



ORIGINAL ARTICLE

The Effect of Music on Peripheral Intravenous Catheter Placement Skills, Anxiety, Self-confidence Perception, and Vital Signs in Nursing Students: Randomized Controlled Trial

Müziğin Hemşirelik Öğrencilerinde Periferik İntravenöz Kateter Yerleştirme Becerisi, Kaygısı, Öz Güven Algısı ve Yaşam Bulguları Üzerindeki Etkisi: Randomize Kontrollü Çalışma

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Abstract

Objective: This study sought to examine the impact of music on nursing students' skills, anxiety levels, perceptions of self-confidence, and vital signs.

Method: This is a randomized, controlled experimental study. It was conducted with 60 nursing students enrolled at a state university. Students in the intervention group (n=30) listened to music during the skill training. Students in the control group (n=30) received standard skill training.

Results: There was no significant difference between the groups in the ability to place peripheral intravenous catheters. It was observed that, in the group that listened to music, anxiety scores decreased, self-confidence scores increased, respiratory rate decreased, and blood pressure increased.

Conclusion: Music listened to by students while practicing peripheral intravenous catheter placement had no effect on skill acquisition, anxiety, self-confidence, respiratory rate, or systolic and diastolic blood pressure.

Keywords: Anxiety, intravenous catheter, music, nursing students

Öz

Amaç: Bu çalışma müziğin hemşirelik öğrencilerinde beceri, kaygı, öz güven algısı ve yaşam bulguları üzerindeki etkisini saptamak amacıyla yapılmıştır.

Yöntem: Bu çalışma, randomize kontrollü deneysel bir çalışmadır. Bir devlet üniversitesinde öğrenim gören 60 hemşirelik öğrencisi ile yürütülmüştür. Müdahale grubundaki öğrenciler (n=30) becerisi uygulaması sırasında müzik dinlemiştir. Kontrol grubundaki öğrenciler (n=30) ise standart beceri eğitimi almıştır.

Bulgular: Periferik intravenöz kateter yerleştirme becerisi açısından gruplar arasında anlamlı bir fark bulunmamıştır. Müzik dinleyen grubun kaygı puanının azaldığı, öz güven puanının arttığı, solunum hızının azaldığı ve kan basıncının arttığı görülmüştür.

Sonuç: Periferik intravenöz kateter yerleştirme uygulaması yapan öğrencilere dinletilen müziğin beceri kazanımı üzerinde bir etkisi olmadığı, kaygıyı azalttığı, özgüveni artırdığı, solunum hızını düşürdüğü ve sistolik-diastolik kan basıncını artırdığı bulundu.

Anahtar Kelimeler: Kaygı, intravenöz kateter, müzik, hemşirelik öğrencisi

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Introduction

Peripheral intravenous catheter (PIVC) insertion is the most commonly performed procedure by healthcare professionals in healthcare institutions (1). A PIVC catheter is a short, flexible tube inserted into a peripheral vein to administer fluid, medication, or blood. Although this procedure is frequently used, it causes numerous complications among patients. For the safe administration of PIVC, it is essential that nurses possess the necessary knowledge and skills (2).

Skills training in nursing education begins in professional skills laboratories. Professional skills laboratories improve psychomotor skills through repetitive practice and reduce students' excitement during the first experience (3). During laboratory training, students have the opportunity to develop their skills using models in preparation for clinical practice (4). Teaching PIVC placement is one of the most challenging skills, both in laboratory settings and in clinical internships (1). The PIVC placement procedure causes stress and anxiety in students due to the multitude of procedural steps, difficulty transferring theory to practice, fear of failure, and traumatic effects on patients (5,6). One of the most important consequences of anxiety is learning difficulties. Although mild anxiety has positive effects on learning, learning problems increase as anxiety level increases (7-9). To enhance nursing students' practical skills during their education, methods such as aromatherapy, guided imagery, progressive relaxation, and music are recommended (10,11). Music is the art of expressing one's feelings, and music therapy is the professional use of music's therapeutic effects to improve individuals' well-being and quality of life across physical, psychological, and social domains (12). The literature indicates that listening to music can reduce anxiety and promote relaxation by influencing the neuroendocrine and autonomic nervous systems (13). Studies have reported that music reduces anxiety related to the first blood-collection experience (7), simulation applications (1), and exams (11,14) and significantly increases clinical exam success (10,13,15).

Studies on this topic indicate that music reduces anxiety in nursing students. We were unable to find any studies demonstrating the effect of music during PIVC insertion, a procedure frequently performed and experienced by nursing students. This study aims to examine the impact of music on nursing students' skills, anxiety levels, perceived self-confidence, and vital signs.

Research Hypotheses

H1: The average scores for anxiety, skill, self-confidence, and vital signs of students in the intervention group differ from those of the control group.

Main Points

- Anxiety is an important factor in the skill development of nursing students.
- Music is often used to relieve anxiety.
- Music reduced the anxiety of nursing students, but it wasn't effective in improving skills.

Material and Method

Study design and setting

A randomized controlled trial was conducted at a state university in Turkey. This clinical trial is registered (registration number: NCT05867277, date: 17.04.2020). Randomization of the study followed the CONSORT report (16).

The study was conducted at the nursing faculty of a state university in Turkey during the 2021-2022 academic year. The study was conducted among students enrolled in the fundamentals of nursing course, which is taught during the spring semester of the first year of the nursing program. This course, which aims to enable nursing students to acquire professional skills, involves 4 h of theoretical instruction and 12 h of practical training per week.

Participants and Sample Size

The population consists of 154 first-grade students. The sample size was calculated using the software. The effect size from a similar study was used as a reference (7). Accordingly, it was determined that, with 90% power and a 5% type I error rate, 26 participants would be required in each group. To allow for possible attrition, 60 students were included in the study. Of the 144 students, 60 were assigned to the intervention and control groups (n=30 each) (Figure 1). Ten students were excluded from the study: five had previously had a PIVC catheter (n=5), four were foreign nationals (n=4), and one did not agree to participate (n=1).

Students who were taking the fundamentals of nursing course for the first time, who were enrolled in the IV catheterization theoretical course for the first time, who had no prior PIVC catheter placement, and who volunteered to participate were included in the study. Students who had graduated from a health-related school and who were foreign nationals were excluded.

Randomization, Allocation, and Blinding

Simple randomization was used to assign students to the groups. Participant blinding was implemented in this study. Students practiced PIVC placement in separate laboratories on the same day, preventing interaction among them. This approach ensured that students were unaware of their group assignments. Furthermore, when students were given information about the study, they remained unaware of their group assignment, as no details about the groups were provided. Because the researchers knew which group the students were in, investigator blinding was not possible.

Instruments

Data were collected using the student information form, the PIVC placement skills checklist, the state anxiety inventory (SQI), and the subjective self-confidence assessment tool.

Student Information Form

It consists of seven questions covering students' sociodemographic characteristics and vital signs.

PIVC Placement Skills Checklist

The checklist, created by the lecturers responsible for the course in accordance with the literature (17,18), consisted of 34 steps. The student received 0 points if they could not complete the process, 1 point if there were missing steps, and 2 points if it was complete. Checklist scores range from 0 to 68. A higher score indicates greater ability in the student.

State Anxiety Inventory

The SQI was developed by Spielberger et al. in 1970 and adapted for Turkish society in 1985 by Öner and Le Compte (19). Determines how the individual feels at a certain moment and under certain conditions. It is a 4-point Likert-type scale consisting of 20 items. The total score ranges from 20 (indicating low anxiety) to 80 (indicating high anxiety) (19). In Öner and Le Compte's (19) study, Cronbach's alpha was $\alpha=0.93$, while in this study it was $\alpha=0.91$.

Subjective Self-confidence Assessment Tool

Using this assessment tool, students were asked to rate their self-confidence on a 0-10 scale. A score of "0" indicated the lowest self-confidence, and a score of "10" indicated the highest self-confidence.

Application of the Study

The study was conducted between April 6 and 11, 2022. Initially, students received four hours of theoretical instruction. A week after the theoretical course, a four-hour laboratory session was conducted. Students were divided into four small groups of 15 students each (two intervention groups and two control groups) for the laboratory session. The groups practiced the skill simultaneously in different laboratories. The students participating in the study performed PIVC placement, which is the first invasive skill conducted during the laboratory practice of the Fundamentals of Nursing course. During the laboratory session, the instructor demonstrated the skill using a PIVC injection arm model. All students practiced the skill at least once. A question-and-answer session reinforced the material.

Written consent was first obtained from the students in the intervention group. Next, pre-test data were collected using the Student Information Form, SQI, and subjective self-confidence assessment tool (SSAT). The vital signs were measured and recorded. Vital signs were measured by the same investigator using the same instruments. Subsequently, music was played at moderate volume for 15 minutes. Afterwards, the laboratory application was initiated, and music was played at a low volume throughout. The Turkish Music Research and Promotion Group provided support for music selection. The music "Acemaşiran", which increases concentration and creativity, was played. The

music was played from a computer through a loudspeaker in the vocational skills laboratory. Immediately after completion of the laboratory application, the skills of all students were evaluated using the PIVC placement skills checklist. Then, the SQI and SSAT were completed, and the post-test data were recorded (Figure 1).

Written consent was obtained from the students in the control group. Next, pre-test data were collected using the Student Information Form, SQI and SSAT. The vital signs were measured recorded. Separate researchers and devices were used to evaluate vital signs in the experimental and control groups. Pre-test and post-test measurements for each group were performed by the same researcher using the same device. Students received standard skills laboratory training without any additional intervention. Immediately after the laboratory application was completed, the skills of all students were evaluated using the PIVC placement skills checklist. Then, the SQI and SSAT were filled in and the post-test data were completed (Figure 1).

Ethical Considerations

Ethics committee approval was obtained from the Scientific Research Ethics Committee of Necmettin Erbakan University (date: 17.04.2020, approval no: 2020/2440). Written informed consent was obtained from the students using the "Informed Consent Form of Volunteers". Permission was obtained from the relevant authors to use the scales.

Statistical Analysis

Data analysis was performed using statistical software. The Shapiro-Wilk test was used to assess whether the data violated the assumption of normality; the data were found

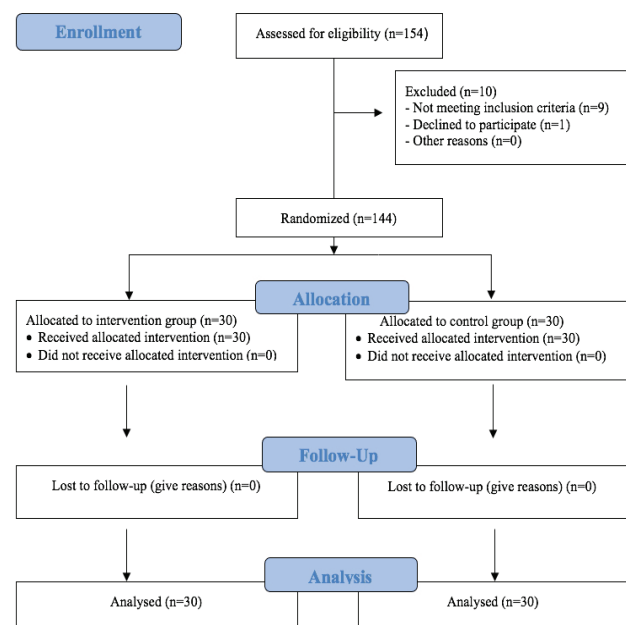


Figure 1.
Flow Chart of the Study Prodecure

to be normally distributed. In the analysis of the students' state anxiety scores, intragroup evaluation was conducted using the paired-samples t-test, while intergroup evaluation was performed using the independent-samples t-test.

Results

The distribution of included students according to their sociodemographic characteristics is shown in Table 1. The groups exhibit homogeneous characteristics.

No significant difference was observed between the groups in PIVC catheter placement skill ($p>0.05$). The average skill level of both groups is above the intermediate level (Table 2). After the intervention, anxiety scores decreased in the intervention group, while self-confidence scores increased ($p<0.05$); in the control group, there were no changes in either anxiety or self-confidence ($p>0.05$) (Table 3).

When the students' vital signs were examined, there was no significant change in the pulse rate of the intervention group after the laboratory application ($p>0.05$), whereas the control group showed a decrease ($p<0.05$) (Table 3).

Discussion

In this study, music listened to by students practicing PIVC catheter placement had no effect on skill acquisition but decreased anxiety, increased self-confidence, decreased respiratory rate, and increased systolic and diastolic blood pressure.

Although the mean PIVC insertion skill score for both groups was above the intermediate level, no difference was observed between the groups. Regularly listening to music is known to enhance cognitive capacity, improve visual

intelligence, increase concentration, and support learning (20). In a similar study, nursing students were made to listen to music while teaching intramuscular injection skills, and it was determined that music was not effective in teaching these skills (21). Another study reported that music had no effect on students' mean objective structured clinical exam (OSCE) scores or on their ability to perform IM injections, PIVC fluid therapy, and tracheostomy suctioning (10). İnangil et al. (11) stated that listening to music increases students' average OSCE scores. Another study found that measuring skills increased in first-year students who listened to natural sounds and practiced progressive muscle relaxation during blood pressure measurement in a vocational skills laboratory (22). A similar study reported that music enhanced student learning and performance during simulation sessions (23). Another study found that music therapy combined with students' basic nursing skills (13). Music may have been ineffective in developing PIVC placement skills in this study because PIVC placement was the first invasive skill performed in a laboratory setting in the fundamentals of nursing course.

The study found that music was effective in reducing anxiety. The literature indicates that listening to music reduces anxiety and promotes relaxation by modulating the neuroendocrine and autonomic nervous systems (13). Because of this feature, music has been used in various studies involving nursing students, and our study obtained similar results. In a study, first-year nursing students who listened to music during their first bloodletting experience showed reduced anxiety (7). In the study by Aksoy and Öztürk (21), nursing students were made to listen to music while being taught intramuscular injection skills, and it was reported that music was not effective for teaching the skill. Another study reported that music reduces anxiety associated with simulation among nursing students (23).

Table 1.
Descriptive Characteristics of Nursing Students

Characteristics	Experimental		Control			
	n	%	n	%	χ ²	p
Gender						
Female	22	73.3	26	86.7	0.935	0.333
Male	8	26.7	4	13.3		
Residence						
Home stay	11	36.7	13	43.3	0.226	0.893
Dormitory+student house	19	60.0	17	56.7		

Table 2.
Comparison of PIVC Insertion Skill Averages of the Intervention and Control Groups

PIVC insertion skills	Min-Max	Mean $\pm$ SD	Test value, p
Experimental	39-54	45.63 $\pm$ 4.13	t=0.325, p=0.746
Control	32-57	45.17 $\pm$ 6.69	

Min-Max=minimum-maximum, SD=standard deviation

Table 3.
State Anxiety, Self-confidence, Pulse, Respiratory, Systolic Blood Pressure, Diastolic Blood Pressure and SPO₂ Pre- and Post-test Score Averages in the Experimental and Control Groups

Scale	Group		Pre-test		Post-test	Test value/p	Partial eta
		Min-Max	Mean ± SD	Min-Max	Mean ± SD		
State anxiety scale	Experimental	24-56	39.40±8.18	22-51	35.87±7.85	t=2.668, p=0.012	
	Control	24-65	42.23±9.83	20-69	44.93±12.75	t=-1.322, p=0.196	0.159
			t=-1.214, p=0.230		t=-3.317, p=0.002		
Self-confidence perception	Experimental	0-10	6.10±2.12	3-10	7.13±1.93	t=-3.618, p=0.001	
	Control	2-10	6.50±1.63	3-10	6.90±1.52	t=-1.209, p=0.236	0.05
			t=-0.818, p=0.417		t=0.521, p=0.604		
Pulse	Experimental	65-110	87.77±13.26	73-120	89.87±12.03	t=-0.713, p=0.481	
	Control	65-123	91.93±13.34	62-116	84.63±12.36	t=4.226, p<0.001	0.045
			t=-1.213, p=0.3230		t=1.662, p=0.102		
Respiratory	Experimental	16-24	19.57±2.34	16-22	18.57±1.70	t=2.892, p=0.007	
	Control	15-26	18.97±2.58	14-26	18.53±2.50	t=0.851, p=0.402	0.000
			t=0.943, p=0.350		t=0.060, p=0.952		
Systolic blood pressure	Experimental	90-130	103±11.19	90-140	115±12.25	t=-5.058, p<0.001	
	Control	90-120	102±9.35	90-125	107±8.44	t=-2.037 p=0.0051	0.144
			t=0.250, p=0.803		t=3.124, p=0.003		
Diastolic blood pressure	Experimental	50-80	65.67±7.28	55-90	72.83±9.16	t=-4.119, p<0.001	
	Control	50-80	62.67±6.40	60-80	67.17±6.11	t=-2.955, p=0.006	0.120
			t=1.696, p=0.095		t=2.818, p=0.007		
SpO ₂	Experimental	90-99	97.17±2.18	94-99	97.17±1.84	t=0.000, p=1.000	
	Control	93-99	97.10±1.87	95-99	98.00±1.29	t=-2.514, p=0.018	0.067
			t=0.190, p=0.850		t=-2.033, p=0.047		

Min-Max=minimum-maximum, SD=standard deviation

Studies have also shown that listening to music is effective in reducing students' test anxiety (11,14). In contrast to these results, Eyüboğlu et al. (10) conducted a study in which first-year nursing students listened to music for 2 weeks before the OSCE and immediately before the exam; the study found that music had no effect on OSCE test anxiety. These results suggest that listening to music may be effective in reducing anxiety.

Students who listened to music exhibited increased self-confidence. We suggest that this finding is related to the decrease in students' anxiety levels and to their acquisition of skills above the medium level. Feltz's (24) definition of self-confidence also supports this explanation. Although similar results have not been reported in the literature, one study found that music played during the simulation did not affect self-efficacy (23).

Following music exposure, the intervention group exhibited higher systolic and diastolic blood pressure and a lower respiratory rate. Fear and anxiety increase heart rate, cardiac output, and vascular resistance by stimulating the

sympathetic nervous system, thereby increasing blood pressure (17,25-27). The literature states that listening to music reduces anxiety and prevents increases in vital signs (28,29). One study reported that music therapy contributed to a positive change in students' blood pressure (10). A meta-analysis examining the effects of music practices on stress-related outcomes reported that music practices were associated with reductions in physiological parameters, such as blood pressure and pulse (28). Similarly, a study of university students found that listening to music reduced blood pressure and pulse rate (14). Aksoy and Oztürk (21) reported that listening to music did not change the vital signs of nursing students. In our study, although the respiratory rate of the students' intervention group decreased, their blood pressure increased. This may be due to the students deliberately holding their breath during the measurement.

Study Limitations

This study has some limitations. The first is that the PIVC placement skill consists of many steps. Second, different instructors provided skills training to the students in the

laboratory. Another limitation is that the vital signs were measured by different researchers using different devices.

Conclusion

In this study, it was found that music listened to students practicing PIVC catheter placement had no effect on skill acquisition, decreased anxiety, increased self-confidence, decreased respiratory rate, and increased systolic-diastolic blood pressure. Based on these results, it is recommended that music be played in vocational skills laboratories for nursing education to reduce students' anxiety and increase self-confidence. In similar studies, the effect of music can be evaluated by having students listen to different musical genres. In addition, the application of this study to basic nursing skills that involve fewer steps may yield different results.

Ethics Committee Approval: Ethics committee approval was obtained from the Scientific Research Ethics Committee of Necmettin Erbakan University (date: 17.04.2020, approval no: 2020/2440).

Informed Consent: Written informed consent was obtained from all participants.

Footnotes

Author Contributions: Surgical and Medical Practices – S.S., B.C., F.Y.Ö., A.G.; Concept – S.S., B.C.; Design – S.S., B.C.; Data Collection or Processing – S.S., B.C., F.Y.Ö., A.G.; Analysis or Interpretation – S.S., B.C., F.Y.Ö., A.G.; Literature Search – S.S., B.C., F.Y.Ö., A.G.; Writing – S.S., B.C., F.Y.Ö., A.G.

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