The Learning Effects of Flipped Classroom Model on Nursing Student's Vital Signs Skills: A Quasi-Experimental Study

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Abstract

Aim: The aim of the study is evaluated to the effect of the education with the flipped classroom class learning model in nursing psychomotor and cognitive and skills

Method: A quasi experimental design was used with intervention (n=40) and comparison group (n=40), pre-test-post-test measures in the study. The experimental group (n=40) received a flipped classroom learning approach along with vital sings modules with learning and practicing the required, whereas the control group (n=40) received traditional classroom instruction. A knowledge test and a skills checklist were used to assess student performance.

Results: The highest scores in post-test knowledge exam and skills exams were received by students who experienced flipped classroom education group ($\bar{X}$=62.15±16.55; $\bar{X}$=45.25±14.77, respectively). In addition, when the psychomotor skill test post-test total scores between the groups were examined, it was found that the experimental group had higher scores than the control group ($\bar{X}$=38.92±0.85, $\bar{X}$=30.79±1.41 respectively).

Conclusion: The utilization of the flipped class model in nursing education was found to positively affect both theoretical knowledge and psychomotor skill acquisition.

Keywords: Nursing, education, flipped classroom, psychomotor skills.

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ETHICAL STATEMENT: The data was collected after the approval of the Girne American University Ethical Committee (Ethical Committee number and date: 10.02/19-07.03.2019).

Ters Yüz Sınıf Modelinin Hemşirelik Öğrencilerinin Yaşamsal Belirti Becerileri Üzerindeki Öğrenme Etkileri: Yarı Deneysel Bir Çalışma

Öz

Amaç: Bu çalışmanın amacı, ters yüz sınıf sınıf öğrenme modeli ile verilen eğitimin hemşirelik psikomotor, bilişsel ve becerilerine etkisini değerlendirmektir.

Yöntem: Çalışmada yarı deneysel deney (n=40) ve kontrol gruplu (n=40), ön son test ölçümleri olan bir bir tasarım kullanıldı. Deney grubu yaşamsal bulgular modülünde teorik ve pratik öğretimde ters yüz eğitim modeli ile eğitim alırken, kontrol grubunda sadece geleneksel öğretim modeli ile eğitim aldılar. Öğrenci performanslarını değerlendirmek için bir bilgi testi ve beceri kontrol listesi kullanıldı.

Bulgular: Post-test bilgi sınavı ve beceri sınavlarında en yüksek puanları ters yüz sınıf eğitimi alan öğrenciler aldı (sırasıyla $\bar{X}$ =62.15±16.55; $\bar{X}$ =45.25±14.77). Ayrıca gruplar arası psikomotor beceri sınavı post-test toplam puanları incelendiğinde, deney grubunun kontrol grubuna göre daha yüksek puanlar aldığı bulundu (sırasıyla $\bar{X}$=38.92±0.85, $\bar{X}$=30.79±1.41).

Sonuç: Ters yüz sınıf modelinin hemşirelik eğitiminde kullanılmasının hem teorik bilgileri hem de psikomotor beceri kazanımını olumlu yönde etkilediği bulundu.

Anahtar Sözcükler: Hemşirelik, eğitim, tersyüz sınıf, psikomotor beceri.

Introduction

Due to the changing patient profile, developing health care technologies, and increasing quality service demands in recent years, health care institutions have become an increasingly complex environment. Nursing students must have high-level cognitive skills such as problem-solving and critical thinking to adapt to this change after graduation[1,2]. On the other hand, it does not seem possible to educate nurses of the desired quality with traditional education models where the trainer still used in nursing education is actively in the center, the student is a passive listener, and the flow of information is maintained one-way.[2-6.]

International institutions also support the opinion that the existing teaching methods for nursing educators to train more qualified nurses are insufficient[3,7,8]. This requirement is also stated in the reports of the American Institute of Medicine (IOM), "Crossing the Quality Chasm" and the World Health Organization's Nurse Educator Core Competencies[7,8]. In these reports, nurse educators are advised to use appropriate course materials, information technologies and to encourage individualized, innovative, active learning in the education process, where students are active, facilitating learning.[9,10]. The flipped classroom learning model (FCM), one of the innovative, active learning methods that have been used frequently in medicine and health, is seen as a good option to meet the educational expectations of nursing students[11,12]. FCM, which was first started

to be used in secondary education in the USA, is an innovative model that primarily delivers pre-prepared course contents to pre-course students, reinforces learning with discussions and practices under the guidance of the instructor in the classroom, increases students' interaction with each other, and focuses on cooperative, student-centered practice[13,14]. While the learning objectives of the lower and relatively easy steps of Bloom's taxonomy are self-learned by the student, the activities of the higher steps such as analysis and synthesis, which the student may have difficulty with on his/her own, take place in the classroom thanks to this model[14-,17]. Another remarkable feature of this model is that it can meet the needs of the student profile that prefers to use today's popular communication models by allowing the use of digital education technologies and social networks[3,4,18-20]. In the results of research conducted on this model in many educational sciences, the model has advantages such as increasing in-class interaction, giving the student learning responsibility, providing advanced learning motivation, problem-solving, and increasing critical thinking skills[4,10,15,21,22]. In addition to these advantages, it has been reported that educators have limitations such as requiring more time and infrastructure, equipment resources, being difficult for students who do not have a habit of working on their own, and missing out on wrong learning[4,5,14,23].

In nursing education, which is an applied discipline, psychomotor skill acquisition is as critical as cognitive skills[24,25]. They are innovative and interactive learning methods that enable the student's active participation in the learning process, making them one of the most effective educational methods in the acquisition of cognitive and psychomotor behaviors to the students[24].

Since FCM is one of the active learning methods, it seems possible to use it in psychomotor skills education[26]. However, while the effectiveness of most FCM-related studies in affective and cognitive fields is evaluated in the relevant literature, the number of studies evaluating the effectiveness of FCL related studies on vocational psychomotor skills training is quite insufficient[26,27]. In this respect, our study is one of the limited numbers of studies that reveal the effect of the flipped class method on both theoretical knowledge and psychomotor skill acquisition with an experimental and control group, semi-experimental design, and evaluates the effectiveness of laboratory education with the flipped method. The specific purpose of our study is to evaluate the effect of FCM on cognitive and psychomotor areas of nursing education by comparing it with the verbal-based traditional education model (TCM).

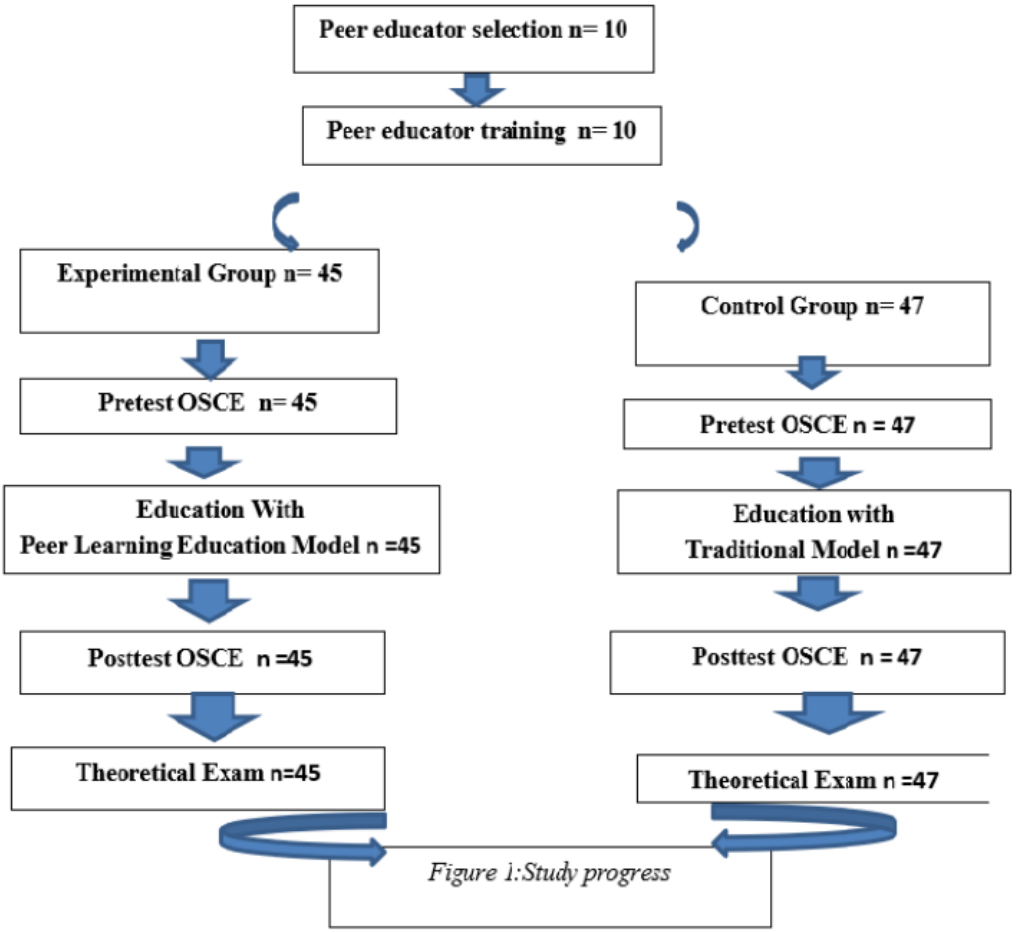
Material and Method

Study Design and Sample

The universe of the study consisted of all of the nursing students (n=80) studying in the first year of a university in Cyprus in the 2018-2019 academic year. Students selected by simple random selection sampling in the study were divided into the experimental (n=40) and control groups

(n=40). The G power analysis was conducted by the researchers to determine the sample size was found to be .83. No participant left the study at the end of the study. The study was carried out using a semi-experimental design by evaluating the experimental and control groups with pretests and posttests. In this study, the students in the experimental group were educated with the theoretical part of the vital signs course and the laboratory practice by flipped classroom model (FCM). On the other hand, the students in the control group were learning based on the traditional classroom model (TCM) and laboratory practice was given by the demonstration method. The nursing students are given theoretical courses and laboratory applications in the spring semester in the first grade, for a total of 14 weeks. All participants in the study received a total of 15 hours of training for the vital sign's modules of the theoretical course, and it was provided for laboratory practice in two weeks. Each group's theoretical and laboratory course hours last 40 minutes (Figures 1).

Figure 1. Study progress



The Training of the Experimental and Intervention Groups

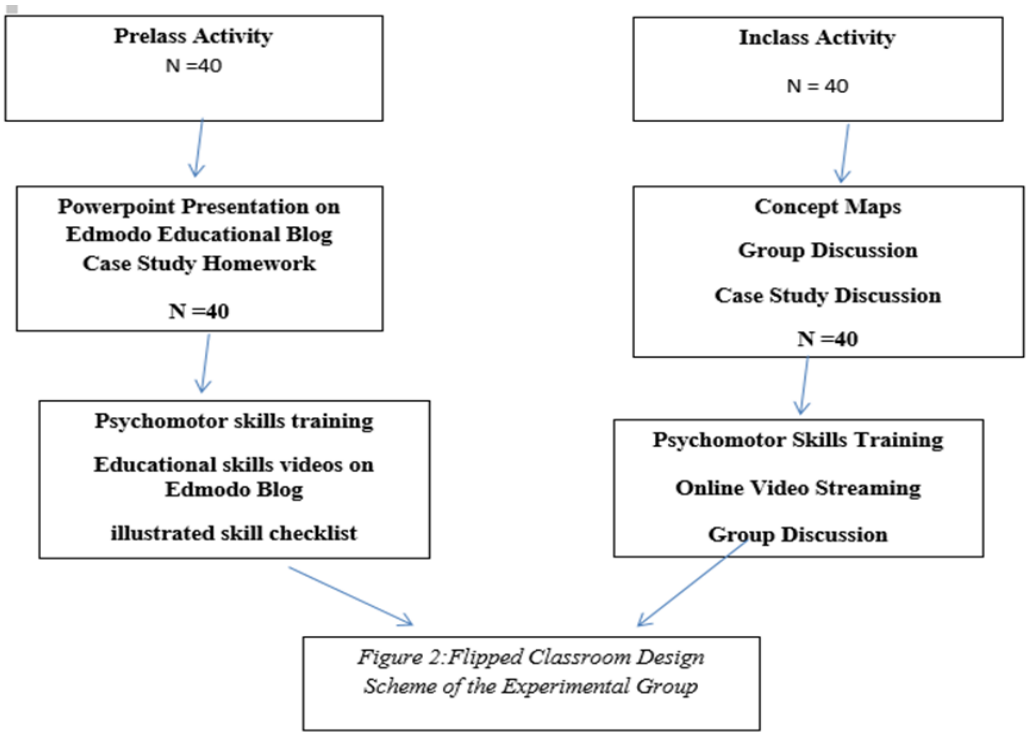
The experimental and control group students were informed about the study and explained how to conduct vital signs laboratory and theoretical courses. Before the data collection phase in the study, the online course materials for the experimental group were created by the researchers from the Edmodo site, which is a virtual classroom management tool and ed-modo social network. For the content of the educational blog, opinions were obtained from the faculty members who are experts in the subject. In line with the expert opinions, PowerPoint presentations, online skill training videos, case examples, and case assignments related to the vital signs module were uploaded to this education blog. Educational videos uploaded to the Edmodo educational blog were created by readers based on checklists in MP4 format by shooting with mobile cameras. After obtaining the consent of all the students in the study, the researchers created a chat group in WhatsApp, a messaging application for communication with the students in the experimental group. With this chat group, an invitation was sent via email to the educational Edmodo personal education blog, where the researchers were administrators. With the invitation sent to the Edmodo platform, each student created their passwords and usernames and accessed the web page. They were informed that they could download the app from the Google Play or Apple Store so that they could access the Edmodo blog from the WhatsApp communication group. Experimental group students were trained in the classroom two days after accessing online course materials on their educational blog. After the responsible educator in the classroom first presented the physiology of vital signs concept map, a theoretical course was taught in the form of question and answers for each vital skill. Later, the students were divided into five groups of eight people and given 40 minutes to do the case assignments given as homework on the Edmodo blog. After the groups completed their case assignments, each group representative explained how they solved the case assignment in the classroom, and the theoretical training of the vital sign's module was completed for the students in the experimental group. The students in the control group received a total of 8 hours of theoretical training with the trainer in a traditional classroom method (TCM) and PowerPoint verbal presentations for theoretical education. The same course contents were presented to both groups in the study. Both theoretical and skill training were given to the control and experimental groups in equal periods.

Psychomotor Skills Training

Psychomotor skill training was given to the students in the experimental group using FCM. For flipped class psychomotor skill training, a total of 28 minutes of five educational videos and pictorial skill checklists of blood pressure measurement, body temperature measurement, pulse measurement, and respiratory measurement skills belonging to the module were uploaded on the Edmodo blogs of the students before the classroom. Students were asked to access online training videos on the training blog before being trained in the skills laboratory. Five instructors formed

five groups of eight people from the experimental group for psychomotor skill training. Before the group study, training videos of each clinical skill were watched. At the next stage, all students in each group were asked to perform clinical skills training models according to the steps of the checklists. The group educator only managed the group without explaining the skills and correcting the steps of applying the mistakes made by the students so that all the students could do the skills at once. After each clinical skill was performed by students on educational models, students were given time to learn skills within the group. Skill learning was provided by counseling the students during the free working time of the group educators. The students in the control group traditionally completed the vital sign laboratory training with the demonstration method within 8 hours.

Figure 2. Flipped classroom design



Data Collection

In the study, using quantitative data collection methods, students were given a socio-demographic questionnaire form, a theoretical test to evaluate the theoretical effectiveness of education, and a skill test using checklists for psychomotor skills. The data for the study was collected between April 2019 and May 2019.

The sociodemographic form, which was created by the researchers, consisted of a total of 15 questions, including the sociodemographic characteristics of the students, such as age, gender, academic achievement, and their views on the FCM model.

Clinical skill checklists were created to be used in the evaluation of vital signs before the psychomotor skill exam. These forms are checklists in which the process skills steps are scored and the skill level is shown as a score to evaluate the success of the students in the experimental and control groups in the skill training given with FCM and TCM. The skill checklists in the forms were created by adhering to the "Vital Signs" section in the “Taylor Clinical Skills" book[28]. Skill checklists created by the researchers were sent to a total of seven academicians who are experts in the field. While evaluating the forms, each correct step applied by the students was scored as "1” point, and each step where they did not score or made mistakes was scored as "0” point. The maximum score to be obtained from the life-finding skill forms was determined as “44” points.

The Theoretical Knowledge Exam

The theoretical knowledge exam for the evaluation of the theoretical knowledge obtained in the vital findings’ module consisted of a total of 25 multiple-choice questions, including the physiology of vital signs, basic principles of measurement, factors affecting the measurement of vital signs, medical terms specific to vital signs, measurement values according to developmental periods, and evaluation of vital signs. The exam duration was 30 minutes and the score of each question was evaluated as "4” points. The highest score to be obtained from the exam was determined as 100 in total. The theoretical knowledge exam was given to the experimental and control groups 10 days after the theoretical training of the course of the vital sign. Cronbach's alpha value was found to be 0.71 in the statistical analysis performed to test the reliability of theoretical exam tests.

Psychomotor Skill Exam

The psychomotor skill exam was conducted twice as a pre- test-post-test before the skill training and 10 after the training. To evaluate the skills in the application exam, a total of 4 clinical skill stations were created where body temperature measurement, respiratory measurement, radial pulse measurement, and arterial blood pressure measurement were evaluated by the auscultation method with a tympanic membrane thermometer. Skill lists created by the researchers were used for the students' evaluations. In the exam, the students were taken to the exam in the order listed in the class list without being divided into experimental and control groups. In the exam, each student was given equal time for each skill. The aim study aims to prevent possible bias by selecting the educators who took the exams from among the researchers.

Data Analysis

SPSS statistics and version 24.0 software were used to analyze the data. The data set included the data related to the sociodemographic questionnaire form of the students, the pretest-posttest scores obtained from the knowledge test exam, the pretest and posttest total scores obtained from the practice test. Descriptive statistics, the Mann-Whitney U test, and chi-square tests Cronbach's alpha values were performed first in the statistics. Cronbach alpha value was calculated to test the reliability of the theory exam.

Study Ethics

The data was collected after the approval of the Girne American University Ethical Committee (ethical committee number and date: 10.02/19-07.03.2019). The people who wanted to be included in the study were first informed about it, and they were told that they were free to leave the study at any time. After the information, written informed consent was obtained from the students who wanted to participate in the study. The sociodemographic questionnaires given to the students were completed by the students based on their self-reports. The study was conducted by the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Results

Participant Characteristics

The study was conducted using 80 first graders who were taking the course on the fundamentals of nursing at a school of nursing. The sociodemographic characteristics of the students sampled revealed that 47 percent of the students were in the age group 20-22 and also 38% were male students. The statistical analysis found no statistical difference in terms of the school graduates, age group, gender, the place where they stayed, and both groups were found to have a homogeneous distribution (p=.302, p=.484, and p=.247 respectively) (Table 1).

Table 1. Characteristics of participants of homogeneity between groups

Variables	Control group		Experimental group		X^2 / P
Gender	n	%	n	%	
Male	15	38.5	20	50.0	x^2=1.065 p=.302
Female	25	61.5	20	50.0	
Age group					
17-19 age	18	46.2	13	33.3	x^2=1.450 p=.484
20-22 age	18	43.6	20	51.3	
≥23	4	10.3	6	15.4	
Online education experience					
Yes	15	35.9	19	47.5	
No	25	64.1	21	52.7	
Using online educational material					
Yes	35	87.2	37	92.5	
No	5	12.8	3	7.5	
Total	40	100	40	100	

Psychomotor Skill Exam Results

The psychomotor skill exam pre-test scores of the students were assessed after the skill training on vital findings. The pretest scores after the flipped classroom learning of the groups of students in the sampling indicated that there was a statistically significant increase in total vital skills scores of the students in both the experimental group and the control group ($\bar{X}$=22.18±1.8, $\bar{X}$=21.07±1.22, p>.05, respectively) (Table 2). Additionally, the comparison of post-test total scores between the groups revealed that the post-test total scores were higher in the experimental group than in the control group ($\bar{X}$=38.92±0.85, $\bar{X}$=30.79±1.41 respectively). The difference was found to be a statistically significant difference (p<.05, z= -3.22) (Table 2).

Table 2. The comparison of psychomotor skill exam and theoretical exam in both groups

Variables		**Test scores**	
		$\bar{X}$ ± SD	
Theoretical Exam Scores	Experimental group (FCM)n=40	62.15± 16.5	
	Control group (TCM) n=40	45.25± 14.7	
t		-4.29	
P[a]		.00*	
		Pre-test scores	**Post-test scores**
		$\bar{X}$± SD	$\bar{X}$± SD
Skill Exam Scores	Experimental group (FCM)n=40	22.18 ± 1.8	38.92 ± 0.8
	Control group (TCM) n=40	21.07±2.1	30.79 ± 1.4
Z		1.22	3.22
P[b]		.072	.022*

Theoretical Exam Result

A theoretical test was held on vital research topics 10 days after the theoretical training was given to reveal the effect of education given with the flipped classroom approach and traditional education on students' knowledge acquisition. According to the t-test results, the test scores of the experimental group were found to be higher than the control group ($\bar{X}$ =62.15±16.55; $\bar{X}$ =45.25±14.77, respectively) (Table 2).

Discussion

The study aims to examine the effect of FCM on theoretical knowledge and psychomotor skills acquisition in the vital signs course module. In the study, the effectiveness of the training was evaluated as pretest, posttest, semi-experimental, and control groups. One of the most important findings in our study was that the knowledge level of the students in both groups who completed the vital findings module increased, and the scores of the experimental group who received flipped education were higher than the other group. In the literature, studies reporting that FCM contributes positively to theoretical knowledge acquisition in nursing students support this finding. In one of these studies, Oh et al., studied nursing a informatics course with flipped classroom using film clips[21,27,29-35]. As a result of the study, knowledge about each core concept of nursing vital signs reflected significant improvement and 96.8% of the students suggested the use of flipped classrooms. Greenwood et al. conducted two semesters of surgical nursing course with

the flipped class model by delivering voice PowerPoint presentations to students before the course and using case studies during the course[35]. It was reported by the researchers that there was a positive correlation between FCM and student achievement in the theoretical test results. In the pre-and post-test experimental and control group design study conducted by Kim et al., the 14-week patient safety course was given to 32 nursing students with flipped classroom training supported by group studies, group discussions, online courses, and small exams [27]. Forty-three students in the control group were not taught this course in the study. As a result of the study, it was reported that the experimental group was more successful in the theoretical knowledge test than the control group and they adopted FCM. These results suggest that FCM provides an active learning environment, provides an opportunity to interact with educators and other students, improves knowledge analysis and synthesis skills, and increases the permanence of the information. Based on the literature and our study results, the increase in theoretical knowledge scores in the experimental group supports the conclusion that FCM is effective in theoretical knowledge acquisition.

Another important result of our study was the increase in the scores of both groups in the skill test where the vital finding psychomotor skill of the students was evaluated. In addition to this result, it was found that there was a difference between the pretest-posttest scores of the experimental group in the statistical analyzes and the experimental group received higher scores than the control group. This result confirms our hypothesis that FCM is also effective in skill training. Considering the literature, studies in which nursing students learn basic nursing skills with FCM are quite limited. The limited results of the study in the literature are in line with our findings. For example, Kim et al· prepared a 10-week course module containing information and clinical skills such as chronic obstructive disease care, diabetic patient care, and blood transfusion in patients with femoral fractures[27]. In his study with a total of 202 nursing students, the experimental group was trained with FCM, which includes team-based learning and knowledge evaluations, while the control group was trained with a model in which the nursing skills checklists were used as educational materials. As a result of the evaluation made with a total of four separate psychomotor simulation tests, it was determined that the test scores of the experimental group were higher than the control group. In the Kim et al 2019 study evaluating the effectiveness of psychomotor skill acquisition in the flipped class approach, the knowledge acquisition of the students was evaluated in the patient safety course given to nursing students, and it was reported that the flipped class model had a positive effect on clinical skill acquisition[27].

In the study by Wu et. al study evaluating the effectiveness of FCM in the field of medicine, suturing skills training was taught to 78 medical students by making online videos and in-class presentations[11]. As a result of the study, FCM was reported to contribute to psychomotor skill learning. The results of this study show that FCM contributes to psychomotor skill training. The

fact that FCM is effective in skills education is thought to be related to students' taking more responsibility in the learning process and providing a flexible learning environment.

There are studies in the literature showing that FCM does not differ between traditional methods in theoretical knowledge acquisition and psychomotor skill education in nursing. It is taught to medical, pharmaceutical, and nursing students as a part of the pharmacology course as traditional and apart as mixed with the FCM approach[9,20,26]. As a result of the evaluation, although the test scores of the FCM group were higher, there was no difference between them and traditional education. In addition to these studies, Geist et al. conducted the teaching of the pharmacology course with FCM in the experimental group and the control group with TCM to compare the effectiveness of FCM and TCM models in theoretical knowledge acquisition in nursing students[20]. As a result of the study, although the group receiving flipped education was more successful than the other group receiving 3-course modules, there was no difference between the two groups in terms of success on the final exams. Among the studies showing that FCM is not superior to educational methods in psychomotor skills education in nursing students, Hogenson et al. gave pre-laboratory preparation of insulin pen application skills to a group of students with FCM with online training videos, while the other group was traditionally given illustrated written laboratory training material[26]. As a result of the evaluation, it was found that there was no difference between the two methods in psychomotor skill acquisition.

Conclusion

Due to the rapid changes in educational technologies and methods, the changing student profile, and the transition from educator-centered education methods to learning methods in learning, the flipped classroom education approach has become more frequently used. In our study, the FCM effect of the pre-and post-test semi-experimental, control group design and vital findings in theoretical knowledge and skills were evaluated. The results showed that the level of knowledge and psychomotor skill scores of FCM used in the learning of the vital findings course was higher than the other group. It is thought that the flipped model that provides an active learning environment is an appropriate approach in theoretical knowledge and psychomotor skills education, and that it is a method that enables students to cooperate and take responsibility in learning.

Limitations of the Study

The study has some limitations. Firstly, we could not evaluate all nursing skills, only psychomotor skills in the course of the vital signs were evaluated. Secondly, the limitation was the small size of the sample, and the setting was just one institution. Thirdly, the use of video in the flipped classroom group may have positively influenced the scores and performances of students. Lastly,

three months later, measurements can be repeated so that it can be seen whether the educational method with the learning videos contributes to the students' permanent learning skills or not.

Future Implications

According to our study results, FCM was found to be effective in both theoretical and psychomotor skill education. The use of FCM can be considered an opportunity for nursing education to move away from traditional models and to active student-centered education. In future studies, it is recommended to repeat the model in larger populations to see if it is suitable for practice in larger groups of students. Besides, the experiences and attitudes of the students studying with FCM can be evaluated and suggestions can be reached to ensure the more effective use of this model. Studies to evaluate the opinions and suggestions of academicians who provide training on the flipped classroom model can be planned and can guide the integration of the model into nursing education with the results found. In addition to these studies, it is thought that studies using flipped models, including different active learning activities in psychomotor skills education, will contribute to vocational education.

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