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# Nursing students' knowledge and self-confidence in peripheral intravenous catheterization in Türkiye

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## Abstract

**Background:** Improving the success of peripheral intravenous catheterization (PIVC) requires developing students' clinical self-confidence alongside their theoretical knowledge. This study aimed to examine the relationship between nursing students' PIVC knowledge levels and their self-confidence.

**Methods:** This correlational study was conducted with nursing students enrolled at a university in Türkiye. A total population sampling approach was used; of 359 eligible students invited, 253 agreed to participate. Data were collected face-to-face between January and April 2026 using a Demographic Data Form, the Peripheral Intravenous Catheter Insertion Knowledge Form, and the Peripheral Intravenous Catheter Insertion Self-Confidence Scale for Nursing Students. Data were analyzed using descriptive statistics, multiple linear regression, one-way ANOVA with Tukey HSD post-hoc tests, and Pearson correlation analysis in SPSS 23.

**Results:** Academic year, positive beliefs about catheter insertion ability, and experience performing PIVC under supervision in clinical practice were significant positive predictors of both total PIVC knowledge ($R2 = 0.168$, $p < 0.001$) and self-confidence scores ($R2 = 0.323$, $p < 0.001$). Statistically significant differences across academic years were found in total PIVC knowledge scores [$F(3, 249) = 5.927$, $p = 0.001$, $\eta^2 = 0.067$] and total PIVC self-confidence scores [$F(3, 249) = 9.435$, $p < 0.001$, $\eta^2 = 0.102$]. A statistically significant, weak-to-moderate positive correlation was observed between the students' total PIVC knowledge scores and total self-confidence scale scores ($r=0.320$, $p< 0.001$).

**Conclusion**: The findings indicated that as nursing students' PIVC knowledge levels increased, their self-confidence also increased. To sustain knowledge over time and address technical skill gaps, refresher PIVC training should be integrated into the curriculum at each grade level and incorporate simulation-based training models that support motor skill acquisition into laboratory sessions.

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## Highlights

**What is current knowledge?**

Theoretical knowledge and clinical self-confidence are key determinants of nursing students' competency and patient safety during invasive interventions. While PIVC is taught early in nursing education, students' knowledge retention and confidence levels can fluctuate as they progress through clinical placements.

**What is new here?**

This study contributes to the literature by demonstrating a positive association between nursing students' knowledge and self-confidence regarding peripheral intravenous catheter placement. Students with higher knowledge scores also reported higher self-confidence levels.

## Introduction

Peripheral intravenous catheterization (PIVC) is an essential intervention for numerous diagnostic and therapeutic procedures in hospitals (1). It has been reported that over 40,000 PIVCs are used worldwide; furthermore, a study conducted in a single state hospital in our country between June and July documented 578 PIVC procedures (2,3). However, despite the widespread use of this procedure, success rates on the first attempt are reported to vary from 35% to 62.1%, with the literature highlighting that unsuccessful attempts negatively impact both patient comfort and healthcare expenditures (3,4). These findings indicate that the success rate on the first attempt needs to be improved. To achieve this, in addition to improving procedural knowledge and skills, it is also necessary to foster practitioners' positive perceptions of their ability to perform the intervention (5).

During their undergraduate education, nursing students receive both theoretical and practical instruction in PIVC skills. Throughout this training period, after receiving theoretical instruction in PIVC, students watch instructional videos, observe laboratory demonstrations, and then perform the procedure on manikins (6). National and international studies indicate that nursing students perform the skill with accuracy rates varying between 80% and 100%, and that their knowledge and skill scores are reported to be above average (7-9). However, due to factors such as students primarily observing the procedure under instructor supervision, experiencing fear and anxiety during practice, and having negative perceptions of their ability to perform the skill, students reportedly experience considerable anxiety, fear, and feelings of inadequacy when transferring the knowledge and skills acquired throughout their training to the clinical setting (10). In particular, the responsibility of performing the procedure on actual patients may lead students to focus on the possibility of making errors, thereby causing a decrease in their self-confidence (9-11). Self-confidence refers to an individual's belief in their ability to perform a task successfully, and it is an important determinant of the clinical decision-making process. Although numerous studies have evaluated students' knowledge, the self-confidence levels necessary for reflecting this knowledge in the clinical setting remain insufficiently investigated (8,12). The absence of a significant correlation between the knowledge scores and self-confidence levels of nurses in the research carried out by Massey and colleagues (2023) raises questions about how knowledge translates into clinical decision-making and confidence in performing interventions during nursing education (13). A student's theoretical comprehension of a skill does not necessarily indicate confidence in their ability to perform the intervention on patients (10). Therefore, this study aimed to assess nursing students' self-confidence levels toward PIVC skills and to examine the correlation between their knowledge levels and self-confidence regarding the procedure.

## Methods

This study employed a correlational design. The study population comprised all nursing students (N = 359) enrolled in the Department of Nursing at Yalova University in Türkiye. A total population sampling approach was used, with N = 253 nursing students consenting to participate. A post-hoc power analysis conducted via G*Power (v3.1) indicated that the final sample size of N = 253 provided a statistical power of %99 at an alpha level of 0.05 and a medium effect size. These results suggest that the sample size was statistically adequate for ANOVA and correlation analyses.

**Data collection**

The research data were collected face-to-face between January and April 2026 using a researcher-developed data collection instrument. The instrument comprised demographic characteristics, the Peripheral Intravenous Catheterization (PIVC) Procedure Knowledge Form, and the Nursing Student Peripheral Intravenous Catheter Insertion Self-Confidence Scale.

Demographic Data Form: The form comprised five questions addressing the students' age, gender, academic year, experience in performing PIVC in clinical practice, and their attitudes toward performing PIVC (8).

Peripheral Intravenous Catheterization (PIVC) Procedure Knowledge Form: Developed by the researcher based on a previous study, this form presents statements concerning pre-procedural preparation, the application process, and recording procedures (8). The form was updated through the omission of certain statements. The form was reviewed by eight faculty members specializing in the fundamentals of nursing for expert review. Expert opinions were evaluated using the Davis technique, in which each expert rated the draft items on a 4-point Likert scale ranging from 1 to 4 (1 = Not appropriate, 2 = Somewhat appropriate, 3 = Appropriate, 4 = Highly appropriate). Following the expert panel evaluation, the Content Validity Index (CVI) was calculated as 0.96. Students were asked to classify each statement as 'true', 'false', or 'I don't know'. The propositions in the knowledge form were analyzed under three subheadings: preparation (15 questions), application (11 questions), and recording (10 questions), with a total of 36 propositions. Correct answers to each proposition were scored as 1 point, whereas incorrect or 'I don't know' responses received 0 points. The maximum possible scores were therefore 15 for the preparation subheading, 11 for the application subheading, 10 for the recording subheading, and a total score of 36. The internal consistency reliability of the PIVC Knowledge Form was evaluated using the Kuder-Richardson Formula 20 (KR-20) because of its dichotomous (Correct/Incorrect) scoring system. The KR-20 coefficient was calculated as 0.78, indicating good internal consistency.

Peripheral Intravenous Catheter Insertion Self-Confidence Scale for Nursing Students: The scale was developed by Marchionni and colleagues (2024) and was adapted into Turkish and validated by Özbay and colleagues (2025), assesses nursing students' self-confidence in learning and performing peripheral intravenous (IV) catheter insertion (4,11). The scale comprises 15 items and three subdimensions: peripheral IV catheter cannulation confidence, peripheral IV catheter preparation and safety confidence, and peripheral IV catheter learning confidence. The minimum possible scale score is 1, and the maximum score is 5. The total score to be obtained from the scale varies between 1 and 5, with higher scores indicating greater self-confidence. The Cronbach's alpha coefficient of the scale was 0.936, and it was 0.964 in this research.

**Statistical analysis**

Descriptive data were presented as frequencies, percentages, and mean values. The normality of the data distribution was evaluated using the Kolmogorov-Smirnov test. Multiple linear regression analyses were conducted to determine the variables predicting PIVC knowledge and self-confidence scores. Homogeneity of variances across academic groups was assessed using Levene's test of equality of variances. One-Way Analysis of Variance (ANOVA) was conducted to compare PIVC knowledge and self-confidence scale scores across academic years. To determine the specific groups driving significant differences, the Tukey HSD post-hoc test was applied. The association between knowledge and self-confidence scale scores was assessed using correlation analysis. Data were analyzed using SPSS 23.0. A p-value of $< 0.05$ was considered statistically significant.

## Results

This study examined the relationship between nursing students' PIVC knowledge levels and their self-confidence in catheter insertion, of the 359 eligible nursing students invited, 253 agreed to participate voluntarily, yielding a response rate of 70.5%. The participants' mean age was 21.18 ± 2.64 (Min=18, Max=41), and most participants were female (70%). Most students also reported performing PIVC under the supervision of a preceptor nurse or faculty member during clinical practice (79.4%), and 72.7% expressed positive beliefs about their ability to perform PIVC (Table 1).

**Table 1.** Some variables of nursing students (N=253)

| Variables | n | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Female | 177 | 70 |
| Male | 76 | 30 |
| **Academic year** | | |
| 1st | 71 | 28.1 |
| 2nd | 66 | 26.1 |
| 3rd | 57 | 22.5 |
| 4th | 59 | 23.3 |
| **Status of performing PIVC on a patient under guidance in clinical practice** | | |
| Yes | 201 | 79.4 |
| No | 52 | 20.6 |
| **Perception regarding the ability to insert a PIVC on a patient** | | |
| Agree | 184 | 72.7 |
| Undecided | 8 | 3.2 |
| Disagree | 61 | 24.1 |

PIVC: Peripheral Intravenous Catheter

Analysis of students' responses regarding PIVC showed that the rates of correct answers to the statements in the preparation phase were higher than 'false' or 'no opinion' responses. However, in the implementation phase, students most frequently answered technical statements such as the duration of tourniquet application on the arm and advancing the steel needle within the vein. Regarding the documentation phase, the students generally had a good grasp of the rules, mostly responding incorrectly only to the erroneous statement 'the patient's diagnosis should be included on the catheter label,' while answering above average on all other documentation statements (Table 2).

The students' mean knowledge score regarding the PIVC procedure was 31.06 ± 4.78, and their mean total score on the PIVC self-confidence scale was 3.92 ± 0.64 (Table 3).

To identify factors predicting students' PIVC total knowledge and self-confidence scores, two separate multiple linear regression analyses were conducted. The multiple regression model predicting total PIVC knowledge was statistically significant ($F(4, 175) = 10.063$, $p < 0.001$) and accounted for 16.8% of the variance (Adjusted $R2 = 0.168$). Higher class levels ($\beta = 0.268$, $p < 0.001$), status of performing PIVC on a patient under guidance in clinical practice ($\beta = -0.198$, $p = 0.007$), and positive belief in one's ability to insert a catheter ($\beta = -0.214$, $p = 0.005$) significantly predicted higher knowledge scores, whereas gender was not a significant predictor ($\beta = -0.032$, $p = 0.656$). Similarly, the multiple regression model predicting PIVC self-efficacy was statistically significant ($F(4, 175) = 22.341$, $p < 0.001$) and explained 32.3% of the total variance (Adjusted R2= 0.323). Positive belief in catheter insertion capability ($\beta = -0.318$, $p < 0.001$$), higher class level ($\beta = 0.302$, $p < 0.001$), and experience performing PIVC under supervision in clinical practice ($\beta = -0.245$, $p < 0.001$) emerged as significant positive predictors of self-efficacy, while gender was not a significant predictor ($\beta = -0.051$, $p = 0.441$) (Table 4).

**Table 2.** Nursing students' responses to the peripheral intravenous catheter insertion knowledge form (N=253)

| Statements | True | | False | | No Idea | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Disposable gloves are used. | 242 | 95.7 | 4 | 1.6 | 7 | 2.8 |
| An appropriate size catheter/cannula is used. | 237 | 93.7 | 4 | 1.6 | 12 | 4.7 |
| Saline drawn into a syringe is used. | 199 | 78.7 | 43 | 17 | 11 | 4.3 |
| A vacutainer is used. | 30 | 11.9 | 213 | 84.2 | 10 | 4.0 |
| A tourniquet is used. | 238 | 94.1 | 12 | 4.7 | 3 | 1.2 |
| Sterile gloves are used. | 39 | 15.4 | 205 | 81 | 9 | 3.6 |
| Transparent dressing/securement material is used. | 241 | 95.3 | 2 | 0.8 | 10 | 4.0 |
| A clamp is used. | 41 | 16.2 | 199 | 78.7 | 13 | 5.1 |
| A sharps container is used. | 239 | 94.5 | 12 | 4.7 | 2 | 0.8 |
| Hands are washed before the procedure. | 248 | 98 | 3 | 1.2 | 2 | 0.8 |
| The patient is positioned before the procedure. | 221 | 87.4 | 16 | 6.3 | 16 | 6.3 |
| There is no need to wear gloves before the procedure. | 18 | 7.1 | 232 | 91.7 | 3 | 1.2 |
| The dorsal metacarpal vein can be evaluated for an appropriate vein before the procedure. | 198 | 78.2 | 24 | 9.5 | 31 | 12.3 |
| The femoral artery can be evaluated for IV catheter insertion before the procedure. | 47 | 18.6 | 173 | 68.4 | 33 | 13 |
| The cephalic vein can be evaluated for an appropriate vein before the procedure. | 189 | 74.7 | 33 | 13 | 31 | 12.3 |
| Tourniquet application, warm application, keeping the arm below heart level, and opening and closing the fist increase vein visibility." | 238 | 94.1 | - | - | 15 | 5.9 |
| Tapping the vein can be performed to promote venous enlargement in elderly individuals. | 69 | 27.3 | 164 | 64.8 | 20 | 7.9 |
| The tourniquet is applied 10-15 cm above the selected vein. | 229 | 90.5 | 12 | 4.7 | 12 | 4.7 |
| The tourniquet applied to the arm can remain in place for more than 5 minutes. | 239 | 94.5 | 4 | 1.6 | 10 | 4.0 |
| The radial pulse should remain palpable when the tourniquet is applied. | 184 | 72.7 | 49 | 19.4 | 20 | 7.9 |
| The selected vein should be wiped along the pathway from proximal to distal using an antiseptic cotton ball/sponge. | 209 | 82.6 | 31 | 12.3 | 13 | 5.1 |
| There is no need to wait for the site to dry after cleaning the area. | 29 | 11.5 | 215 | 85.0 | 9 | 3.6 |
| The vein should be entered with the IV catheter bevel facing up at an angle of 0-10 degrees. | 84 | 33.2 | 169 | 66.8 | - | - |
| During IV catheter insertion, the angle should be decreased after entering the vein. | 240 | 94.9 | 7 | 2.8 | 6 | 2.4 |
| During IV catheter insertion, the steel needle continues to be advanced along with the catheter after blood is observed in the flashback chamber. | 44 | 17.4 | 203 | 80.2 | 6 | 2.4 |
| During IV catheter insertion, the tourniquet should be released before removing the steel needle. | 217 | 85.8 | 19 | 7.5 | 17 | 6.7 |
| The IV catheter label should include the date of insertion. | 247 | 97.6 | 2 | 0.8 | 4 | 1.6 |
| The IV catheter label should include the time of insertion. | 208 | 82.2 | 36 | 14.2 | 9 | 3.6 |
| The IV catheter label should include the patient's diagnosis. | 186 | 73.5 | 41 | 16.2 | 26 | 10.3 |
| The initials of the practitioner's first and last name should be written on the IV catheter label. | 236 | 93.3 | 12 | 4.7 | 5 | 2.0 |
| The IV catheter label should include the patient's name. | 157 | 62.1 | 64 | 25.3 | 32 | 12.6 |
| During the IV catheter insertion procedure, the steel needle is disposed of in the medical waste container. | 110 | 43.5 | 134 | 53 | 9 | 3.6 |
| During the IV catheter insertion procedure, the gloves used are disposed of in the medical waste container. | 243 | 96 | 3 | 1.2 | 7 | 2.8 |
| During the IV catheter insertion procedure, hand hygiene should be performed before documenting the procedure on the nurse observation form. | 238 | 94.1 | 4 | 1.6 | 11 | 4.3 |
| When documenting the IV catheter insertion procedure on the nurse observation form, the date of the procedure should be written. | 244 | 96.4 | 6 | 2.4 | 3 | 1.2 |
| When documenting the IV catheter insertion procedure on the nurse observation form, the name of the nurse who performed the procedure should be included. | 246 | 97.2 | 5 | 2.0 | 2 | 0.8 |

IV: Intravenous

**Table 3.** Mean knowledge scores of nursing students regarding peripheral intravenous catheter insertion and their mean scores on the peripheral intravenous catheter insertion self-confidence scale (N=253)

| Measures | | Minimum | Maximum | Mean | SD |
|---|---|---|---|---|---|
| **Knowledge** | Preparation | 2 | 15 | 12.93 | 2.35 |
| | Application | 0 | 11 | 8.78 | 1.64 |
| | Documentation | 1 | 10 | 9.34 | 1.68 |
| | **Total** | 4 | 36 | 31.06 | 4.78 |
| **Scale** | Cannula Confidence | 1 | 5 | 3.91 | 0.67 |
| | Preparation and Safety Confidence | 1 | 5 | 4.01 | 0.67 |
| | Learning Confidence | 0.75 | 5 | 3.86 | 0.70 |
| | **Total** | 0.93 | 5 | 3.92 | 0.64 |

Min-Max values represent the actual achieved scores by the participants in this study.

**Table 4.** Multiple linear regression analysis results predicting peripheral intravenous catheter knowledge scores and PIVC self-confidence score (N=253)

| Variables | | B | Std Error | $\beta$ | t | p |
|---|---|---|---|---|---|---|
| **Total Knowledge Score** | Constant | 22.415 | 1.832 | - | 12.235 | < 0.001 |
| | Sex | -0.184 | 0.412 | -0.032 | -0.447 | 0.656 |
| | Year | 0.895 | 0.241 | 0.268 | 3.714 | < 0.001 |
| | Status of performing PIVC on a patient under guidance in clinical practice | 1.432 | 0.521 | -0.198 | -2.749 | 0.007 |
| | Perception regarding the ability to insert a PIVC on a patient | -1.105 | 0.384 | -0.214 | -2.878 | 0.005 |
| | $R = 0.432$, $R^2 = 0.187$, Adjusted $R^2 = 0.168$, F (4, 175) = 10.063, p < 0.001 | | | | | |
| **Total Self-Confidence Score** | Constant | 48.620 | 2.945 | - | 16.509 | <0.001 |
| | Sex | -0.512 | 0.662 | -0.051 | -0.773 | 0.441 |
| | Year | 1.842 | 0.387 | 0.302 | 4.760 | < 0.001 |
| | Status of performing PIVC on a patient under guidance in clinical practice | -3.120 | 0.837 | -0.245 | -3.728 | <0.001 |
| | Perception regarding the ability to insert a PIVC on a patient | -2.985 | 0.617 | -0.318 | -4.838 | < 0.001 |
| | R = 0.581, $R^2 = 0.338$, Adjusted $R^2 = 0.323$, F (4, 175) = 22.341, p < 0.001 | | | | | |

β ; Standardized Beta Coefficient

When nursing students' mean PIVC knowledge scores were compared across academic years, statistically significant differences were found across academic years in Total Knowledge Scores [F (3, 249) = 5.927, p = 0.001], demonstrating a medium effect size ($\eta^2$ = 0.067). Tukey HSD post-hoc comparisons showed that fourth-year students achieved significantly higher total knowledge scores compared to second-year (p = 0.010) and third-year (p < 0.001) students. Among the knowledge subdimensions, a statistically significant difference was observed in the Preparation subdimension [F (3, 249) = 9.444, p < 0.001, $\eta^2$ = 0.102], where fourth-year students scored significantly higher than first-year (p = 0.001), second-year (p < 0.001), and third-year (p < 0.001) students. Similarly, a significant difference was found in the Documentation subdimension [F (3, 249) = 2.957, p = 0.033, $\eta^2$ = 0.034], with fourth-year students scoring significantly higher than third-year students (p = 0.017). By contrast, no statistically significant difference was observed across academic years in the Application knowledge subdimension [F (3, 249) = 1.859, p = 0.137, $\eta^2$ = 0.022]. Regarding PIVC self-confidence, statistically significant differences were observed across all subdimensions as well as in Total Self-Confidence Scores [F (3, 249) = 9.435, p < 0.001], indicating a medium-to-large effect size ($\eta^2$ = 0.102). Post-hoc pairwise comparisons showed that for Total Self-Confidence Scores, first-year students reported significantly lower confidence levels compared to second-year (p = 0.025), third-year (p = 0.036), and fourth-year (p < 0.001) students. Across the subdimensions, significant differences were identified in Cannula Confidence [F(3, 249) = 6.900, p < 0.001, $\eta^2$ = 0.077], where fourth-year students reported higher scores than first-year students (p < 0.001); in Preparation and Safety Confidence [F (3, 249) = 7.275, p < 0.001, $\eta^2$ = 0.081], with first-year students scoring significantly lower than second-year (p = 0.033) and fourth-year (p < 0.001) students; and in Learning Confidence [F(3, 249) = 12.783, p < 0.001, $\eta^2$ = 0.133], which exhibited the largest effect size, showing significant pairwise differences between first-year and second-year (p = 0.023), third-year (p = 0.019), and fourth-year (p < 0.001) students, as well as between second-year and fourth-year (p = 0.005) students (Table 5).

A statistically significant weak-to-moderate positive association was observed, between nursing students' mean PIVC knowledge scores and all subdimension mean scores of the PIVC self-confidence scale. A statistically significant weak-to-moderate positive association was also found between their mean PIVC knowledge score and the mean total score of the PIVC self-confidence scale (p < 0.05) (Table 6).

**Table 5.** Mean PIVC knowledge and self-confidence scale scores by academic year (N=253)

| Measures | | Year | Mean ± SD | 95% Confidence Interval (95% CI) [Lower, Upper] | Homogeneity of variance (Levene statistic, P-value) | One-way ANOVA statistic (*F*), df, P-value | Effect size ($\eta^2$) | Post-hoc group comparison* |
|---|---|---|---|---|---|---|---|---|
| PIVC knowledge form | Preparation | 1st | 12.76±2.08 | [12.28, 13.25] | L = 8.167, p < 0.001 | F (3, 249) = 9.444, p < 0.001 | 0.102 | 1st-4th (p = 0.001) 2nd-4th (p < 0.001) 3rd-4th (p < 0.001) |
| | | 2nd | 12.39±2.39 | [11.83, 12.95] | | | | |
| | | 3rd | 12.40±2.97 | [11.66, 13.14] | | | | |
| | | 4th | 14.27±1.20 | [13.93, 14.61] | | | | |
| | Application | 1st | 8.90±1.32 | [8.59, 9.21] | L = 2.454, p = 0.064 | F (3, 249) = 1.859, p = 0.137 | 0.022 | None |
| | | 2nd | 8.74±1.85 | [8.30, 9.17] | | | | |
| | | 3rd | 8.38±1.95 | [7.89, 8.87] | | | | |
| | | 4th | 9.06±1.33 | [8.69, 9.44] | | | | |
| | Documentation | 1st | 9.35±1.50 | [9.00, 9.70] | L = 1.638, p = 0.181 | F (3, 249) = 2.957, p = 0.033 | 0.034 | 3rd-4th (p = 0.017) |
| | | 2nd | 9.36±1.61 | [8.98, 9.74] | | | | |
| | | 3rd | 8.85 ± 1.76 | [8.41, 9.29] | | | | |
| | | 4th | 9.77 ± 1.80 | [9.26, 10.28] | | | | |
| | Total Knowledge Score | 1st | 31.01±3.96 | [30.08, 31.94] | L = 2.825, p = 0.040 | F (3, 249) = 5.927, p = 0.001 | 0.067 | 2nd-4th (p = 0.010) 3rd-4th (p < 0.001) |
| | | 2nd | 30.50±5.19 | [29.28, 31.72] | | | | |
| | | 3rd | 29.64±5.43 | [28.28, 30.99] | | | | |
| | | 4th | 33.11±3.38 | [32.15, 34.07] | | | | |
| PIVC self-confidence scale | Cannula Confidence | 1st | 3.66 ± 0.58 | [3.52, 3.80] | L = 1.096, p = 0.351 | F (3, 249) = 6.900, p < 0.001 | 0.077 | 1st-4th (p < 0.001) |
| | | 2nd | 3.94 ± 0.70 | [3.78, 4.10] | | | | |
| | | 3rd | 3.92 ± 0.70 | [3.75, 4.10] | | | | |
| | | 4th | 4.17 ± 0.59 | [4.00, 4.34] | | | | |
| | Preparation and Safety Confidence | 1st | 3.74 ± 0.62 | [3.60, 3.89] | L = 0.884, p = 0.450 | F (3, 249) = 7.275, p < 0.001 | 0.081 | 1st-2nd (p = 0.033) 1st-4th (p < 0.001) |
| | | 2nd | 4.04 ± 0.72 | [3.87, 4.21] | | | | |
| | | 3rd | 4.04 ± 0.60 | [3.89, 4.19] | | | | |
| | | 4th | 4.27 ± 0.61 | [4.10, 4.45] | | | | |
| | Learning Confidence | 1st | 3.53 ± 0.61 | [3.39, 3.67] | L = 0.903, p = 0.440 | F (3, 249) = 12.783, p < 0.001 | 0.133 | 1st-2nd (p=0.023) 1st-3rd (p=0.019) 1st-4th (p<0.001) 2nd-4th (p=0.005) |
| | | 2nd | 3.85 ± 0.70 | [3.69, 4.02] | | | | |
| | | 3rd | 3.88 ± 0.72 | [3.70, 4.06] | | | | |
| | | 4th | 4.25 ± 0.60 | [4.08, 4.42] | | | | |
| | Total Self-Confidence Score | 1st | 3.65 ± 0.56 | [3.51, 3.78] | L = 0.822, p = 0.483 | F (3, 249) = 9.435, p < 0.001 | 0.102 | 1st-2nd (p=0.025) 1st-3rd (p=0.036) 1st-4th (p<0.001) |
| | | 2nd | 3.94 ± 0.68 | [3.78, 4.10] | | | | |
| | | 3rd | 3.94 ± 0.63 | [3.78, 4.10] | | | | |
| | | 4th | 4.22 ± 0.60 | [4.05, 4.39] | | | | |

PIVC: Peripheral Intravenous Catheter; df = Degrees of Freedom, L = Levene statistic for variance homogeneity; $\eta^2$ = Eta-squared; CI = Confidence Interval. Tukey HSD post-hoc test was applied for pairwise comparison.

**Table 6.** The relationship between nursing students' mean knowledge and self-confidence scores regarding the peripheral intravenous catheter insertion procedure (N=253)

| Measures | | Cannula Confidence | Preparation and Safety Confidence | Learning Confidence | Total |
|---|---|---|---|---|---|
| Preparation | r | 0.264 | 0.310 | 0.283 | 0.297 |
| | p | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| Application | r | 0.224 | 0.273 | 0.233 | 0.252 |
| | p | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| Documentation | r | 0.219 | 0.257 | 0.236 | 0.247 |
| | p | < 0.001 | < 0.001 | < 0.001 | < 0.001 |
| Total | r | 0.337 | 0.337 | 0.303 | 0.320 |
| | p | < 0.001 | < 0.001 | < 0.001 | < 0.001 |

r: Pearson Correlation Coefficient. All correlations are positive and statistically significant (p < 0.05).

## Discussion

In this study examining nursing students' knowledge and self-confidence levels regarding PIVC skills, the students' knowledge scores were above average. This finding is consistent with national studies reporting that nursing students' knowledge levels regarding PIVC management range from moderate to good (8,14,15).

Analysis of the students' responses concerning preparation steps showed that they answered all statements in the preparation phase with a high rate of accuracy, and they also demonstrated strong knowledge of procedural steps such as handwashing and site cleaning. In a study by Hernon et al. (2024) with student nurses, the authors found that while more than half of the students stated that the PIVC procedure should be performed using a clean technique, which is an incorrect response, more than half also correctly identified the solution to be used for skin cleaning prior to the procedure and responded correctly to statements regarding other aseptic principles (9). Similarly, in the study conducted by Etafa et al. (2020), the authors reported that students mostly answered correctly to the statements regarding aseptic principles prior to PIVC (16). Therefore, the high rate of correct responses to the statements, particularly those related to the preparation phase, may indicate adequate awareness of aseptic principles among the students.

In the PIVC implementation phase, students answered most statements correctly to all statements except for the statement concerning the duration of tourniquet application on the arm. The high rate of correct responses to the statements in the implementation phase is consistent with observational studies evaluating nursing students' skills (8,9,17). However, the significant deficiencies identified in technical aspects, such as the duration of tourniquet application on the arm, align with previous findings suggesting that students may overlook critical physiological parameters, such as monitoring circulation in actual patients, during manikin practice in laboratory settings (8,18,19).

Documentation is a critical component of peripheral intravenous catheterization that ensures the timely identification of complication risks, continuity of care, and the protection of patient safety and patient privacy principles in accordance with legal and ethical standards by fully documenting the insertion date, time, and the practitioner's details (20,21). In the present study, the finding that the majority of students responded incorrectly to the statement regarding the inclusion of the patient's diagnosis on the catheter label parallels the study conducted by Taşkıran et al. (2023) with nursing students, which reported that the statement with the lowest rate of correct responses was the inclusion of the patient's medical diagnosis on the securement label (15). This result highlights the need for students to review technical details regarding documentation standards and patient privacy.

Previous research suggests that confidence in professional skills increases the likelihood of successful performance (22,23). In the present study, students' self-confidence in PIVC was above average. This result is close to the value reported in the scale's validity and reliability study (12). In contrast, in the study conducted by Kaliyaperumal et al. with student nurses, it was reported that the students' self-confidence toward the procedure was at a moderate level and required further development (24). The finding that 72.7% of the students in this study held positive perceptions regarding their ability to perform PIVC suggests a high level of perceived self-efficacy within Bandura's theoretical framework, which serves as a critical source of motivation in the clinical decision-making process (25). Therefore, students' positive perceptions of PIVC support the research findings on their self-confidence levels.

As the clinical experience of nursing students increases, their knowledge and skill levels are expected to improve. In comparisons across academic years, the higher PIVC knowledge and self-confidence levels among senior students align with studies indicating that clinical competence develops as experience and training duration increase (8,26-28). However, the decrease in PIVC knowledge scores among second- and third-year students is attributed in the literature to the predominance of specialty-specific courses in this period and the insufficient repetition of fundamental skills in clinical settings (15,27). The relatively high PIVC knowledge levels among first-year students may be associated with the fact that theoretical and practical training on the topic is provided during the first year at the institution where the research was conducted, so the material remains recent in their learning. Nevertheless, the observation of the lowest self-confidence regarding PIVC in first-year students may reflect their greater need for practical experience compared to those in other academic years.

In this study, although the correlation was weak-to-moderate, the authors found that as the students' knowledge level increased, their self-confidence regarding PIVC also rose. Because no studies examining both PIVC knowledge and self-confidence among nursing students were identified, the study conducted by Indarwati et al. (2022) with nurses was considered; that study identified an association between the nurses' experience and knowledge levels regarding the PIVC procedure and their self-confidence levels (29). Similarly, in the study conducted by Massey et al. (2023) with registered nurses, a relationship was observed between knowledge regarding PIVC and the level of self-confidence toward the procedure (13). Identifying this association among students still in training is educationally important. This finding suggests that for students in the pre-professional preparation stage, theoretical background may contribute to their confidence in clinical practice. Furthermore, the multiple linear regression models highlighted that while knowledge and self-confidence are interrelated, they are jointly shaped by active clinical practice under guidance and positive self-belief rather than demographic characteristics such as gender. These findings emphasize that structuring nursing curricula to maximize supervised hands-on PIVC opportunities may help translate theoretical knowledge into robust clinical self-confidence.

This study has several limitations. First, recruiting nursing students from a single faculty limits the generalizability of the findings to a broader population of nursing students. Second, data were collected using self-report questionnaires, which may introduce self-reporting bias and social desirability bias, as students might have overestimated their knowledge or self-confidence levels. Third, due to the observational cross-sectional design, potential confounding variables, such as prior clinical experience, extracurricular training, or individual learning motivation, were not fully controlled, which may have influenced the observed differences across academic years.

## Conclusion

Nursing students demonstrated satisfactory procedural knowledge and above-average self-confidence regarding peripheral intravenous catheterization. Knowledge and self-confidence differed across academic years, with knowledge showing variation across training levels and self-confidence generally increasing with academic progression. A positive association was also observed between students' PIVC knowledge and self-confidence. Given the cross-sectional design, these findings should be interpreted as associations and differences between academic-year groups rather than changes attributable to educational progression. The observed variation in knowledge, particularly during the middle academic years, supports the consideration of continuous PIVC refresher training and simulation-based practice throughout the nursing curriculum. Longitudinal studies are warranted to determine how PIVC knowledge and self-confidence change over time within individual students.

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## Ethical Statement

Before the study began, written approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Yalova University (No: 2025/505, Date: 23.12.2025) and the office of the dean of the faculty where the study would be conducted. Prospective participants were informed that participation was entirely voluntary and that personal data confidentiality would be maintained. Informed consent was obtained from participating students, following the provision of a document detailing the study's objective, duration, and topic. For the scale employed in the study, permission was obtained from the authors by email. The study was conducted in accordance with the principles of the Declaration of Helsinki.

## Conflicts of Interest
None.

## Author Contributions
HE: Conceptualization, Methodology, Data curation, Formal analysis, Supervision, Writing, Review, and Editing.

## Data Availability Statement
Data will be made available upon reasonable request, subject to review by the researcher and consideration of data confidentiality.

## Use of Artificial Intelligence
The AI tool (Gemini) was used solely for language refinement and grammatical correction.

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