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The effect of case-based teaching and flipped classroom methods in comparison with lecture method on learning and satisfaction of internship students in surgery

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Abstract:

INTRODUCTION: Teaching is one of the most important needs of human societies, and selecting the best method of teaching is so important to improve the teaching as well as learning of students. The purpose of this study was to determine the effect of case-based teaching (CBT) and flipped classroom methods in comparison with lecture method on students' learning and satisfaction at internship of Department of General Surgery, Isfahan University of Medical Sciences.

MATERIALS AND METHODS: This experimental study was performed on fifty medical surgery internship students in Isfahan University of Medical Sciences in 2017. Students were randomly divided into two groups of control group and intervention group. The data were collected by a posttest after holding every class and a researcher-made form for evaluating students' satisfaction after the end of the project. The results of this study were analyzed by SPSS 21 software using descriptive statistical methods (mean and standard deviation) and paired *t*-test.

RESULTS: The comparison of the mean posttest scores in the three classes showed that the mean scores of the students in the intervention group in the first and second sessions unlike the third session were higher than that in the control group; this difference was statistically significant in the first session (P = 005) and the third session (P = 0.002). Students' satisfaction with case-based learning method (4.03 ± 0.87) was higher than that of lecture method (2.88 ± 0.78).

CONCLUSION: In CBT and flipped classroom, students' learning and the quality of teaching were improved. In addition, students were more satisfied with this method in comparison with the lecture method. However, it should be noted that the success of using this teaching method depends on choosing the appropriate subject.

Keywords:

Case-based teaching, flipped classroom, lecture

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Introduction

Teaching and learning has always been one of the basic needs of the human community.[1] Selection of the most suitable and effective educational method is the most important factor of the educational progression and learning of learners.[2] Although the rate of learning of learners is influenced by various individual and environmental factors, the teaching method is certainly very important.[3,4] The role of the teacher is not just the transfer of information, but he/she should also facilitate learning process so that the student, with self-confidence as well as

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acquiring information, can make the best decision in similar cases.[5]

In the traditional method of teaching, the lecture method, students only receive information from the lecturer and try to remember them instead of trying to understand it. Critical thinking is a learning requirement that is not provided for students in the lecture method.[6]

Educational psychologists believe that learning will be effective when combined with the active participation of students in learning. There is evidence that students have a better clinical performance through problem-based learning.[7] Case-based teaching (CBT) method is one of the new methods of education in which students are taught according to a clinical scenario and measure their learning. Obviously, the success rate in this method depends on the quality of the proposed clinical scenario.[8] This kind of teaching begins with a real or hypothetical clinical description, and students become involved in the clinical problem, and thus they acquire the ability to think critically in real and sensitive situations and develop the ideas and skills necessary to become a physician having a sense of responsibility.[9] This approach improves the teaching and learning using trainees' knowledge of dealing with real clinical cases, and students can better understand the relationship between learning and clinical skills. CBT focuses on the clinical scenario, and bringing students in real conditions improves learning as well as the skills of thinking and creativity of students.[10-12] In this method, students appear to better remember the information.[13] Evidence suggests that students like the case-based educational method and believe that it improves their learning; teachers are also content with this educational method because they believe that by using this method, they can save time and they can also create dynamism and motivation among students and make student consider teaching interesting.

On the other hand, the other strategy that is emphasized today is the use of the flipped classroom. In the flipped classroom approach, students become relatively ready scientifically before the class using the specified references and they discuss the clinical case when they attend the classroom.[14]

Despite the high emphasis on the use of active methods in medical education, in most clinical departments, theoretical classes are held in the method of lecture, and therefore, the majority of students in these departments are not satisfied with the performance of the education. This problem is exacerbated by holding apprenticeship theory classes in inappropriate times, and students consider the theory educational plan as weak and tedious. In addition, in surgical departments, the professors go to the operating room in the morning and there is no medical round for all of the students. Therefore, the executives of the plan decide to make changes to the method of presenting the content of this course. Accordingly, when analyzing various studies that have been done about the impact of teaching methods in the form of flipped classrooms and CBT, their results suggest an increased learning and satisfaction of learners.[15,16] The aim of this study was to use the case-based and flipped classroom method for internship students in General Surgical Department and to measure the impact of these interventions on the rate of students' learning and satisfaction in this department.

Materials and Methods

This intervention was an experimental study that was performed on 136 medical surgery internship students in the General Surgical Department of Isfahan University of Medical Sciences in 2017. The intervention was conducted in such a way that from 36 sessions of theory classes, in three sessions of gallbladder and bile duct diseases, treating patients with trauma and familiarity with the general principles of plastic surgery by three different professors, students were divided into two groups of intervention (25 students) and control (25 students). The professor held the class in the lecture form for the control group at first, and then immediately continued the same topic of the class in the case-based and flipped classroom teaching method for the intervention group. In the intervention group, all of the students were ready scientifically before the class by studying the references provided by the General Surgery Group, Schwartz's Book. Six students were randomly selected by the professor for presentation. At the beginning of the class, professors put forward a clinical scenario according to the topic of the lesson and asked selected students how to deal with the cases, and the selected students, in accordance with the clinical case, requested some information and tests. And so, in the field of diagnosis and treatment, and how to deal with the actual clinical cases, the professors and students discussed diagnosis, treatment, and how to deal with real clinical cases. Because there were a lot of students in the classrooms, we used fish bowl method and finally, if necessary, corrective and supplementary information was provided by the professor.

The control group and intervention group were compared using a quiz in the end of each session. The quiz questions in both groups were similar, and there were four multiple-choice questions. At the end of the project, a satisfaction comparison test was held using a researcher-made tool; in fact, a satisfaction assessment form was given to the control group and the intervention group. The satisfaction assessment form for

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the control group included five questions (Cronbach's alpha = 0.88), and there were 12 questions for the intervention group (Cronbach's alpha = 0.96). The questions were about the impact of each of the lecture and case-based methods on acquiring critical thinking skills and problem-solving skills, increasing students' understanding of the relationship between theoretical courses and clinical skills, the degree of satisfaction of learners from each of the teaching methods. In addition, at the end of each session, there were interviews with the classroom professors, and they said their views on the strengths and weaknesses of lecture method and CBT method. Finally, the data were collected by SPSS software 21 ((IBM Corp, Armonk, NY, USA) and were analyzed using descriptive statistical methods (mean and standard deviation) and paired *t*-test.

Results

Fifty people participated in this project (response rate 100%); 42% of them were men (21 persons, 11 in the control group and 10 in the intervention group) and 58% were women (29 persons, 14 in the control group and 15 in the intervention group).

The comparison of the mean posttest scores in the three classes showed that the mean scores of the students in the intervention group in the first session (3.63 ± 0.5) were statistically significantly different with the first control group (3.08 ± 0.0.8) (*P* value== 0.005), and in the second session, in the intervention group, the mean scores (3.17 ± 0.77) were higher than the mean of the second control scores (2.88 ± 0.78), but there was no significant difference (*P* = 0.28). In addition, in the third session, the mean scores of students in the control group (3.40 ± 0.707) were higher than those of the intervention group (2.67 ± 0.87), and this difference was statistically significant (*P* = 0.002) [Table 1]. By performing covariance analysis and entering the subject as a covariant, the results showed that there is a relationship between the teaching method and the subject [Figure 1]. A comparative study of student satisfaction using lecture and CBT methods showed that students' satisfaction with case-based learning method (4.04 ± 0.84) was higher than lecture method (2.89 ± 0.79) [Table 2]. The mean and standard deviation of the answers to each of the questions of the satisfaction questionnaire are shown in Tables 3 and 4.

In an interview with the professors of the project at the end of the course, their degree of satisfaction with the CBT method was higher than the lecture method. Although the teachers believed that cognitive behavioral therapy (CBT) classes were more difficult and time-consuming for them, active participation of students in the CBT method would make teaching for them more enjoyable. An example of a statement of the professors is as follows:

Table 1: Mean and standard deviation of posttest scores in two groups in three sessions

Group	Mean±SD	*n*	*P*
L1			
Lecture	3.08±0.812	25	0.005
Case	3.63±0.495	24	
Total	3.35±0.723	49	
L2			
Lecture	2.88±0.781	25	0.28
Case	3.17±0.761	24	
Total	3.02±0.777	49	
L3			
Lecture	3.40±0.707	25	0.002
Case	2.67±0.868	24	
Total	3.04±0.865	49	

SD=Standard deviation

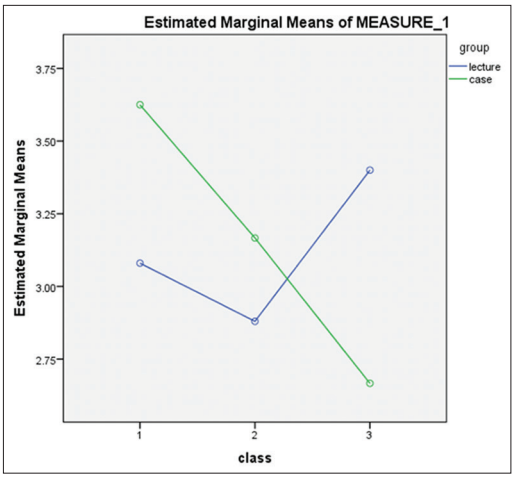

Figure 1: Covariate diagram between teaching method and posttest scores

Concerning the benefits of this method, one of the professors said: "*In the new method, active participation of student in the discussion is more*," and the other professors also said that "*Due to the participation and dynamism of students in this method, our motivation is also more to deliver the material.*"

Concerning the constraints of this method, one of the professors said that: "*In the lecture method, there is an opportunity to present all the material, but we cannot do so in the new method because it is time-consuming*," and another professor said that "*Only certain topics which can be considered as a case may be presented in this way, and all the topics cannot be presented in this way*."

Discussion

As the findings of the study showed, the rate of learning and the mean scores of students in the three classes was not the same; in the first class, the subject of dealing

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with the trauma patient and the rate of learning of the students participating in the CBT method and the flipped classroom were higher than the students in the lecture group. Many researchers have compared the two methods of CBT method and lecture method. Their results also indicate that the CBT method increases the quality of learning, increases students' dynamism, and also leads to obtaining higher scores.[17-24] The increase in the quality of learning in a group teaching method is also emphasized in the study performed by Frame *et al*.[25] In a study published by the American Society of Physiology in September 2013, the traditional teaching method was compared with the problem-solving method. In this study, two colleges were selected and in one of them, the curriculum was presented with a lecture method and in the other one, the curriculum was based on problem-solving. Sixty first-year medical students were selected; they learned respiratory physiology, their knowledge was examined using multiple-choice questions, and their skills were examined in the lab. Students scored higher in both tests using the curriculum based on problem-solving method.[26] In addition, Moffett and Mill investigated the flipped classroom and evaluated it using Kirkpatrick model and concluded that the students were more satisfied with the flipped classroom in terms of the reaction rate and had better performance in multiple-choice tests in terms of the learning rate.[27]

However, the mean scores of the students in the two groups of control and intervention in the second and third classes, the topics of bile duct diseases and the general principles of plastic surgery, indicate that there was no significant difference between the mean scores of the two groups in the second class, and the rate of students' learning in the lecture method was higher than the intervention group in the third class. Some of the other studies have also the same results. Whillier compared the effectiveness of the traditional method and the flipped classroom. He used this method to learn the lessons of nerve anatomy, and his research results showed that there was no significant difference in their final scores in the two groups.[28]

In a quasi-experimental design research, Jensen *et al*. compared an active flipped classroom with an active flipped classroom. They concluded that both methods are equivalent in learning and the learners were satisfied with both methods.[29] In this study, the different results obtained from the scores of the different sessions are due to the factors including the more specific references of the topic of treating with the patient with trauma compared to the third session, the general principles of plastic surgery, the lesser experience of the professor in the field of case-based training method at the third session, the inadequate time to study before the class for the third session, and differences in terms of holding classes. The difference in the scores of the intervention and control group at different sessions suggests that all clinical topics cannot be presented using a clinical case, as the teacher of the general principles of plastic surgery believed that this topic cannot be taught using a clinical case, and this result is also confirmed by the covariance test.

Regarding the comparison of students' satisfaction with the two teaching methods, our research showed that students' satisfaction with CBT method was significantly higher than the lecture method, and students preferred the new teaching method and described the new teaching method with terms such as motivating, more dynamism, more lasting learning, and not being tedious.

In an interview with the organizers of the project at the end of the course, we found that their degree of satisfaction with the CBT method was higher than the lecture method. In their study on the impact of teaching method of flipped classroom, Rose *et al*. and Tolks *et al*. showed that the quality of learning and satisfaction of learners has increased.[15,30]

Table 2: Mean and standard deviation of satisfaction with the teaching method

Group	Ls mean	Cs mean
Lecture		
Mean	2.8800	
n	25	
SD	0.78740	
Case		
Mean		4.0367
n		25
SD		0.87238

SD=Standard deviation, Ls=lecture satisfaction, Cs=case based satisfaction

Table 3: Frequency, mean, and standard deviation of answers to satisfaction inquiries in the control group

Items	Very high and high (%)	Medium (%)	Very low and low (%)	Mean±SD
1. The effect of the lecture method on critical thinking skills	36	36	28	3.08±1.07
2. The effect of the lecture method on problem-solving skills	20	36	44	2.8±1
3. The effect of the lecture method on enhancing your understanding of the relevance of theory lessons and clinical skills	20	48	32	2.92±0.95
4. The effect of lecture method on mastering the raised subject	20	48	32	2.88±0.72
5. How satisfied you are with the teaching method of the lecture	20	48	32	2.72±0.97

SD=Standard deviation

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Table 4: Frequency, mean, and standard deviation of answers to satisfaction inquiries in the intervention group

Items	Very high and high (%)	Medium (%)	Very low and low (%)	Mean±SD
1. The effect of CBT teaching method on critically thinking skills compared to lecture method	84	8	8	2.24±1.05
2. The effect of CBT method on problem solving skills compared to lecture method	84	12	4	4.24±0.83
3. The effect of CBT method on independent learning skills compared to lecture method	60	36	4	1±4 4±1
4. The effect of CBT method on enhancing your understanding of the relevance of theory lessons and clinical skills compared to lecture method	60	32	8	3.92±1.04
5. The effect of CBT method on mastering the raised subject compared to lecture method	56	28	16	3.76±1.13
6. The effect of CBT method on reducing the boring class compared to lecture method	72	20	8	4.12±1.01
7. The effect of CBT method on increasing sense of responsibility in dealing with real clinical cases compared to lecture method	64	16	20	3.8±1.26
8. Preliminary explanation of the CBT class process	64	12	24	3.64±1.22
9. Enough opportunity for prestudy	72	12	16	4.08±1.15
10. Sufficient ability to hold a session	68	24	8	4±1
11. The suitability of the discussed clinical scenario	92	4	4	4.36±0.76
12. Applicability of CBT method to other clinical courses	76	20	4	4.28±0.94

Cronbach's alpha for satisfaction inquiry of intervention group=0.95, Cronbach's alpha for satisfaction inquiry of control group=0.88. CBT=Case-based teaching

In a study on the articles related to flipped classroom, Haqqani *et al*. concluded that the flipped classroom is an educational method that includes two separate parts; these parts are individual direct education outside the classroom and group education inside the classroom. According to them, one of the advantages of this method is interactivity and one of the disadvantages of this method is spending more time and effort by the teacher.[31]

According to the findings of this research, we cannot certainly ignore the importance and impact of a good lecture in learning on learning. However, as the medical profession is a practical profession, it requires the acquisition of scientific–practical experiences and the higher level of involvement of the learners of this knowledge in identifying diseases and dealing with real cases. The CBT method and flipped classroom teaching method provide a good opportunity for learners to better imagine that they are in a real situation for dealing with patients and to perform better in similar clinical situations. The teachers should carefully select their teaching methods to provide conditions for improving students' critical thinking and their more active participation in classrooms. The teachers should provide the conditions required for a discussion to make the students more powerful. It is also recommended that this teaching method be evaluated and implemented in other clinical groups.

One of the strengths of this study was measurement of the effect of CBT and flipped classroom on learning and satisfaction method and also examined the effect of content. One of the limitations of this study is that the students of the intervention group may be informed of the questions of the first group, the control group; to prevent it, there was more serious control on the arrival and departure of the students in both groups. The other limitations of this study included the access of students to references in the control group before the sessions and the fact that we could not statistically analyze the impact of the professor as an important factor in the results of the intervention. Therefore, it is suggested that we should use a satisfaction assessment form to analyze the quality of teaching of the professors.

Conclusion

According to the above, our research results indicate that in CBT and flipped classroom, the quality of teaching was improved as well as students' satisfaction increased with this method than lecture method. Therefore, using this new method of teaching in other clinical courses can also be effective in improving students' learning. However, it should be noted that the success of using this teaching method depends on choosing the appropriate subject.

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Conflicts of interest

There are no conflicts of interest.

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