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 Miyase AVCI<sup>a\*</sup>

<sup>a</sup>Res. Asst., Aksaray University,  
miyaseavci26@gmail.com

\*Corresponding Author

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## Impact of Station Technique on Nursing Students' Injection Practice and Satisfaction

### Abstract

Active learning methods such as the station technique are believed to improve both technical skills and emotional competencies among students. However, evidence comparing their effectiveness to traditional methods remains limited. This study aimed to evaluate whether the station technique, an active learning method, enhances nursing students' invasive injection skills and satisfaction levels compared to traditional teaching methods. The study was conducted in a randomised controlled design. The intervention group included students who practised by station technique (n=47) and the control group included students who practiced by traditional method (n=47). Research data were collected using Student Satisfaction Scale Short Form and Injection Checklists. Data were collected once after practice. The intervention group demonstrated significantly higher median scores in subcutaneous and intramuscular injection skills compared to the control group (p<0.05). No significant difference was found between groups regarding intradermal injection skills. Similarly, no statistically significant differences were observed between the groups in overall satisfaction levels or in the subscales of the Student Satisfaction Scale-Short Form. The station technique effectively enhanced students' subcutaneous and intramuscular injection skills but did not significantly affect satisfaction levels compared to traditional methods. The station technique can be a valuable strategy in nursing education to improve practical skill acquisition, particularly in invasive procedures.

**Keywords:** Intradermal injection, intramuscular injection, nursing education, subcutaneous injection, student satisfaction



## İstasyon Tekniğinin Hemşirelik Öğrencilerinin Enjeksiyon Uygulamaları ve Memnuniyeti Üzerindeki Etkisi

### Öz

İstasyon tekniği gibi aktif öğrenme yöntemlerinin öğrencilerde hem teknik becerileri hem de duygusal yeterlilikleri geliştirdiğine inanılmaktadır. Ancak, bu yöntemlerin geleneksel yöntemlerle etkililiğini karşılaştıran kanıtlar sınırlı kalmaya devam etmektedir. Bu çalışma, aktif bir öğrenme yöntemi olan istasyon tekniğinin, hemşirelik öğrencilerinin invaziv enjeksiyon becerilerini ve memnuniyet düzeylerini geleneksel öğretim yöntemlerine kıyasla artırıp artırmadığını değerlendirmeyi amaçlamıştır. Çalışma, randomize kontrollü bir tasarımda yürütülmüştür. Müdahale grubunda istasyon tekniği ile pratik yapan öğrenciler (n=47) ve kontrol grubunda geleneksel yöntemle pratik yapan öğrenciler (n=47) yer almıştır. Araştırma verileri Öğrenci Memnuniyet Ölçeği Kısa Formu ve Enjeksiyon Kontrol Listeleri kullanılarak toplanmıştır. Veriler uygulamadan sonra bir kez toplanmıştır. Müdahale grubu, kontrol grubu ile karşılaştırıldığında deri altı ve kas içi enjeksiyon becerilerinde anlamlı şekilde daha yüksek medyan puanlar

göstermiştir ( $p<0.05$ ). Gruplar arasında deri içi enjeksiyon becerileri açısından anlamlı bir fark bulunmamıştır. Benzer şekilde, gruplar arasında genel memnuniyet düzeylerinde veya Öğrenci Memnuniyet Ölçeği-Kısa Formunun alt ölçeklerinde istatistiksel olarak anlamlı bir fark gözlenmemiştir. İstasyon tekniği öğrencilerin deri altı ve kas içi enjeksiyon becerilerini etkili bir şekilde geliştirmiş ancak geleneksel yöntemlere kıyasla memnuniyet düzeylerini önemli ölçüde etkilememiştir. İstasyon tekniği, özellikle invaziv prosedürlerde pratik beceri edinimini geliştirmek için hemşirelik eğitiminde değerli bir strateji olabilir.

**Anahtar kelimeler:** Deri içi enjeksiyon, kas içi enjeksiyon, hemşirelik eğitimi, deri altı enjeksiyon, öğrenci memnuniyeti



### Introduction

Nursing education is complex, and standards highlight that theoretical knowledge and practical learning need to be integrated.<sup>1</sup> Integrating multiple learning domains can be challenging for nursing students.<sup>2</sup> Skills labs, where theoretical education is supported by practice, provide students with opportunities to get new nursing skills and use equipment safely.<sup>3</sup> So, theoretical training is supported by practices in skill labs.

Today, although modern teaching methods are being used skills training in nursing is more teacher-centered and based on traditional methods. Traditional education has certain drawbacks, such as limiting students' ability to engage actively in processing information, building understanding, or applying knowledge in practical ways.<sup>4</sup> Moreover, the shortage of nursing educators hinders the training of nurses in traditional education systems,<sup>5</sup> and teacher-centered methods have proven insufficient for cultivating the skills required in modern nursing practice.<sup>6</sup> Therefore, different learning methods support nursing practice and enhance patient outcomes are needed.<sup>7-10</sup> To achieve desired learning outcomes and enhance student satisfaction, it is crucial to adopt methods that effectively address the complexities of clinical environments.<sup>11</sup> Various teaching strategies have been introduced to help students develop the knowledge, skills, and attitudes essential for nursing practice.<sup>7-9,12</sup> Among these, active learning methods have gained particular attention. Active learning is strongly linked to improvements in students' self-efficacy, motivation, and academic achievement.<sup>13,14</sup> Students engaged in active learning adopt a constructive approach, striving to comprehend the subject rather than merely repeating what is taught during lessons. They are encouraged to independently acquire information instead of simply memorizing facts.<sup>15</sup> The international application of active learning strategies in nursing education has demonstrated significant benefits, including enhanced critical thinking, improved clinical performance, greater knowledge competence, and more effective translation of theoretical knowledge into practical skills.<sup>16,17</sup> These methods can be implemented through diverse activities such as concept mapping, one-on-one mentoring, web- and computer-based learning, distance education, simulation-supported learning, case discussions, and creative approaches like drama and role-play.<sup>18</sup>

The learning at stations technique, one of the active learning approaches, is a contemporary method that allows students to realize their own learning according to the multiple intelligence approach by utilizing cooperative learning strategies.<sup>19</sup> Learning stations provide students with maximum learning opportunities.<sup>20</sup> According to Benek and Kocakaya the station technique is a teaching method in which students carry out a series of learning activities in special areas created in educational environments (inside or outside the classroom) by working individually or in groups with the help of instructions previously created by the teacher or collaboratively by the teacher and students to learn or review a subject.<sup>19</sup> Ocak et al. lists the positive aspects of the station technique as follows: (1) It offers students different learning opportunities simultaneously, (2) it allows students to use more than one sense organ during the learning process by appealing to different intelligence areas, (3) the concepts learned are reinforced by repetition with more than one station, and (4) the station technique helps students develop a sense of responsibility since they learn the information on their own.<sup>21</sup> The station approach is a flexible and scalable instrument for moving towards integrated curricula, and it can be successfully adapted to teach basic subjects in preclinical years of Health Science degrees.<sup>22</sup> Station technique promotes deep learning and has a positive impact on academic performance for learning objectives involving higher order thinking skills in medical curricula.<sup>23</sup>

It can be said that the station technique increases students' academic success, improves their problem-solving skills, and enables them to be responsible, discover their own learning methods, gain

affective skills, increase their self-confidence, and strengthen their communication with peers. In this work, we aimed to understand whether learning at station technique impact skill and satisfaction. Today's nursing undergraduate students, the majority of whom are from Generation Z, prefer to actively participate in education and need alternative, innovative ways to participate in the learning process.<sup>24,25</sup> In this regard, the use of innovative active learning methods that complement traditional education methods should be supported.<sup>26</sup> One of the active teaching methods is the station technique, which is thought to facilitate the skill learning process. Thus, we conducted a randomized controlled methods research study to analyze whether students' intradermal (ID), subcutaneous (SC) and intramuscular (IM) injection practice success score and satisfaction with station technique outperform traditional learning methodologies at different levels.

### **Hypotheses**

*H<sub>1-0</sub>*: There is no significant difference in students' success scores between station-based injection practice (ID, SC, IM) and traditional learning methodologies.

*H<sub>1-1</sub>*: Students practicing injections (ID, SC, IM) using station-based methods achieve significantly higher success scores compared to those using traditional learning methodologies.

*H<sub>2-0</sub>*: There is no significant difference in students' satisfaction levels between station-based injection practice (ID, SC, IM) and traditional learning methodologies.

*H<sub>2-1</sub>*: Students practicing injections (ID, SC, IM) using station-based methods report significantly higher satisfaction levels compared to those using traditional learning methodologies.

### **Materials And Methods**

#### ***Design***

The study was conducted in a randomised controlled design.

#### ***Setting***

This research was carried out in the nursing department of a university in Türkiye during the spring term of the 2023–2024 academic year. Approval for the study was granted by Aksaray University's Human Research Ethics Committee (Date: 28.02.2024, No: 2024/01-68), and additional institutional permission was also secured from Faculty of Health Sciences of Aksaray University. Participation was entirely voluntary. Prior to data collection, all participants were informed about the study's aims, procedures, potential risks, and expected benefits. Each participant provided written informed consent. Participant confidentiality and anonymity were carefully protected throughout the study. No ethical concerns emerged during the research process.

#### ***Participants***

The participants comprised 122 first-year students enrolled in a four-year nursing program, all of whom were registered for the Fundamentals of Nursing course. Fundamentals of Nursing course, a core component of the first-year spring semester in the nursing baccalaureate program, is a compulsory requirement for obtaining an undergraduate degree in nursing. The course spans a total of 420 hours, including 252 hours dedicated to laboratory work and clinical practice. Participants in this study were undergraduate nursing students enrolled in the Fundamentals of Nursing course for the first time. The inclusion criteria were designed to ensure that all participants were encountering clinical practice and invasive injection skills for the first time. Therefore, eligible participants were those (a) enrolled in a health sciences faculty or school of nursing, (b) taking the Fundamentals of Nursing course for the first time, (c) with no prior clinical experience, and (d) who had not previously received any training in invasive injection skills. Students were excluded if they (a) had previously completed the Fundamentals of Nursing course, (b) had any prior clinical experience, (c) had received training in invasive injection skills, or (d) had already completed a degree or formal education in another health-related field (e.g., midwifery, physiotherapy, paramedicine). These criteria were applied to ensure a homogeneous sample of novice nursing students with no prior exposure to clinical or practical injection training. The nursing degree program at the university was deemed appropriate for the research objectives. Initially, 122 students were registered for the course. However, nine students who did not attend the course and 13 students who failed to meet the inclusion criteria were excluded from the study. As a result, 100 students who met the inclusion criteria were included in the study. During the study, three students from each group were excluded due to incomplete or incorrect questionnaire responses. The study concluded with 94 participants, comprising 47 students in the experimental group and 47 in the control group (Figure 1). Since the study aimed to include all students registered for the Fundamentals of Nursing course, no power analysis was conducted beforehand. However, after data collection, the post-hoc power analysis was performed using the GPower

program. With 94 participants, an effect size of 0.79, and a margin of error of 0.05, the study's power was calculated to be 0.97.

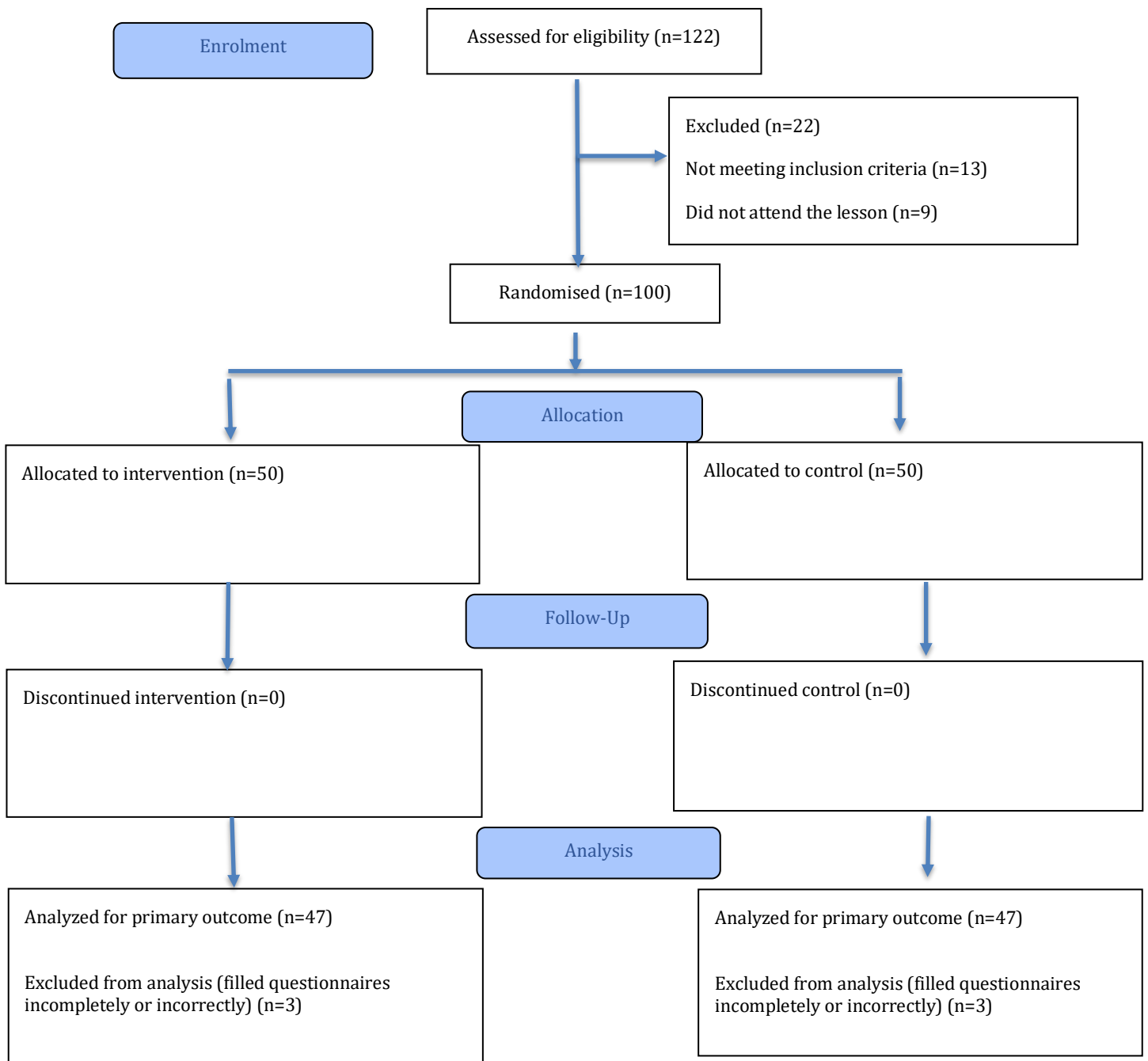


Figure 1. The flow chart of study

### **Data Collection Tools**

The research data were collected using Student Satisfaction Scale Short Form and Injection Checklists.

#### **Student Satisfaction Scale- Short Form (SSS-SF)**

Originally developed by Baykal, Sökmen, and Korkmaz to assess nursing students' satisfaction with their education, the scale was later revised by Baykal et al.<sup>27,28</sup> It includes 53 items categorized into five sub-dimensions: teaching staff (12 items, 1–12), school administration (9 items, 13–21), involvement in decision-making (7 items, 22–28), scientific, social, and technical facilities (12 items, 29–40), and educational and instructional quality (13 items, 41–53). Each statement is rated using a 5-point Likert scale, where 5 indicates "Strongly agree" and 1 indicates "Strongly disagree." The average score for each sub-dimension is obtained by dividing the total score by the number of items in that category. Scores approaching 1 reflect low satisfaction, while those nearing 5 indicate high satisfaction. The scale demonstrated high internal consistency in its original validation with a Cronbach's alpha of 0.97.<sup>28</sup> In the present study, the reliability coefficient of the SSS-SF was determined as  $\alpha = 0.99$ .

#### **Injection Checklists**

The literature was reviewed, and three checklists were created to assess students' application skill levels: the "Intradermal Injection Checklist, Subcutaneous Injection Checklist, and Intramuscular Injection Checklist".<sup>29,30</sup> The checklists were presented to three experts for their opinions. Following these expert opinions, 29-item Intradermal Injection Checklist, 30-item Subcutaneous Injection Checklist, and 27-item Intramuscular Injection Checklist were created. A pilot application was conducted with five second-year nursing students using the created checklists to determine if there were any problems with the functioning of the procedure steps. No scoring was performed during this application; only the interrelationships of the procedure steps were checked. No problems were detected with the procedure steps, and the items were then scored. Each item scored as two points-accurately completed, one point-completed but not accurately and zero point-not completed. The lowest score for all forms was zero, while the highest scores were 58 for the Intradermal Injection Checklist, 60 for the Subcutaneous Injection Checklist, and 54 for the Intramuscular Injection Checklist. The forms were used while students completed the application. Scores were calculated after the application was completed. Because each scale has a different maximum score, raw scores were standardized to a 100-point scale using the formula: (Achieved Score / Highest Possible Score)  $\times$  100.

#### **Randomisation and Blinding**

A stratified randomization approach was employed to ensure group homogeneity. Students were categorized into two strata based on their grade point averages: 2.00–3.00 and 3.01–4.00. Students were randomly assigned to one of two parallel groups, initially in 1:1 ratio, to receive either one of two methods traditional or a station technique. Using a simple random sampling method, 50 students were selected from each stratum to form the experimental and control groups. The researcher conducted a pilot study with five second grade students and no changes were made to the groups until the completion of the study.

The study guarantees the statistician's blindness. An independent statistician analysed the data to avoid bias in the evaluation. Since the researcher was a practitioner, she was not blinded. To prevent interaction between groups, students were unaware of their assigned group until the demonstration stage.

#### **Interventions**

The Fundamentals of Nursing course at the institution where the study was conducted included theoretical instruction on Mondays, with laboratory practices held on Wednesdays and Thursdays. The theoretical content of the practical sessions was delivered to all students simultaneously in the same classroom by the researcher. Checklist forms outlining the procedural steps for the practical exercises were distributed to the students. As will be discussed further, the researcher created homogeneous groups based on grade averages. To prevent potential biases due to interactions among students that could influence research outcomes, all practice sessions were planned to be completed in one day. On Thursday, all students were into the same laboratory, where the researcher demonstrated the procedural steps for each practice to all students. The students were then separated into different classrooms according to their assigned groups. To reinforce the procedural steps, students in the experimental group used a station method, while those in the control group were given free study time. The experimental group was supervised by the researcher, while three added instructors provided support for the control group. Following this, each student was asked to perform three procedures individually. A pilot study with second grade students was conducted to ensure there were no assessment discrepancies among the researcher and instructors, confirming consistency. Checklists prepared by the researcher and instructors were used to record whether each step of the procedures was completed. Satisfaction forms were distributed to each student upon

completing their practice, requesting them to provide feedback. The data collected from the survey forms and checklists were recorded for further analysis. Intervention was completed in three phases: preparation, implementation and outcomes.

### **Preparation**

Course content and checklists for three injections were created. A presentation about the station method was prepared, and materials (three cardboards, colored papers with printed practice steps, three bell glasses, and enough pins) were provided. Titles were written on cardboard. Stations, targets, course plans, instructions, task cards, signs, movement schedules, organization, and evaluation criteria were decided.

Three instructors supported the skill-teaching phase of the course. To ensure consistency during the evaluation of their students, the researcher trained them on how to fill out the checklist. The researcher and instructors conducted a pilot study with five second grade students. Upon comparing the complete checklists, no differences were seen.

### **Implementation**

#### **Experimental group**

**Stations:** Three stations, called “*ID Injection Station, SC Injection Station, and IM Injection Station*” were set up. The stations were designated according to the practice to be made.

**Target:** The goal of each station was to describe the sequential steps of the practices in the correct order.

**Course plan:** The theoretical course was explained, and checklists were delivered to the students. The students were divided into two groups and placed in different classes. Before the practice, a presentation about the station technique was given, and questions were answered. Using the demonstration method, all injections were performed by the teacher on simple simulators. Students were then randomly divided into three groups, with group leaders and timekeepers selected. The groups were assigned to stations: the first group to the first station, the second group to the second station, and the third group to the third station. Materials prepared for the implementation were placed at the stations.

The implementation started with the ringing of a bell. The students were asked to draw the required number of steps from the bell jar within five minutes and to place the steps correctly in the numbered places on the cardboard. Five minutes later, the bell rang again, and the students moved to the next station, restarting the clock. This process was repeated once more. After all groups had visited all the stations, the checklists were reviewed with all groups to evaluate whether the process steps were appropriate.

**Instructions:** For correct application of the technique, the following instructions were prepared and read to the students: “*There are three stations where you can practice ID, SC, and IM injections. The first station is designated for ID, the second for SC, and the third for IM injection practice. Three groups will be randomly selected, and each group will have a leader and a timekeeper chosen. You will have five minutes at each station. At the start, the first group will go to the first station, the second group to the second station, and the third group to the third station. In the first five minutes, group leaders will take 10 practice step cards from the first bell jar, 10 from the second bell jar, and 9 from the third bell jar. You will arrange the practice steps in the correct order according to the previously distributed checklists. When the five minutes are up, the timekeeper will ring the bell. After the bell rings, do not make any further placements and move to the next station as indicated by the signs. In the second five minutes, group leaders will take 10 practice step cards from the first bell jar, 10 from the second, and 9 from the third. The same process will be repeated. After the second bell rings, stop making placements and switch stations according to the signs. In the final five minutes, group leaders will take 9 practice step cards from the first bell jar, 10 from the second, and 9 from the third. Repeat the same process. At the second and third stations, you may review and adjust the steps arranged by the other groups. The activity will conclude after a total of 15 minutes.*”

**Task Cards:** (1) List the steps for ID injection as you learned during theoretical training, within 5 minutes. (2) List the steps for SC injection as you learned during theoretical training, within 5 minutes. (3) List the steps for IM injection as you learned during theoretical training, within 5 minutes.

**Signs:** ID Injection Practice Station, SC Injection Practice Station, IM Injection Practice Station

**Movement Schedules:** When your time is up, move to the next station in a clockwise direction (following the arrows between the stations).

**Organization:** The skills laboratory was organized with designated stations, each labeled with station names and signs. Instructions were read to the students, and the teacher introduced all the stations, objectives, and materials. Classroom rules were established collaboratively with the students. These rules included keeping noise levels down, following instructions, handling materials carefully, and leaving the

station promptly when time was up. Once the students confirmed they understood their tasks, the practice phase began.

**Evaluation:** The teacher provided a general evaluation of the groups. The practice steps were reviewed to ensure they were performed in the correct order. Each student was observed performing the tasks on the simulators, and the steps were verified using checklists. After the practice, students were given the SSS-SF forms to complete.

#### **Control group**

Students in the control group were shown the applications by the course instructors using a demonstration method on simple models. They were given the same amount of time as the experimental group to work on the practice skill process steps. The students were examined individually on the simulators, and the steps were checked off from the checklists by the teacher. After the practice, the SSS-SF forms were given to the students to fill out. After the evaluation process was completed, students in the control group were also given the opportunity to use the station technique.

#### **Outcomes**

Students' performance was quantified based on the Practice Skill Checklists. SSS-SF was used to determine the satisfaction levels of students.

#### **Data Collection**

The researcher and instructors completed skill checklists. After finishing the practices, students filled out satisfaction forms. In the experimental group, the researcher managed record-keeping and form distribution, while instructors conducted these tasks in the control group. After explaining the purpose of the research to the students and obtaining their consent, the survey forms were distributed to them. Personal data was coded to guarantee anonymity. Data analysis has been made with only the variables of students who took the implementation.

#### **Data Analysis**

Data were analyzed using IBM SPSS Statistics (Version 25.0. Armonk, NY: IBM Corp.). Continuous variables were reported using the mean ( $\bar{x}$ ), standard deviation (SD), median (M), and interquartile range (IQR). Categorical variables were presented as numbers (n) and percentages (%). Normality analyses were performed using both statistical and graphical methods. The Kolmogorov–Smirnov test was used to assess the normal distribution of continuous variables. In addition, skewness and kurtosis coefficients, histograms, Normal Q–Q plots, and comparisons between the mean, median, and mode were examined. A p-value greater than 0.05 in the Kolmogorov–Smirnov test and skewness–kurtosis coefficients within  $\pm 1.0$  were considered indicative of normal distribution.<sup>31-34</sup> Since the data did not meet most of these criteria (Kolmogorov–Smirnov,  $p < 0.05$ ; skewness and kurtosis values outside  $\pm 1.0$ ), non-parametric tests were used for group comparisons. To find the source of differences between groups in multiple comparisons, the Bonferroni correction was applied. Detected differences are shown by the numbers '1-2-3' and the greater-than symbol '>'. The reliability of the scales was assessed using Cronbach's  $\alpha$  method. In all tests, statistical significance was set at  $p < 0.05$ .

## **Results**

### **Characteristics of Participants**

The distribution of students' descriptive characteristics is presented in Table 1. Of the students, 73.4% were female, 81.9% did not wish to change departments, 70.2% were satisfied with their departments, and 69.1% had not participated in scientific activities. The distributions across all categories were found to be homogeneous between the groups.

**Table 1.** Descriptive characteristics of the students.

Descriptive Characteristics	Experimental	Control	Total		
	Group (n=47)	Group (n=47)	(n=94)	Z	p
<b>Quantitative Variables</b>	$\bar{x} \pm SS$	$\bar{x} \pm SS$	$\bar{x} \pm SS$		
Age	19.72±1.62	19.23±1.43	19.48±1.54	-1.869	0.062
Grade point average	2.96±0.55	2.92±0.52	2.94±0.53	-0.405	0.686
<b>Categorical Variables</b>	<b>Experimental</b>	<b>Control</b>	<b>Total</b>	<b>Chi-Square</b>	
	<b>Group (n=47)</b>	<b>Group (n=47)</b>	<b>(n=94)</b>	<b>Analysis</b>	
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	$\chi^2$	<b>p</b>
<b>Gender</b>					
Female	35 (74.5)	34 (72.3)	69 (73.4)	0.000 <sup>2</sup>	1.000
Male	12 (25.5)	13 (27.7)	25 (26.6)		
<b>Request to change department</b>					
Yes	9 (19.1)	8 (17.0)	17 (18.1)	0.000 <sup>2</sup>	1.000
No	38 (80.9)	39 (83.0)	77 (81.9)		
<b>Satisfaction with the department</b>					
Satisfied	32 (68.1)	34 (72.3)	66 (70.2)	0.051 <sup>2</sup>	0.822
Dissatisfied	15 (31.9)	13 (27.7)	28 (29.8)		
<b>Participation in scientific activity</b>					
Yes	13 (27.7)	16 (34.0)	29 (30.9)	0.199 <sup>2</sup>	0.655
No	34 (72.3)	31 (66.0)	65 (69.1)		

$\bar{x}$ : Mean, SS: Standart deviation, n: Count, %: Percentage,  $\chi^2$ : Chi-Square Analysis, 1: Pearson chi-square test value, 2: Continuity correction test value, Z: Mann Whitney U test standardized Z test value

**Comparison of Median Invasive Injection Skill Scores of Both Groups**

The comparison of students' median values for invasive injection skill scores is presented in Table 2. The median value for ID injection was 100.00 (IQR=1.72) in the intervention group and 100.00 (IQR=0.00) in the control group. Although the control group's median value was slightly higher, the difference was not statistically significant. For SC injection, the median was 100.00 (IQR=0.00) in the intervention group and 100.00 (IQR=3.33) in the control group. The median values of the intervention group were higher, and the difference was statistically significant. For IM injection, the median was 96.30 (IQR=7.41) in the intervention group and 92.59 (IQR=14.81) in the control group. The intervention group had significantly higher median values than the control group.

**Table 2.** Comparison of skill scores in experimental and control groups.

Invasive Injections	Experimental		Control		Z	p
	Group (n=47)		Group (n=47)			
	M [IQR]	$\bar{x} \pm SS$	M [IQR]	$\bar{x} \pm SS$		
ID Injection	100.00 [1.72]	98.72±2.45	100.00 [0.00]	99.19±1.93	1.466	0.143
SC Injection	100.00 [0.00]	99.79±0.82	100.00 [3.33]	97.30±4.38	- <b>4.336</b>	<b>&lt;0.001</b>
IM Injection	96.30 [7.41]	95.35±5.70	92.59 [14.81]	89.95±10.51	- <b>2.572</b>	<b>0.010</b>

M [IQR]: Median [Interquartile range; 75th- 25th Percentiles], n: Number, Z: Mann Whitney U test standardized Z test value.

### Comparison of Median Satisfaction Levels of Both Groups

The homogeneity of the groups was evaluated using their Grade Point Averages (GPA). No significant difference was found ( $p>0.05$ ), indicating that the groups were academically comparable. The comparison of the median values for the total SSS-SF and its subscales among students is presented in Table 3. Upon examining the SSS-SF median values, no statistically significant differences were found between the intervention and control groups for the total SSS-SF ( $p=0.458$ ) or for any of the subscales: SSS-SF teaching staff ( $p=0.420$ ), SSS-SF school administration ( $p=0.655$ ), SSS-SF participation in decisions ( $p=0.730$ ), SSS-SF scientific, social, and technical facilities ( $p=0.824$ ), and SSS-SF quality of education and training ( $p=0.794$ ).

**Table 3.** Comparison of satisfaction level median in experimental and control groups

Scale and Sub-dimensions	Experimental Group (n=47)		Control Group (n=47)		Z	p
	M [IQR]	$\bar{x}\pm SS$	M [IQR]	$\bar{x}\pm SS$		
SSS-SF Total	4.66 [1.00]	4.43±0.61	4.83 [1.00]	4.48±0.60	0.743	0.458
SSS-SF teaching staff	4.83 [1.00]	4.58±0.54	5.00 [1.00]	4.64±0.47	0.806	0.420
SSS-SF school administration	4.67 [1.00]	4.40±0.66	4.67 [1.00]	4.43±0.66	0.447	0.655
SSS-SF participation in decisions	4.71 [1.00]	4.45±0.62	5.00 [1.00]	4.44±0.71	0.346	0.730
SSS-SF scientific-social and technical facilities	4.50 [1.00]	4.32±0.79	4.42 [1.00]	4.35±0.76	0.223	0.824
SSS-SF quality of education and training	4.62 [1.00]	4.42±0.69	4.85 [1.00]	4.49±0.62	0.261	0.794

M [IQR]: Median [Interquartile range; 75th- 25th Percentiles], n: Number, Z: Mann Whitney U test standardized Z test value, SSS-SF: Student Satisfaction Scale-Short Form

### Discussion

In this study, we aimed to understand whether station technique impacted students' practice skill success score and satisfaction. Our findings showed a significant difference in favor of the experimental group in the practice of IM and SC injection skills using the station technique. However, no significant difference was found between the groups regarding ID injection and satisfaction levels.

We found a significant effect of the station technique on the ability to apply SC and IM injections. Undergraduate nursing students acknowledge that active learning strategies enhance foundational understanding, the application and integration of knowledge, engagement in the learning process, self-directed learning, and the human dimension of education.<sup>2</sup> Beichner et al. observed improvements in students' conceptual understanding and skill development following the transformation of traditional classrooms into active learning spaces.<sup>35</sup> Similarly, a systematic review of 108 studies from various countries revealed strong correlations between learning environments and positive educational outcomes.<sup>36</sup> Traditional educational approaches face several limitations, such as restricting students' ability to actively engage in processing information, building understanding, or applying knowledge in practical contexts.<sup>4</sup> Furthermore, the shortage of nursing educators exacerbates these challenges, hindering the effective training of nurses within traditional educational frameworks.<sup>5</sup> In this study, we rearranged our work environment differently from the traditional method, offering students a learning environment distinct from their usual settings. We encouraged all students to actively participate in the lesson using the station technique. We believe that the significant increase in students' skill levels is related to this aspect of active learning.

There was no significant difference between the satisfaction level and ID success level. Both groups exhibited high levels of success and satisfaction. Due to the limited number of studies similar to our method in the literature, some studies using active learning methods examined the effect on satisfaction. In this context, SC injection training using digital games was found to increase satisfaction.<sup>37</sup> Students who used the game-based learning method were found to have high satisfaction with IM injection training.<sup>38</sup> IM injection training using an augmented reality application was found to have no impact on satisfaction.<sup>39</sup> At the institution where the study was conducted, the traditional teaching method involves demonstrating the application to students, who then replicate it on simple simulators. The current method, being a form of

active learning, and the high scores obtained from the scales explain the lack of significant difference. It is believed that the station technique does not have any negative aspects regarding its use in skill applications.

Partial student participation, the dual role of the researcher as both an instructor and faculty member are limitations. Another limitation is that the station method, while effective for reinforcing cognitive knowledge and ensuring the sequential execution of psychomotor skill steps, does not directly enhance psychomotor skill development. The study was conducted in only one institution from the country. Therefore, it cannot be generalized. It will be important to test the effects of this technique with more diverse samples.

### Conclusion

This study highlights the effectiveness of the station technique in improving nursing students' technical skills, particularly in subcutaneous and intramuscular injections. The results demonstrate that the station technique provides a more engaging and interactive learning environment, contributing to higher skill acquisition compared to traditional teaching methods. While the station technique did not show significant differences in intradermal injection skills or student satisfaction, its impact on practical skill development is noteworthy. The findings suggest that the station technique has the potential to enhance nursing education by fostering skill-based learning in a more structured and hands-on manner. Integrating such active learning strategies into nursing curricula can better prepare students for clinical practice, improving patient safety and the quality of care provided. From a health policy perspective, the implementation of active learning techniques like the station method could lead to more effective and efficient training programs for nursing professionals, addressing the growing demand for skilled healthcare workers. Policymakers may consider supporting the adoption of evidence-based teaching methods in nursing schools to promote both the technical proficiency and emotional intelligence required in modern healthcare settings.



**Reviewer:** External, Independent

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### Declarations:

**1. Originality Statement:** This study was not derived from any thesis.

**2. Author Contributions:** Conceptualization: M.A.; Idea: M.A.; Literature Review: M.A.; Data Collection: M.A.; Data Processing: M.A.; Analysis: M.A.; Writing – Original Draft: M.A.; Writing – Review and Editing: M.A.

**3. Ethics Committee Approval:** Ethics committee approval for this study was obtained from the Aksaray University Human Research Ethics Committee with the decision dated 28/02/2024 and numbered 2024/01-68.

**4. Funding/Support:** This study did not receive any financial support.

**5. Conflict of Interest:** The author(s) declare that there is no conflict of interest.

**6. Generative Artificial Intelligence Statement:** No generative artificial intelligence tools were used at any stage of this study.

**7. Sustainable Development Goals:** This work is related to the following United Nations Sustainable Development Goals.





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