based and virtual instruction on student learning, satisfaction, and content retention among surgical technology students at Isfahan University of Medical Sciences.

**MATERIALS AND METHODS:** The population of this two-stage, quasi-experimental study consisted of 40 surgical technology students at the School of Nursing and Midwifery. After fulfilling inclusion criteria, they were randomly assigned to the virtual instruction group (VG,  $n = 20$ ) and the traditional, lecture-based instruction group (TG,  $n = 20$ ). Data were collected via a researcher-made student satisfaction questionnaire and two learning examinations. Their validity and reliability had been confirmed. The data were analyzed using SPSS 13 and analytical and descriptive tests ( $P < 0.05$ ).

**RESULTS:** There was no statistically significant difference between the TG and the VG with respect to the mean score in the first examination ( $P = 0.89$ ). However, the two groups were significantly different in terms of the mean score in the second examination ( $P = 0.03$ ). Regarding content retention and recall performance, the VG outperformed the TG. Furthermore, the mean satisfaction score of the VG ( $132.24 \pm 17.92$ ) was higher than that of the TG ( $115.56 \pm 17.57$ ) ( $P < 0.05$ ).

**CONCLUSION:** Virtual instruction and lecture-based instruction had comparable short-term learning outcomes. Nevertheless, with the passage of time, it was revealed that virtual instruction could result in better learning performance and higher content retention and satisfaction.

## Keywords:

Lecture, operating room, surgical technology, virtual instruction

## Introduction

Nowadays, university students find it necessary to gain knowledge in different fields, and surgical technology students are no exception.<sup>[1]</sup> Curriculums are generally taught based on two instructional models, namely teacher centered and student centered. In teacher-centered

instruction, the main objective is to shape student behavior and get students to conduct themselves in a predetermined manner. In this model, students rely on the teacher as the center of the learning activity and may easily forget what they learn.<sup>[2]</sup> Lecturing is one of the most common traditional methods in the teacher-centered

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model. Lecture-based instruction has both advantages and disadvantages. It is cost-effective. The content is well organized and logically and directly presented in this method. Moreover, it enhances the teacher's speaking skills and students' note-taking skills. Nevertheless, lecture-based instruction is a passive method, fails to take individual differences into account, and is inappropriate for teaching practical skills and improving mental skills at higher learning levels. Furthermore, there is every likelihood that students will forget the content soon.<sup>[3]</sup>

One of the ways of improving traditional, lecture-based instruction is using active learning. In this method, students have an active engagement in the learning process. Such methods have necessarily positive effects on their learning.<sup>[4]</sup> Over the past decade, the world has witnessed the rapid development of information technology, and the advent of the World Wide Web has affected our lives. It has many important educational applications.<sup>[5]</sup> Since the complex process of learning should not be confined to the classroom, we can use electronic learning (or e-learning), a newly emerged method, to overcome barriers of traditional instruction and provide convenient and flexible access to learning.<sup>[6]</sup>

E-learning refers to an educational system in which the teacher and the learner are separated by physical distance but connected by technology-enabled tools, and the learning content is electronically delivered via a range of technologies.<sup>[7]</sup> This instructional method has several benefits. It reduces travel costs and time to and from an event, opens up learning opportunities for everyone, provides easy access to a wide range of learning resources, gives students the flexibility to learn at any place and at any time, provides them with developmental feedback on their progress, makes possible the efficient utilization of resources, and prevents any unnecessary duplication.<sup>[8]</sup> E-learning is a shift from teacher-centered instruction to student-centered instruction.<sup>[9]</sup>

There are numerous studies on the effects of virtual instruction on student learning and satisfaction. In 2006, researchers at Troy University in Florida explored student perceptions of distance learning and compared the traditional and online learning methods. The results indicated that most students preferred distance education because it allowed them to balance their other commitments such as long hours at work and family issues more easily. Furthermore, the students perceived that distance learning courses were of higher quality than traditional learning courses. Overall, the students had a positive attitude toward virtual instruction.<sup>[9]</sup> Another study compared the outcomes of distance education and traditional education in a community college. The results showed that students taking traditional courses had higher achievement and completion rates than those

taking distance learning courses; moreover, the students had a negative attitude toward virtual instruction in the community college.<sup>[10]</sup>

A study compared the effects of e-learning and lecture-based learning on the knowledge of 40 nurses who had participated in a continuing medical education (CME) program on fluid and electrolyte disorders. The results revealed that the two learning methods had similar outcomes.<sup>[11]</sup> Nevertheless, a study that compared the effects of the computer-based and lecture-based instructional methods on nursing students' content retention in an internship course reported that computer-based instruction led to higher content retention.<sup>[12]</sup> All of these reports show contradictions in the effectiveness of the lecture-based and virtual methods of instruction among students. These contradictions and the necessity for an improvement in the instruction of surgical technology students made the researchers of the current study to find a better teaching method for these students.

Since the researchers found no study which could compare effects of lecture-based and virtual instruction on surgical technology students' learning, content retention, and satisfaction, they conducted the present study to determine and compare the effects of the two methods on the three variables among surgical technology students at Isfahan University of Medical Sciences in 2019.

## Materials and Methods

This two-stage, quasi-experimental study explored the impact of lecture-based and virtual education on three dependent variables, namely student learning, satisfaction from these instruction methods, and content retention. The inclusion criteria were studying surgical technology at the School of Nursing and Midwifery at Isfahan University of Medical Sciences, earning a credit in anesthesia, showing a willingness to participate in the study, and providing informed consent. The exclusion criteria were failing to attend at least two lectures and taking the course for a second time. The study population consisted of all students who earned a credit in anesthesia in the second semester in 2019 ( $n = 40$ ). Participants were randomly allocated to lecture-based instruction group (LG,  $n = 20$ ) and virtual instruction group (VG,  $n = 20$ ). For random allocation, they were randomly numbered using odd, and even numbers and their numbers were written on individual pieces of paper and were put in a bag. Then, papers were selected one by one and numbered from 1 to 40. Finally, students whose papers were numbered with even numbers were allocated to the LG and those whose papers were numbered with odd numbers were allocated to the VG group.

The participants who were taught to the students were airway management and intubation. The TG attended two sessions and the content was taught in the lecture format. The VG studied the same content virtually, via a PowerPoint presentation with a voice-over and a learning management system (LMS) on the Internet. A unique username and password had been assigned to each student in the VG so that the students could login to the LMS. They were asked to keep their usernames and passwords confidential. The VG students could only access the content on the website in a specific time period. Both the groups were taught by the same teacher for the same length of time and within formal teaching hours. Holding lecture-based classes for the TG and providing the VG with the material virtually were simultaneous.

Data were collected via a researcher-made student satisfaction questionnaire from teaching methods and two knowledge exams. The students took the first examination a week after the end of the course and the second examination a month after it. The goal of the examinations was to assess participants' learning. Both the groups took the examinations simultaneously. Each examination contained 17 multiple-choice questions and three short-answer questions. The examiner, who wrote the questions for and graded the examinations, was the teacher of the students. Since this was a single-blind study, the examination papers only bore a student ID number rather than a name so that the examiner could not know which student was in which group at the time.

The satisfaction questionnaire comprised 39 items which were rated on a 5-point Likert scale (1 = completely disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, and 5 = completely agree). The lowest and highest possible scores for all the items were 39 and 195, respectively. The content validity of this questionnaire was assessed and confirmed by five instructors from the Department of Medical Education and ten instructors from the Department of Operating Room of Isfahan University of Medical Sciences, Isfahan, Iran. The same ten instructors from the Department of Operating Room were also asked to assess the content validity of the examinations. The reliability of the data-collection tools was assessed using internal consistency that was estimated using Cronbach's alpha (0.97 for the satisfaction questionnaire and 0.87 for the examinations).

The data were analyzed using the SPSS software version 13.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis was done to report means and standard deviations. The Chi-square and the independent-sample *t*-tests were used to compare the groups respecting

participants' gender, age, previous-semester grade point average, and the mean scores of satisfaction and knowledge examinations.

## Results

A total of 40 students took part in this research. Eleven (27.5%) students were male and 29 (72.5%) were female. The TG group was in the age range of 20–22 years and the VG was in the age range of 20–23 years. One student from the TG group failed to take the first examination and one student from each group failed to take the second examination. These students were excluded from the study.

The Chi-square test indicated that there was no statistically significant difference between the two groups in terms of the gender frequency distribution ( $P > 0.05$ ) [Table 1]. The independent-sample *t*-test showed no statistically significant difference between the two groups with regard to the mean age and the grade point average in the previous semester ( $P > 0.05$ ) [Table 2]. The means and standard deviations of the first and second examinations for the TG were  $16.21 \pm 1.99$  and  $12.90 \pm 2.64$ , respectively. The results showed a significant decrease in the mean score of the TG 4 weeks after the first examination ( $P < 0.001$ ). The means and standard deviations of the first and second examinations in the VG were  $16.29 \pm 2.19$  and  $14.26 \pm 2.41$ , respectively. The independent sample *t*-test revealed that there was no statistically significant difference between the two groups with respect to the mean learning score 1 week after the instruction ( $P > 0.05$ ); however, the mean learning score decrease in the VG was less than that in the TG ( $P < 0.05$ ) [Table 3]. The independent sample *t*-test showed that the mean satisfaction score of the VG ( $132.24 \pm 17.92$ ) was higher than that of the TG ( $115.56 \pm 17.57$ ) ( $P < 0.05$ ) [Table 4].

**Table 1: Comparing the two groups in terms of the gender frequency distribution**

Gender	TG, n (%)	VG, n (%)	Chi-square test		
			$\chi^2$	df	P
Male	6 (30)	5 (25)	0.53	2	0.77
Female	14 (70)	15 (75)			
Total	20 (100)	20 (100)			

TG=Traditional instruction group, VG=Virtual instruction group

**Table 2: Comparing the two groups with regard to the mean age and the grade point average in the previous semester**

Variable	Mean±SD		Independent-sample <i>t</i> -test			
	TG	VG	F	Df2	Df3	P
Age (year)	20.70±0.73	20.80±0.83	0.59	1	38	0.55
GPA	16.10±1.15	16.51±1.45	1.57	1	38	0.22

SD=Standard deviation, TG=Traditional instruction group, VG=Virtual instruction group, DF2=Between Groups, DF3=Within Groups

**Table 3: Comparing the two groups with respect to the mean and standard deviation of the scores of the two examinations**

Group	Examination, mean±SD		P
	First	Second	
TG	1.99±16.21	2.64±12.90	<0.001
VG	2.19±16.29	2.41±14.26	<0.001
Significance level (P)	0.89	0.03	

SD=Standard deviation, TG=Traditional instruction group, VG=Virtual instruction group

**Table 4: Comparing the two groups with regard to the mean score of student satisfaction with the instructional method**

Group	Mean±SD	Independent-sample t-test			
		F	df	df	P
TG	115.56±17.57	48.20	2	57	<0.001
VG	132.24±17.92				

SD=Standard deviation, TG=Traditional instruction group, VG=Virtual instruction group

## Discussion

The current study compared the effects of virtual and lecture-based instruction on student learning, content retention, and satisfaction from these instruction methods in surgical technology classes at Isfahan University of Medical Sciences. The research results showed that there was no statistically significant difference between the TG and the VG groups with respect to the mean score of the first examination. This means that the short-term effects of the two instructional methods on learning were similar; however, their long-term effects on learning (content retention) were significantly different. In fact, the impact of virtual instruction on learning lasted longer. Moreover, there was a statistically significant difference between the two groups in terms of student satisfaction and the students were more satisfied with virtual instruction than with lecture-based instruction.

Results of some studies are consistent with the present research. Mohammadi reported that students who had received computer-based (virtual) instruction had higher content retention.<sup>[12]</sup> Golchai *et al.* indicated that the scores of students using “Virtual Medical Teaching” were significantly higher than students using traditional teaching.<sup>[13]</sup> However, exploring effects of lecture-based and computer-based multimedia instruction on the learning level of students taking a triage course, Tadrissi *et al.* demonstrated that traditional, lecture-based instruction was more effective than which teaching method.<sup>[14]</sup> This is not in line with the results of the current study. Hugenholtz *et al.* compared the effects of e-learning and lecture-based instruction on the learning level of occupational physicians in a CME program. The results showed that the two methods had comparable effects on the knowledge level of the learners

in the two groups; however, there was no statistically significant difference between the groups.<sup>[15]</sup> In addition, Demetriadis and Pombortsis indicated that there was no statistically significant difference between the TG and the group taking e-lecture-based instruction with regard to the knowledge level, although students in the lecture group were more satisfied with the flexibility of the learning experience.<sup>[16]</sup> Ludlow and Platin reported that students preferred web pages to slides/tapes for accessibility, image quality, and freedom of navigation.<sup>[17]</sup>

Differences in training course, learners’ educational level, and content delivery quality are factors that influence individuals’ learning.<sup>[18]</sup> Considering the effect of these factors on the level of learning, it is possible to find out the reasons for the differences between the results of the present study and other studies. In addition, the potential effects of the lack of homogeneity between the control and intervention groups in other studies should be considered.

In this study, learners’ satisfaction with the virtual teaching method was more than a lecture teaching method. Consistent with this finding, a study conducted in the course of dental pharmacology showed that students’ satisfaction with virtual learning was more than the traditional lecture delivered last year.<sup>[19]</sup> Students’ freedom to determine the right place and time for teaching is one of the strengths of virtual education, which can be one of the factors affecting the satisfaction of VG compared to the TG.<sup>[20]</sup>

There were three limitations in this study. The sample size was small. Individual differences in using software were not taken into account. Moreover, no pretest was administered prior to the instruction. Nevertheless, it must be mentioned that giving a pretest could have indirectly provided the TG with the syllabus and course objectives through test questions, thereby having encouraged them to do self-study. This would have confounded the comparison of the two groups.

## Conclusion

The present study revealed that satisfaction and content retention were higher in the VG than in the TG. Hence, it would be better to provide students with a blend of virtual and lecture-based instruction to improve their learning and achievement significantly. It is recommended that paramedical students, particularly surgical technology students, have virtual instruction as much as possible.

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### Conflicts of interest

There are no conflicts of interest.

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