ORIGINAL ARTICLE

# USE OF THE FLIPPED EDUCATION MODEL IN CARDIOVASCULAR SYSTEM EXAMINATION

## Ters-Yüz Eğitim Modelinin Kardiyovasküler Sistem Muayenesinde Kullanımı

Serpil TOPCU[1], Cagla TOPRAK[2]

[1]Demiroğlu Bilim Üniversitesi, Florence Nigtingale, Hemşirelik Yüksekokulu, İstanbul, Türkiye.
[2]İstanbul Atlas Üniversitesi.

## ABSTRACT

**Objective:** The flipped classroom approach is based on shared responsibility for learning by students and teachers, empowering students to take an active role in the learning process. While there have been positive outcomes in the use of this model in nursing theoretical and practical courses, its active implementation within the educational system is limited. This study was planned to evaluate the effectiveness of the flipped education model in nursing students, specifically in the teaching of the "Cardiovascular System Examination" topic within the Health Assessment course. It is a comparative research study.

**Material and Methods:** In the comparative research design applied, 25 students taking the course were randomly assigned to the experimental and control groups. The flipped education model was applied to one group, integrating it into both theoretical and laboratory applications. Non-parametric tests were used for data analysis.

**Results:** It was observed that the theoretical and practical scores of the flipped education group were higher than those of the in-class group, but the difference was not statistically significant ($p>0.05$). The mean theoretical score in the in-class group was 74 ± 8.50, and the practical score was 73 ± 9.20, while in the flipped education group, the mean theoretical score was 77 ± 13.36, and the practical score was 74 ± 20.46.

**Conclusion:** The study concluded that the flipped education model is suitable for use in both theoretical and practical medical courses.

**Keywords:** *Education; Nursing; Flipped Classroom*

Serpil TOPÇU, Dr. Öğr. Ü. (0000-0003-1819-4221)
Çağla TOPRAK, Dr. Öğr. Ü. (0000-0002-7540-8575)

## ÖZET

**Amaç:** Ters yüz sınıf yaklaşımı, öğrencilerin ve öğretmenlerin öğrenme konusundaki sorumluluğunu paylaştığı bir yaklaşıma dayanır ve öğrencilere öğrenme sürecinde aktif bir rol alma fırsatı sunar. Modelin hemşirelik teorik ve uygulama derslerinde kullanımı ve etkinliğine dair olumlu çıktılar olmasına rağmen eğitim sistemi içinde aktif kullanımı sınırlıdır. Bu çalışma, hemşirelik öğrencilerinde, sağlığı değerlendirme dersi kapsamında yer alan "Kardiyovasküler Sistem Muayenesi" konusunun öğretiminde ters yüz eğitim modelinin etkinliğinin değerlendirilmesi amacıyla planlamıştır.

**Gereç ve Yöntemler:** Karşılaştırmalı araştırma tasarımı uygulanan çalışmada dersi alan 25 öğrenci randomize olarak çalışma ve kontrol grubuna atanmış, bir gruba ters-yüz eğitim modeli uygulanmıştır. Model hem teorik hem de laboratuvar uygulamasına entegre edilerek kullanılmıştır. Çalışma verilerinin analizinde non-parametrik testler kullanılmıştır.

**Bulgular:** Ters yüz eğitim grubun teorik ve uygulama puanlarının sınıf içi gruptan daha yüksek olduğu ancak aralarında farkın anlamlı olmadığı görüldü ($p>0,05$). Sınıf İçi Grup (SİG) ortalama teorik puanının 74 ± 8,50, ortalama uygulama puanının 73 ± 9,20 olduğu, Ters Yüz Grup (TYG) ortalama teorik puanının 77 ± 13,36, ortalama uygulama puanının ise 74 ± 20,46 olduğu saptandı.

**Sonuç:** Ters-yüz eğitimin sağlıkla ilişkili teorik ve uygulamalı derslerde kullanıma uygun olduğu sonucuna ulaşıldı.

**Anahtar Kelimeler:** *Eğitim; Hemşirelik; Ters Yüz Sınıf*

**İletişim:**
Dr. Öğr. Ü. Serpil TOPÇU
Demiroğlu Bilim Üniversitesi Florence Nigtingale Hemşirelik Yüksekokulu
Yazarlar Sok. No:17 34394 Esentepe Şişli/İstanbul

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## INTRODUCTION

Nursing is an applied healthcare discipline encompassing theoretical knowledge and skills. Due to this characteristic, nursing education aims to provide students with cognitive, sensory, and psychomotor learning outcomes (1). Over the years, nursing educators have continued to use different teaching methods to achieve these outcomes by following evidence-based research results and technological advancements (2,3). The World Health Organization (WHO) recommends in the "Nurse Educator Core Competencies" report that nurse educators facilitate active learning and utilize appropriate information technology and learning materials in the education process (4). However, research indicates that both in our country and globally, many universities offering nursing education often prefer traditional teaching methods, and nurse educators do not frequently employ new teaching styles (5, 6). When the literature is reviewed, it is noted that the traditional teaching method leads to inadequacies in the development of problem-solving and critical thinking skills in students and in their collaboration with patients, their families, and team members (7).

One of the educational methods that can be used as an alternative to traditional teaching methods, which facilitates the integration of technology into the classroom, is the "Flipped Learning" model developed by Bergmann and Sams in 2007. The model derives its name from the concept of "flipping" traditional education, where activities typically conducted in the classroom are performed at home, and tasks traditionally completed at home are carried out in the classroom (8). The flipped learning model, which requires active student participation, encompasses both out-of-class and in-class applications.

Outside the classroom, educational materials prepared by the instructor are presented to students before the lesson, and the time allocated for the class in the weekly schedule is devoted to activities and reinforcement that help students understand the subject. Unlike the traditional teaching model, this model encourages students to become familiar with the course material in advance, engage in more interaction in the classroom, and participate in practical activities. In the flipped learning model, students are provided with a more flexible learning environment, and it offers educators the opportunity to determine their educational materials more freely (9,10). The model is stated to be adaptable to both practical and theoretical course designs (1,11).

In theoretical courses, the model allows students to use innovative online resources, develop their individual responsibility, research topics before coming to class, and come to class better prepared by taking notes from videos (7,12,13). In practical courses, it has many positive effects, such as active learning, taking responsibility, and effective in-class communication (14,15). In summary, the advantages of flipped learning include enabling each student to learn at their own pace and according to their needs, making in-class learning more active and effective through pre-class preparation, and allowing students to plan their own learning journeys and take responsibility, essentially transitioning from passive learning to active learning (16,17). In studies using the flipped learning method with samples consisting of medical and nursing students, it has been observed that students embrace learning with this method, prefer its use in classes, manage their time more efficiently, and find it effective in achieving their goals (15,18,19). However, some researchers have not found the flipped classroom model superior to traditional models in terms of student exam results and satisfaction (20-22). It is believed that increasing research on the method, which has both positive and negative outcomes in the literature, will provide evidence for educators to decide to use the flipped method. It has been observed that the number of studies on the use of the flipped learning model in both theoretical and practical courses is limited in the national literature. In this context, we designed this study to deliver the content of the "Health Assessment" course, which includes the topic of cardiovascular system examination, using the flipped learning model and evaluating its effectiveness. This study will examine the outcomes of using the flipped learning model in both theoretical and practical classes.

## MATERIALS AND METHODS

This study is a comparative research conducted to evaluate the effectiveness of the flipped learning model,

compared to the traditional teaching method, in teaching the subject of "Cardiovascular System Examination" to nursing students within the scope of the "Health Assessment" course. Hypotheses of the Research:

H1: In the experimental group using the flipped learning model, "Cardiovascular System Examination Knowledge Form" scores are higher compared to the control group.

H2: In the experimental group using the flipped learning model, "Cardiovascular System Examination Practical Assessment Form" scores are higher compared to the control group.

The research was conducted at the Demiroglu Bilim University school of nursing school, english nursing department, between December 2022 and January 2023. There were a total of 25 students (sophomore students) registered for the course. All students volunteered to participate in the research. Students who were 18 years and older, who were taking the "Health Assessment" course for the first time, and who had not previously used the flipped learning model were included in the research. Student Information Form (8 questions), Cardiovascular System Examination Knowledge Assessment Form (15 questions), Cardiovascular System Examination Practical Assessment Form (22 questions) and Flipped Learning Model Evaluation Form (10 questions) was utilized for data collection (23). Students were provided with information about the purpose and method of the study, and written consent was obtained from the students who agreed to participate. After obtaining consent, the "Student Information Form" was administered to the entire sample group. Subsequently, the students were divided into experimental and control groups (12 Control, 13 Experimental) using a simple randomization method. The method of drawing lots was used to form the experimental and control groups. To conduct the research, permission was obtained from the Clinical Research Ethics Committee (Decision No: 08.11.2022/2022-22-03). The research flowchart is presented in Figure 1.

Instructor in the preparation phase: Educational slides to be used in the class were prepared, and two recommended latest edition books related to health assessment (in Turkish and English) were suggested to enhance the understanding of the subject. Additionally, a cardiovascular examination video was prepared, including the steps of the examination to aid in practical understanding. The educational materials have been prepared with the aim of achieving the following learning outcomes; Students are expected to possess knowledge of subjective findings in cardiovascular diseases, discern auscultation areas and anatomical positions of the heart, differentiate between normal and abnormal heart sounds, and demonstrate an understanding of both subjective and objective findings in peripheral artery/vein diseases and beside understanding emergency symptoms in cardiovascular diseases. The educator has been actively conducting the course for 10 years. Additionally, opinions on the content of the educational materials were obtained from two experts.

In the Flipped Learning Group (FLG), the students and educational materials were shared through the "ITS learning" system, which is used by the university for online education and student tracking. Students in the experimental group were asked to prepare for the class by watching the uploaded course materials, the slides used in the traditional method, and the physical examination application video. All educational materials were uploaded to the system and made available for student use one week before the scheduled class time. The system was used to monitor students' use of educational materials. It was decided to exclude students who showed no adherence to the educational materials from the research study. Since all students in the experimental group followed the educational materials, no students were excluded from the research. After the one-week preparation period, separate from the control group, a class session was scheduled for the "Cardiovascular System Examination" topic. The topic was discussed in the classroom using a question-answer method, and any points that were not clear were reinforced. This class lasted for approximately half an hour. After completing the topic, the "Cardiovascular System Examination Knowledge Assessment Form" was administered to the students. After the theoretical class, students were given an additional week to prepare for the laboratory practice, and after this period, a skills assessment was conducted. On the day of cardiovascular system

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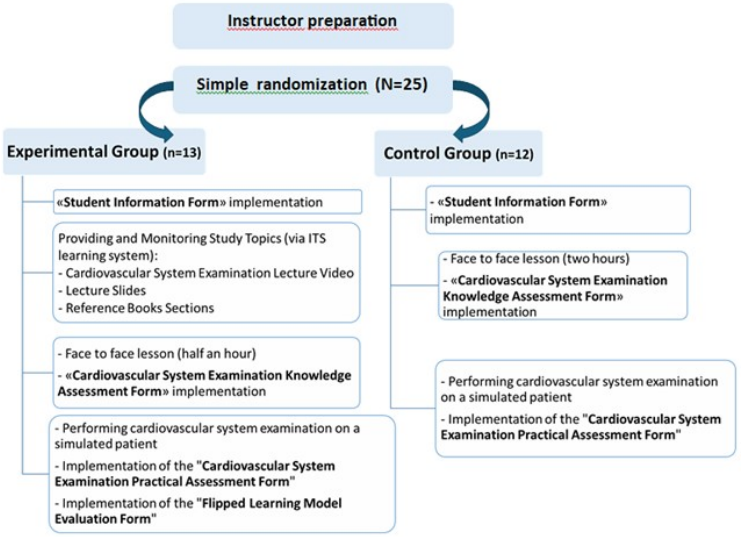
**Figure 1.** Research Flowchart




examination practice, students were taken to the skills laboratory one by one and performed cardiovascular examination on a volunteer simulated patient (a volunteer student not included in the sample group). The researcher filled out the "Cardiovascular System Examination Practical Assessment Form" simultaneously with the examination. Finally, students in the experimental group were administered the "Flipped Learning Model Evaluation Form."

For the In-Class Group (ICG), the "Cardiovascular System Examination" topic was taught by the instructor using educational slides during the regularly scheduled weekly class time. Interactive teaching techniques (brainstorming, discussion, problem-solving) were used for all topics in the Health Assessment course. The allocated time for the course is two class hours. All resources (about cardiovascular system examination) shared with the FLG were also shared with the control group before the class. Students were given the choice to watch and read these resources, and it was not mandatory. Similar to the FLG, students were given one week to prepare for the laboratory practice after the theoretical class, and the skills assessment was conducted at a different time from the experimental group. Students in the control group performed the cardiovascular system examination on a volunteer simulated patient in the skills laboratory one by one, and the researcher evaluated the examination simultaneously using the "Cardiovascular System Examination Practical Assessment Form."

The data obtained from the research were analyzed using computer software (SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago, SPSS Inc.). Descriptive statistical methods were used for the analysis of the study data. Due to the data not showing a normal distribution, non-parametric tests were used for comparative analyses. Mann-Whitney U test was used to compare two independent groups, Kruskal-Wallis test was used to determine significant differences among three or more independent groups and sign test was used to determine whether there is a significant difference between two groups. p-value of $<0.05$ was considered as the statistical significance threshold. To determine the reliability of the cardiovascular examination theoretical knowledge assessment questions, item difficulty index and discrimination index were examined. As a result of the analysis, it was determined that there were two difficult questions, five questions of moderate difficulty, and the rest of the questions were in the easy category. Examining the discrimination index of the items, all questions were included as each item achieved a score exceeding 0.20 (24). There was no difference in the percentage of correct answers to the questions between the two groups ($p > 0.05$) (Table 1).

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**Table 1.** Cardiovascular Examination Theoretical Knowledge Assessment Form Item Difficulty and Item Discrimination Index Values (n=25)

| Question | Correct answer- ICG | Correct answer- FLG | Correct answer Total | Difficulty Index | Discrimination Index | p* |
|---|---|---|---|---|---|---|
| | n | n | n | | | |
| 1. | 10 | 9 | 19 | 0,54 | 0,31 | 0,387 |
| 2. | 10 | 9 | 19 | 0,75 | 0,53 | 0,586 |
| 3. | 7 | 8 | 15 | 0,71 | 0,57 | 0,933 |
| 4. | 9 | 10 | 19 | 0,75 | 0,47 | 0,731 |
| 5. | 5 | 8 | 13 | 0,38 | 0,48 | 0,454 |
| 6. | 3 | 8 | 11 | 0,32 | 0,30 | 0,104 |
| 7. | 7 | 9 | 16 | 0,67 | 0,35 | 0,723 |
| 8. | 9 | 12 | 21 | 0,58 | 0,31 | 0,339 |
| 9. | 9 | 11 | 20 | 0,57 | 0,33 | 0,674 |
| 10. | 11 | 11 | 22 | 0,78 | 0,33 | 0,586 |
| 11. | 11 | 12 | 23 | 0,79 | 0,30 | 0,779 |
| 12. | 11 | 12 | 23 | 0,42 | 0,31 | 0,779 |
| 13. | 9 | 8 | 17 | 0,45 | 0,44 | 0,674 |
| 14. | 10 | 11 | 21 | 0,79 | 0,63 | 0,533 |
| 15. | 9 | 8 | 17 | 0,78 | 0,30 | 0,674 |

p-*Mann-WhitneyU test, ICG: In Class Group, FLG: Flipped Learning Group.

## RESULTS

It was determined that there was no difference between the ICG and FLG groups in terms of introductory information ($p > 0.05$). It was found that students in the FLG needed an average of 106.6 ± 26.4 minutes (ranging from 60 to 150 minutes) to understand the topic and fulfill their responsibilities, while students in the ICG needed an average of 103.3 ± 26.0 minutes (ranging from 80 to 150 minutes). The difference was statistically significant between the groups ($p < 0.05$) (Table 2).

When examining Table 3, it was found that the theoretical score of the ICG was 74 ± 8.50, and the practical score was 73 ± 9.20. For the FLG, the theoretical score was 77 ± 13.36, and the practical score was 74 ± 20.46. The flipped learning group got higher scores in both areas compared to the in-class group, but the difference between was not statistically significant ($p > 0.05$) (Table 3).

It was determined that there was no difference in the results of cardiovascular examination practice between the experimental and control groups (Table 4).

When examining the opinions of the FLG about the model, it was determined that students found the planning of the lesson video to be good, it was sufficient in understanding the topic, they found the reinforcement of the topic in the classroom effective, and they found all the study materials useful. Students expressed a preference for taking the Health Assessment course and all other theoretical courses with the flipped learning model, but they were undecided about practical courses, with about half of them being unsure (Table 5).

## DISCUSSION

In this study, we examined the effects of implementing the flipped classroom model in both a practical and theoretical course. The flipped learning model is reported to assist students in assuming responsibility for their learning, enhancing self-control levels, and consequently advancing their learning skills while fostering a lifelong learning habit (7,25). In our study, it was found that students had similar pre-class preparation conditions and sometimes came prepared to the classes (Table 2) ($p>0.05$). Being prepared for class is influenced by various factors such as students' individual characteristics, past study habits, workload, and motivation (26). Educators desire their students to

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**Table 2.** Distribution of the Demographic Data (n=25)

| | Groups | | | | | | |
|---|---|---|---|---|---|---|---|
| | ICG[a] | | FLG [b] | | Total | | |
| | n | % | n | % | n | % | p |
| Age (Main±SD) | 20.54± 0.967 | | 20.41± 0.900 | | 20.48± 0.918 | | 0.100* |
| GPA[c] point (Main±SD) | 2.02± 0.495 | | 2.18 ± 0.434 | | 2.10± 0.517 | | 0.388* |
| Gender | | | | | | | 0.100* |
| Women | 11 | 91.7 | 13 | 100 | 24 | 96 | |
| Men | 1 | 8.3 | - | - | 1 | 4 | |
| Graduation | | | | | | | 0.846** |
| Regular High School | 1 | 8.3 | - | - | 1 | 4 | |
| Anatolian/Science High School | 9 | 75.0 | 12 | 93.3 | 21 | 84 | |
| Health College | 2 | 16.7 | 1 | 7.7 | 3 | 12 | |
| The ability to read the course notes provided by the instructor before the “Health Assessment” course. | | | | | | | |
| Never | 1 | 8.3 | - | - | 1 | 4 | 0.803** |
| Sometimes | 10 | 83.3 | 11 | 84.6 | 21 | 84 | |
| Always | 1 | 8.3 | 2 | 15.4 | 3 | 12 | |
| The status of watching the videos recommended by the instructor before the “Health Assessment” course. | | | | | | | |
| Never | 1 | 8.3 | - | - | 1 | 4 | 0.064** |
| Sometimes | 6 | 50.0 | 9 | 69.2 | 15 | 60 | |
| Always | 5 | 41.7 | 4 | 30.8 | 9 | 36 | |
| Time spent for course preparation (minutes). | 103.3±26.0 (80-150 min) | | 106.6±26.4 (60-150 min) | | | | 0.032* |

aICG-In Class Group, bFLG- Flipped Learning Group, c GPA- Grade Point Average (0- 4 point), *Mann-WhitneyU test, **Kruskal Wallis test

**Table 3.** Students' Theoretical and Practical Scores for Cardiovascular Assessment (n=25)

| Main Point | Groups | | p* |
|---|---|---|---|
| | ICG[a] | FLG[b] | |
| Theoretical (mean±SD[c]) (min-max) | 74 ± 8.50 (54-86) | 77 ± 13.36 (42-94) | 0.344 |
| Practical (mean±SD) (min-max) | 73 ± 9.20 (58-88) | 74 ± 20.46 (16-100) | 0.388 |

aICG-In Class Group, bFLG- Flipped Learning Group, cStandart Deviation, p- Sign test

arrive prepared for class, yet in the traditional teaching method, class preparation is left to the individual preference of the student. It was found that all students in the experimental group were able to adapt to the flipped learning model's requirement of being prepared for class and fulfilling their responsibilities. The study found no significant difference in the theoretical knowledge and application levels of cardiovascular system examination between the experimental and control groups (Table 3). According to the results of a meta-analysis conducted by Tan et al., there is strong evidence in favor of the flipped classroom, indicating that students in flipped classrooms outperform traditional classroom students in terms of knowledge, skills, and individual learning (10). Another study, including 13 studies,

**Table 4.** Cardiovascular Examination Application Results (n=25)

| | ICG | | | | | | FLG | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Done | | Not done | | Incomplete | | Done | | Not Done | | Incomplete | | p |
| | n | % | n | % | n | % | n | % | n | % | n | % | |
| SUBJECTIVE DATA | | | | | | | | | | | | | |
| Chest Pain | 12 | 100 | - | - | - | - | 10 | 76.9 | 2 | 15.7 | 1 | 7.7 | |
| Dyspnea | 11 | 91.7 | - | - | 1 | 8.3 | 13 | 100 | - | - | - | - | |
| Orthopnea | 10 | 83.3 | 2 | 16.7 | - | - | 13 | 100 | - | - | - | - | |
| Nocturia | 9 | 75.0 | 3 | 25.0 | - | - | 10 | 76.9 | 2 | 15.7 | 1 | 7.7 | p>0.05 |
| Fatigue | 8 | 66.7 | 3 | 25.0 | 1 | 8.3 | 10 | 76.9 | 3 | 23.1 | - | - | |
| Cyanosis | 7 | 58.3 | 3 | 25.0 | 2 | 16.7 | 10 | 76.9 | 3 | 23.1 | - | - | |
| Chronic Illnesses | 12 | 100 | - | - | - | - | 9 | 69.2 | 4 | 30.8 | - | - | |
| Anemia | 9 | 66.7 | 4 | 33.3 | | | 9 | 69.2 | 4 | 30.8 | - | - | |
| Exercise Tolerance | 12 | 100 | - | - | - | - | 10 | 76.9 | 3 | 23.1 | - | - | |
| Coldness/Tingling Extremities | 7 | 58.3 | 5 | 41.7 | - | - | 10 | 76.9 | 3 | 23.1 | - | - | |
| OBJECTIVE DATA | | | | | | | | | | | | | |
| Vital signs | | | | | | | | | | | | | |
| • Body Weight/Height | 5 | 41.7 | 6 | 50.0 | 1 | 8.3 | 7 | 53.8 | 6 | 46.2 | - | - | |
| • Blood Pressure | 8 | 66.7 | 3 | 25.0 | 1 | 8.3 | 10 | 76.9 | 3 | 23.1 | - | - | |
| • Pulse Rate | 11 | 91.7 | - | - | 1 | 8.3 | 11 | 84.6 | 2 | 15.4 | - | - | p>0.05 |
| • Respiration | 6 | 50.0 | 5 | 41.7 | 1 | 8.3 | 8 | 61.5 | 5 | 38.5 | - | - | |
| • Body Temperature | 5 | 41.7 | 5 | 41.7 | 2 | 16.6 | 8 | 61.5 | 5 | 38.5 | - | - | |
| • Pain | 6 | 50.0 | 5 | 41.7 | 1 | 8.3 | 10 | 76.9 | 3 | 23.1 | - | - | |
| Pulse | | | | | | | | | | | | | |
| • Carotid | 11 | 91.7 | 1 | 8.3 | - | - | 11 | 84.6 | 1 | 7.7 | 1 | 7.7 | |
| • Temporal | 10 | 83.3 | 2 | 16.7 | - | - | 12 | 92.3 | 1 | 7.7 | - | - | |
| • Brachial | 10 | 83.3 | 2 | 16.7 | - | - | 13 | 100 | - | - | - | - | |
| • Radial | 12 | 100 | - | - | - | - | 13 | 100 | - | - | - | - | p>0.05 |
| • Femoral | 10 | 83.3 | 2 | 16.7 | - | - | 13 | 100 | - | - | - | - | |
| • Popliteal | 10 | 83.3 | 2 | 16.7 | - | - | 10 | 76.9 | 2 | 15.7 | 1 | 7.7 | |
| • Posterior Tibialis | 8 | 66.7 | 4 | 33.3 | - | - | 10 | 76.9 | 1 | 7.7 | 2 | 15.7 | |
| • Dorsalis Pedis | 11 | 91.7 | 1 | 8.3 | - | - | 11 | 84.6 | 1 | 7.7 | 1 | 7.7 | |
| Oscultation | | | | | | | | | | | | | |
| • Aortic Area | 11 | 91.7 | 1 | 8.3 | - | - | 12 | 92.3 | 1 | 7.7 | - | - | |
| • Pulmonic Area | 11 | 91.7 | 1 | 8.3 | - | - | 12 | 92.3 | 1 | 7.7 | - | - | |
| • Erb's Point | 10 | 83.3 | 1 | 8.3 | 1 | 8.3 | 11 | 84.6 | 1 | 7.7 | 1 | 7.7 | p>0.05 |
| • Tricuspid Area | 11 | 91.7 | 1 | 8.3 | - | - | 10 | 76.9 | 1 | 7.7 | 2 | 15.7 | |
| • Mitral Area/Apex | 12 | 100 | - | - | - | - | 11 | 84.6 | 2 | 15.4 | - | - | |
| Radial Pulse | 8 | 66.7 | 4 | 33.3 | - | - | 6 | 46.2 | 6 | 46.2 | 1 | 7.7 | |
| Heart Rate from Apex | 6 | 50.0 | 6 | 50.0 | - | - | 7 | 53.8 | 5 | 38.5 | 1 | 7.7 | |
| Peripheral Circulation | 6 | 50.0 | 6 | 50.0 | - | - | | | | | | | |
| Capillary Refill | 11 | 91.7 | 1 | 8.3 | - | - | 11 | 84.6 | 2 | 15.4 | - | - | p>0.05 |
| • Skin Color | 6 | 50.0 | 6 | 50.0 | - | - | 10 | 76.9 | 3 | 23.1 | - | - | |
| • Nail Structure | 7 | 58.3 | 5 | 41.7 | - | - | 10 | 76.9 | 3 | 23.1 | - | - | |
| • Allen's Test | 12 | 100 | - | - | - | - | 11 | 84.6 | 2 | 15.4 | - | - | |
| • Varicose Vein | 7 | 58.3 | 5 | 41.7 | - | - | 11 | 84.6 | 1 | 7.7 | 1 | 7.7 | |
| • Edema | 11 | 91.7 | 1 | 8.3 | - | - | 10 | 76.9 | 3 | 23.1 | - | - | |
| • Homan's Sign | 8 | 66.7 | 4 | 33.3 | - | - | 11 | 84.6 | 2 | 15.4 | - | - | |
| • Hair Distribution | 5 | 41.7 | 7 | 58.3 | - | - | 7 | 53.8 | 5 | 38.5 | 1 | 7.7 | |

p- Mann-WhitneyU test, Kruskal vallis test

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**Table 5.** Students' Evaluations of the Flipped Classroom Teaching Model (n=13)

| | n | % |
|---|---|---|
| Was the short lesson video well-planned? | | |
| Yes | 12 | 92.3 |
| No | - | - |
| Partially | 1 | 7.7 |
| Did the short lesson video provide sufficient understanding of the topic? | | |
| Yes | 8 | 61.5 |
| No | - | - |
| Partially | 5 | 38.5 |
| Did in-class reinforcement help you understand the subject? | | |
| Yes | 11 | 84.6 |
| No | - | - |
| Partially | 2 | 15.4 |
| Which of the provided resources was most effective in helping you understand the topic? | | |
| Short video | 3 | 23.1 |
| Lecture slides | 3 | 23.1 |
| Reading material | 2 | 15.4 |
| All of the above | 5 | 38.5 |
| Would you like to cover all the topics of the "Health Assessment" course using this method? | | |
| Yes | 10 | 76.9 |
| No | 3 | 23.1 |
| Would you like this method to be used in practical classes? | | |
| Yes | 6 | 46.2 |
| No | 7 | 53.8 |
| Would you like this method to be used in all other courses? | | |
| Yes | 8 | 61.5 |
| No | 5 | 38.5 |

concluded that the flipped classroom model improved student exam scores, course performance, and satisfaction (27). Similarly, a systematic analysis conducted by Presti and colleagues, compiling data from 13 studies, found positive outcomes for the flipped classroom approach (28). In a review by Betihavas et al., which included 21 studies on the use of the flipped learning model in nursing education, the flipped classroom showed neutral or positive academic results in higher education in nursing (12). In our study, one of the reasons for the similar theoretical exam scores between the two groups is believed to be the fact that the teaching process in the ICG was not entirely traditional. In the course's teaching process, educational materials such as internet resources, videos, and other materials related to each topic were shared with the students before the class, and interactive learning methods were used during the class. Another possible reason for the lack of difference between the two groups may be the sharing of all educational materials with both groups, as well as the adaptation to self-learning and distance education methods due to the pandemic. We also believe that the high motivation of all students to participate in this new teaching method is another contributing factor.In the literature, there are limited studies related to nursing practices, and while some of these studies indicate that the flipped group had higher application scores,

there are also research results that state no difference in application performance (1,20,21,29-32). When we examined the results of cardiovascular examination practice in our study, we found that similar results were obtained in the experimental and control groups, and there was no significant difference between the two groups (Table 3). Furthermore, when the individual application steps were examined, it was observed that both groups remembered and performed all the procedures with a high success rate (Table 4). Students were informed that the theoretical and practical exam results would not be reflected in the course grade before the study. The similarity in results is attributed to all students' desire to learn the cardiovascular examination steps, their reluctance to make mistakes or omissions during the laboratory application, and the creation of a competitive atmosphere between the groups. The varying research results on the effectiveness of flipped learning in practical lessons suggest the need for more research with a higher level of evidence on this topic.

The students have expressed their preference for the use of the flipped learning model in theoretical courses such as the "Health Assessment" course and other theoretical courses (Table 5). Different educational systems or cultural backgrounds can influence the effectiveness of the flipped classroom method and student preferences (33,34). In the Turkish education system, students receive education using traditional teaching methods until university, with exceptions. It was determined that all the students who participated in the study attended a course where the flipped learning model was used for the first time. Students' satisfaction with this method, where they actively participate, can be independent, plan their own study pace, are not obligated to in-class learning, and increase student-teacher interaction, is an expected result.

When we discuss negative aspects related to the method; While the literature often discusses the positive outcomes of the flipped classroom model (17,27), it is also noted that there are shortcomings in measuring changes in nursing students' knowledge, skills, and attitudes (28). In a meta-analysis conducted by Njie and colleagues, they found that mixed results were obtained due to the non-experimental nature of the studies, the use of various methods within the classroom, and the use of the method in a single class (27).

Another negative aspect of the method mentioned in the literature is that students spend more time preparing outside the classroom (11,18,22). Similarly, in our experimental group, it was determined that the FLG spent more time than the ICG ($p<0.05$) (Table 2). This result is listed among the drawbacks of the method in the literatüre (17,26). Nevertheless, we posit that dedicating a specific time to class preparation, a requirement imposed by the flipped classroom method, should not be viewed negatively concerning the attainment of the course's learning outcomes. In addition to this, students have expressed that they felt an increase in their workload, a sense of distancing from the instructor, and concerns about time management (27,35). Furthermore, students are reluctant to abandon the traditional teaching approach that requires less active student participation (35).

From the perspective of the educator, there are negative aspects associated with the method as well. These include the additional time required for integrating each topic into the method compared to the traditional approach, the necessity of ensuring active student participation, and the need for educators to be willing to create enriched lesson plans (10,17). Moreover, the institution where the method is to be used and the students need to have an appropriate technological infrastructure, and educators should be proficient in using technology without encountering issues. In studies where the method is used, students have reported issues related to limited internet access, system problems preventing them from accessing video recordings, and infrastructure problems (5,11,27).

Finally, it's important to note that research on the long-term effectiveness of the method in practical courses is lacking in the literature. Our experimental group indicated that they did not prefer the use of the flipped model in practical courses (Table 4). Nursing practices require learning accurately, comprehensively, and without errors. It is believed that the reason students do not prefer the method in practical courses is due to their concerns about acquiring incorrect or incomplete information when learning on their own.

This study has several limitations. It was conducted

with a small group and applied to a single subject. The small size of the groups may have made it easier to detect unprepared students, potentially increasing their motivation for the study. Applying the method to only one subject might not provide sufficient insight into students' adaptability and preferences for the method when used for an entire course or over a longer duration. The monitoring of educational materials in the intervention group was facilitated through the ITS system. It is noteworthy, however, that the system lacks the capability to assess the extent to which students genuinely derived benefits from the resources. Furthermore, we cannot assert with absolute certainty that the interaction between the two groups was entirely restricted

## CONCLUSION

Upon examining the results of our study, it was found that both of our hypotheses were rejected, indicating that FLGs' theoretical and practical scores were not higher than ICGs'. However, the fact that students were more active while educators played a guiding role in the flipped classroom model and that the results were similar for both groups is a significant finding suggesting the effectiveness of the method. When examining the theoretical and practical exam results, which measure learning, it was observed that there was no significant difference in scores between the self-directed learning group and the instructor-guided learning group. In line with these results, it could be stated that the flipped classroom model has encouraged self-directed learning among the participating students. This finding suggests that flipped classrooms can be used to enhance academic performance and can be integrated into both theoretical and practical nursing education. Nevertheless, due to the limitations discussed earlier, additional studies with larger samples and different theoretical and practical nursing courses are needed to confirm our findings.

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