

Original Article

The Effects of Traditional Lecture and Flipped Classroom on Learning, Learning Retention, and Satisfaction among Operating Room Students: A Comparative Study

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INTRODUCTION

Operating room nursing is a division of the nursing profession and has had significant advances in recent years in different professional areas, including education, research, and practice, to provide quality care.^[1]

The most common teaching method used in classrooms for operating room students is traditional lecture. However, with advances in medical knowledge and changes in students' needs, the efficiency of this method has been questioned.^[2] Moreover, a large proportion of students do not have adequate critical thinking,

ABSTRACT

Background: Rapid changes in communities necessitate the use of new-teaching methods in universities. **Objectives:** This study aimed to determine and compare the effects of traditional lecture and flipped classroom (FC) on learning, learning retention, and satisfaction among operating room students. **Methods:** This two-group quasi-experimental study was conducted in 2018–2019 in the Faculty of Nursing and Midwifery of Isfahan University of Medical Sciences, Isfahan, Iran. Forty-four operating room students who had enrolled in anesthesiology course were selected and randomly allocated to a lecture and a FC group. Data were collected using a researcher-made satisfaction questionnaire and two researcher-made knowledge examinations. Data analysis was performed using the Chi-square, independent-samples *t*, and paired-samples *t*-tests. **Results:** The mean scores of knowledge in the first and the second examinations in the FC group (i.e. 18.85 ± 0.83 and 17.47 ± 1.42 , respectively) were significantly greater than the corresponding mean scores in the lecture group (i.e., 16.21 ± 1.99 and 12.90 ± 2.64 , respectively) ($P < 0.05$). Moreover, the mean score of satisfaction in the FC group was significantly higher than the lecture group (169.44 ± 17.82 vs. 115.56 ± 17.57 ; $P < 0.05$). **Conclusion:** FC is more effective than traditional lecture in promoting students' satisfaction and short- and long-term learning.

KEYWORDS: *Flipped classroom, Learning, Lecture, Operating room, Satisfaction*

communication, and reasoning skills, and hence, most healthcare-related schools and universities have difficulties in fulfilling the healthcare-related needs of their communities.^[3,4]

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Flipped classroom (FC) is one of the alternative methods to traditional lecture.^[5] This method shifts teaching and learning from group-learning environment into individual-learning environment so that educational materials are primarily provided to students outside the classroom and assignments are done in the classroom. In this method, teachers' videotape lectures on educational materials and provide videos to students to watch wherever and whenever possible. Students' free access to educational materials enables them to get ready for classroom activities.^[6] In other words, knowledge is mostly acquired out of the classroom, whereas classroom time is spent on facilitating and reinforcing learning, applying learned materials, and helping students master the materials. Consequently, FC assigns the majority of learning responsibility to students, whereas teachers serve mostly as guides or facilitators.^[7]

Numerous studies have been conducted into the effects of FC on student learning. For example, a study compared the effects of FC and traditional lecture and did not find any significant difference between their effects on student learning.^[8] Another study compared active non-FC and active FC and reported that their effects on student learning and satisfaction were the same and students in both groups reported that their interaction with their teacher in the classroom was more effective in significantly prompting their learning compared with self-learning at home.^[9] Moreover, a study used the Kirkpatrick model to evaluate the effects of FC on learning among two cohorts of veterinary students, namely those who had completed a course through traditional lecture and those who had completed the same course through FC. In general, students preferred FC over lecture, while those in the lecture group had significantly better performance in a series of multiple-choice questions and financial planning.^[10] A comparative study into the effects of lecture and FC on nursing students also reported that although students in the FC obtained higher performance scores in the adult health course, their satisfaction with learning was lower than their counterparts in the lecture group.^[11] These studies show contradictions in the effects of FC and traditional lecture on student learning and hence, it is still poorly known whether FC has priority over traditional lecture.

Objectives

This study aimed to determine and compare the effects of traditional lecture and FC on learning, learning retention, and satisfaction among operating room students.

METHODS

This single-blind quasi-experimental study was carried out in 2018–2019 in the Faculty of Nursing and

Midwifery of Isfahan University of Medical Sciences, Isfahan, Iran.

Participants

Study population consisted of all 44 students who had enrolled in the anesthesiology course in the second semester of the 2018–2019 academic year. Sample size calculation was performed based on the findings of a former study that compared the effect of traditional teaching and FC on students' practical learning and reported that the mean scores of the students in the two groups were 8.71 ± 3.46 and 11.50 ± 3.30 , respectively.^[12] Subsequently, with a type I error of 0.05, a type II error of 0.2, a S_1 of 3.46, a S_2 of 3.30, a μ_1 of 8.71, and a μ_2 of 11.50, sample size was calculated to be 24 per group. However, as the total sample available was 44, all students were included in the study through a census. Participants were randomly allocated to a lecture ($n = 22$) and an FC ($n = 22$) group. 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 44. Finally, students whose papers were numbered with even numbers were allocated to the lecture group, and those whose papers were numbered with odd numbers were allocated to the FC group. Figure 1 shows the sampling procedure. Participants were excluded if they had two or more absences from the course or failed to take the final examinations of the course for any reason.

Intervention

Instructions about airway management and endotracheal intubation were provided to the participants in the lecture group through traditional lecture in two 90-min sessions. For participants in the FC group, the same content was electronically prepared using the Microsoft PowerPoint and uploaded on the learning management system of the study setting. The PowerPoint presentation also included verbal explanations provided by students' instructor. Each participant in the FC group was given a unique username and password to login to the system and was asked to keep his/her username and password confidential. The system provided the instructor with the option to track the number of page view of each student. In addition to the main content, several questions were included in the system to motivate the students for learning. To ensure that all students would study the content, they were asked to give a lecture on the content in the classroom. Students could access the content in the system in a predetermined 24-h period of time. Finally, they attended the classroom, where their instructor provided them with questions about the content and asked them to answer them and discuss their

answers in four- or five-person groups. Each group had 10 min time for each question. In case of any problem, their instructor provided them with brief explanations. Participants in the small groups were not allowed to share their answers with their counterparts in other groups.

Instructions in both groups were provided by the same instructor and in the same time span. In other words, students in the FC group could access the content in the same day their counterparts in the lecture group received education from their instructor in the classroom. This technique helped prevent between group information leakages.

Data collection

To collect the data, we asked the students to complete a researcher-made student satisfaction questionnaire and take two knowledge examination – a week after the end of the course (the first examination) and 1 month after it (the second examination). The goal of the examinations was to assess the participants' learning. Examinations for both groups were administered simultaneously. Each examination contained 17 multiple-choice questions and three short-answer questions. Questions were designed and graded by a same examiner, i.e., students' instructor. Examination papers were anonymous and just labeled with students' identification number; therefore, their instructor was blind to their groups at the time of grading the examinations.

The satisfaction questionnaire consisted of 39 items rated on a five-point Likert scale as follows: 1: "Completely disagree;" 2: "Somewhat disagree;" 3: "Neither disagree nor agree;" 4: "Somewhat agree;" and 5: "Completely agree." The total score of the questionnaire could range from 39 to 195. 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 exams. Reliability assessment was also performed through the internal consistency method which showed that the Cronbach's alpha values of the satisfaction questionnaire and the knowledge exams were 0.97 and 0.87, respectively.

Ethical considerations

This study was approved by the Ethics Committee of Isfahan University of Medical Sciences, Isfahan, Iran (code: IR.MUI.RESEARCH.REC.1397.453). At the beginning of the study, participants were informed about the study aims and methods, voluntary participation,

and confidential data management, and written informed consent was obtained from each of them.

Data analysis

The data were analyzed using the SPSS software version. 13.0 (SPSS Inc., Chicago, IL, USA). The measures of descriptive statistics were used for data description. 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. The level of significance was set at < 0.05 .

RESULTS

In total, 44 students participated in this study in two 22-person groups. One student from each group failed to take the first examination and one from each group failed to take the second examination. Therefore, the study was completed with twenty students in each group. Fourteen students in the lecture group (70%) and 16 in the intervention group (80%) were female. Participants' age ranged from 20 to 22 years. The Chi-square and the independent-sample *t* tests showed no significant between group differences respecting participants' age, and previous-semester grade point average [$P > 0.05$; Table 1].

The means and standard deviations of the first and second exams for the lecture group were 16.21 ± 1.99 and 12.90 ± 2.64 , respectively. The results showed a statistically significant decrease in the mean score of the lecture group 4 weeks after the first exam ($P < 0.001$). The means and standard deviations of the first and second examinations in the FC group were 18.85 ± 0.83 and 17.47 ± 1.42 , respectively. The Student's *t*-test indicated that the mean learning score of the FC group was statistically significantly higher than that of the lecture group 1 week after the instruction ($P < 0.05$). Furthermore, the mean learning score decrease in the FC group was less than that in the lecture group [$P = 0.001$; Table 2]. The mean score of satisfaction in the FC group was also significantly greater than the lecture group (169.44 ± 17.82 vs. 115.56 ± 17.57 ; $P = 0.001$).

DISCUSSION

The results showed a significant difference between

Table 1: Between-group comparisons respecting participants' age and previous-semester grade point average

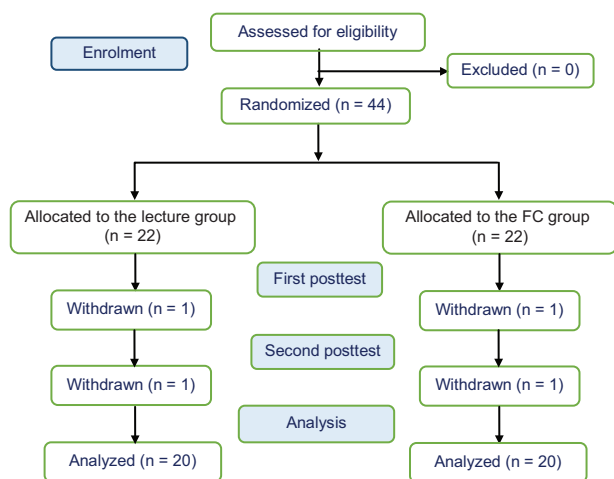
Variable	Group, mean \pm SD		Results	
	Lecture	FC	<i>t</i>	<i>P</i>
Age (years)	20.70 \pm 0.73	20.55 \pm 0.60	0.59	0.55
Grade-point average	16.10 \pm 1.15	16.84 \pm 1.37	1.57	0.22

SD: Standard deviation

Table 2: Between-group comparisons respecting the mean scores of the knowledge examinations

Group	Examinations, mean±SD		P ^a
	First	Second	
Lecture	16.21 ± 1.99	12.90 ± 2.64	0.001
FC	18.85 ± 0.83	17.47 ± 1.42	0.001
P ^b	0.001	0.001	

^aThe results of the paired-sample *t*-test; ^bThe results of the independent-sample *t*-test. SD: Standard deviation, FC: Flipped classroom

**Figure 1: The flow diagram of the study**

the lecture group and the FC with regard to the mean learning scores 1 week and 1 month after the instruction. This means that short-term and long-term effects of the two methods on learning were not similar and the impact of flipped instruction on learning lasted longer. The higher level of learning in the FG must have resulted from preclass preparation, active engagement in class, feedback from the teacher, and so on.

The findings of the present study are consistent with the findings of several previous studies, which reported that FC produced more positive effects than FC on learning.^[13-15] A study showed that FC significantly promoted learning and satisfaction among students in a pharmacology course.^[16] Similarly, a study into the effects of FC in a statistics course showed that students in the FC group had better performance in the final examination compared with their counterparts in the lecture group.^[17] Another study evaluated the effects of FC on students in a genetic, evolution, and biodiversity course and reported that although FC had no significant effects on learning outcomes, it was associated with students' greater engagement and more positive attitude toward learning.^[18] Moreover, a study evaluated the effects of FC on learning and satisfaction among dental students in a preclinical course on periodontal disease and reported that although all students preferred FC,

its effects did not significantly differ from the effects of traditional lecture.^[19] Another study into the effects of FC showed that students had a positive learning experience of FC and most of them preferred it over traditional lecture in which a large part of classroom time was allocated to the instructor's lectures.^[20] FC is a student-centered method in which students need to actively engage in the learning process.^[21,22] Such engagement helps them realize their potentials, improves their learning, and thereby, enhances their satisfaction.

Contrary to our findings, a study showed that students' satisfaction with FC was significantly lower than their satisfaction with lecture.^[11] This contradiction may be due to students' different learning styles and lack of time to cope with a new teaching method.

This study had two main limitations, i.e., the sample size of the study was rather small, and the study was conducted using a post-test only design. Of course, performing a pretest could indirectly provide participants in both groups with the course outline and objectives and encourage them to do self-study. Therefore, given the limitations of this study, it is recommended that further studies be conducted with a larger sample size. We also faced two main problems during the study, i.e., participants in the FC group did not know how to use the learning management system and we could not afford the costs of preparing and providing the FC-related content. The first problem was resolved through providing students with education about using the system, and the second problem was resolved by receiving financial support from the Isfahan University of Medical Sciences, Isfahan, Iran, and assistance from the Virtual Education Department of the university.

CONCLUSION

This study concludes that compared with traditional lecture, FC is associated with higher learning retention and student satisfaction. Therefore, it can be used as an alternative to traditional lecture to facilitate learning among students in medical sciences fields, particularly operating room.

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Conflicts of interest

There are no conflicts of interest.

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