Innovative Teaching Method: Evaluating Peyton's Four-Step Approach for Intravenous Cannulation Skills in Nursing

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Abstract

Background: This study compared the effectiveness of the Peyton four-step approach, an innovative training method, with the conventional method for acquiring peripheral intravenous cannulation (IV cannulation) skills in first-year nursing students.

Methods: A quasi-experimental design with 16 randomly allocated students (case: n=8, control: n=8) was used. The case group received Peyton's approach in two 180-minute sessions over 2 weeks, while the control group received conventional training. Data on demographics, learning styles, self-efficacy, and IV cannulation skills were collected before and after the intervention.

Results: Both groups were similar in baseline characteristics. The Peyton approach significantly improved learning scores (p<0.01), reduced average IV cannulation time, and increased successful attempts compared to the conventional method. No significant difference was found in general self-efficacy (p=0.0419). Students in the case group showed significantly higher acceptance of the Peyton approach (p=0.039).

Conclusion: The Peyton four-step approach is a more effective method for teaching peripheral intravenous cannulation compared to the traditional method. This approach has the potential to improve student learning and patient care. Further research is needed to explore its advantages and disadvantages in diverse educational settings.

Keywords: Nursing education, Peyton approach, intravenous cannulation, self-efficacy, learning.

Introduction

Nursing, an inherently practice-oriented discipline, mandates robust clinical education to empower students in delivering safe, high-quality patient care. Procedural skills training constitutes an indispensable component of competency-based nursing education, empowering students to seamlessly translate theoretical knowledge into practical application [1, 2].

Nursing procedural skills encompass a repertoire of practical interventions employed by nurses to deliver direct patient care. These skills are indispensable for executing a diverse range of tasks, including medication administration, phlebotomy, IV cannulation, and wound management [3]. However, conventional instructional approaches for procedural skills training in nursing have been criticized for their inefficiencies [4]. This highlights the need for innovative educational solutions. Implementing innovative educational solutions, such as clinical simulations, problem-based learning, experiential learning, and active teaching methodologies within authentic clinical settings like healthcare centers and hospitals, holds promise for enhancing the quality of procedural skills education [2, 5].

Although innovative educational solutions within authentic clinical settings can improve procedural skills education, the potential stress associated with real-patient interactions needs to be carefully considered. Acquiring skills and learning through interaction with real patients can be highly stressful for nursing students, as they recognize that any error could result in patient harm or even death [2, 5, 6]. Moreover, nursing education faces the challenge of an increasing student-to-instructor ratio for procedural skills training, potentially hindering students' ability to develop new competencies [2, 7]. Consequently, students must actively engage in hands-on training prior to entering clinical settings. This necessitates the development of a clinical skills lab where students can practice in a safe environment [2, 6]. A clinical skills lab provides students with the opportunity to rehearse procedures before performing them on real patients, thereby reducing anxiety during their first encounter with actual patients [2].

Simulation-based education (SBE) has emerged as an efficacious approach to enhance nursing students' procedural skills, ultimately improving clinical outcomes [5, 6]. By providing a safe, stress-free environment for practicing hands-on skills, SBE fosters students' confidence and competence in performing real-world patient care procedures.

However, crafting a successful learning experience for nursing students hinges on employing appropriate pedagogical methods that align with learning objectives. Traditional procedural skills training approaches, such as the 'observe-and-do' method, can be challenging for students [7]. In this method, students first observe a skilled nurse performing a skill and then attempt it themselves. This approach can lead to anxiety, self-doubt, and ineffective learning, as students fear making mistakes and harming patients, potentially resulting in student dissatisfaction and incompetence [2].

In response to these challenges, innovative educational approaches are emerging with the aim of actively engaging students, fostering creativity, and strengthening their problem-solving skills. These approaches emphasize active and experiential learning, transforming students from passive recipients of information into active participants in the learning process.

Rodney Peyton (1998) introduced a method for teaching procedural skills to nurses that is rapidly gaining widespread adoption. Known as the "Peyton Four-Step Approach," this method has been recognized as a standardized educational approach and an effective, evidence-based method for teaching procedural skills to nursing students [5, 6]. The approach consists of four structured, pre-determined steps:

1. **Demonstration:** The instructor demonstrates the desired skill to the students, outlining the learning objectives and performing it at a normal pace without additional commentary.
2. **Deconstruction:** The instructor repeats the skill, breaking down each step into detail and demonstrating it fully and accurately.
3. **Elicitation (Guided Practice):** The instructor performs the skill a third time, following the students' explanations.
4. **Performance (Independent Practice):** The student performs the skill while explaining each sub-step independently and without prompting from the instructor [2].

Emerging evidence suggests that the four-stage Peyton approach may be more effective than conventional methods in enhancing nursing students' knowledge, motivation, and engagement, promoting deeper learning, skill retention, reducing anxiety, strengthening problem-solving skills, and self-confidence in performing procedural skills [2, 5-7].

The Peyton approach offers several advantages, stemming from its alignment with various learning theories, particularly in stage three (understanding). This stage emphasizes students' deep comprehension of the procedural skill, enabling them

to focus on intricacies and precise refinements during the coach-guided practice stage [2, 5-7]. Stage four (performance) entails independent execution of procedural skills. Thus, through repeated practice, students gain high confidence in their abilities and can perform satisfactorily in diverse settings.

While the Peyton approach demonstrates promise, it is not without limitations. These include resource-intensiveness (requiring additional instructors and training space), the need for instructor training in effective implementation, time constraints, and alignment with academic calendars. Additionally, assessing student learning in the Peyton approach may be more challenging [8]. One particular limitation arises from the original design of the Peyton approach for a one-on-one trainer-to-student ratio. This structure doesn't translate well to common skills laboratory settings where nursing student groups are often larger, ranging from five to eight trainees or even more [2, 6]. As a result, adaptations of the Peyton four-stage approach have been proposed specifically for small group skills training in the skills laboratory [6, 7].

This study investigates the effectiveness of the Peyton approach, an active learning method, compared to the conventional method for teaching procedural skills to nursing students. We aim to provide evidence informing the selection of appropriate instructional approaches in nursing skills education. The findings may influence the teaching of procedural skills to future nurses, potentially improving patient care quality. Furthermore, this study contributes to understanding the efficacy of active learning approaches in nursing education.

Methods and Materials:

This quasi-experimental study investigated the effectiveness of the four-step Peyton instructional approach on peripheral intravenous cannulation skill acquisition among first-semester nursing students during two group clinical skills training sessions in a laboratory setting. Peripheral intravenous cannulation was chosen as a common nursing clinical task due to its routine use in clinical practice and limited anatomical knowledge requirement, which is typically possessed by first-semester nursing students [12]. First-semester students were selected for the study to allow for a more accurate assessment of skills following minimal practical exposure and to prepare them for clinical practice [8]. The study was conducted over two weeks alongside the regular curriculum at the School of Nursing and Midwifery, Islamic Azad University, Najafabad Branch.

Ethical Approval:

Ethical approval was granted by the Ethics Committee in Research of Islamic Azad University, Najafabad Branch with the ethics code IR.IAU.NAJAFABAD.REC.1402.224. Written informed consent was obtained from all participants. Participation in the study was voluntary. Students were informed that the purpose of the study was to compare different teaching methods. Refusal to participate had no impact on subsequent assessments or other evaluations in the curriculum. Students also agreed not to discuss the training with their friends and not to have access to IV cannulation videos.

Study Population:

The study population included all nursing students admitted in September 2023 (n=63). Inclusion criteria were: first-semester nursing student in the first six months of education, not participating in other laboratory skills training at the time of the study, and willing to consent to video recording of the skill. Exclusion criteria were: previous training as a paramedic, previous experience in IV cannulation or blood sampling, inability to attend training sessions at scheduled times, and absence from training program sessions.

Sampling:

From the population, samples were selected based on inclusion criteria and randomly assigned to either the intervention or control group using a convenient sampling method. Sample size was determined based on previous studies, with 4 students per subgroup. In the study by Lapousi et al. (2018), the instructor-to-student ratio was 1:10 [6], and in the study by Nikoudi et al. (2014), the ratio was 1:3 [7], and in the study by Kulkarni (2023), the ratio was 1:10 [8]. A total of 16 first-semester nursing students were randomly assigned to one of the two groups.

Intervention:

The nursing skills book authored by faculty members of the school, which was regularly used in previous classes, was given to both the intervention and control groups. The intervention group performed intravenous cannulation using the Peyton four-step approach in the clinical skills laboratory. The Peyton four-step approach was delivered in 2 sessions of 180 minutes each over 2 weeks. The control group received IV cannulation training using the traditional "observe-do" method in the school. One student in the control group dropped out from the study in the second session, and follow-up continued with 7 participants.

Sample and Data Collection:

A total of 15 first-semester nursing students aged 18-21 years were recruited in the first week of the Autumn 2023 semester. Participants completed a demographic information questionnaire (age, gender, healthcare education background, socioeconomic status, and residence) and self-administered questionnaires to assess their learning motivation using the Learning Styles Questionnaire [6] and self-efficacy using the General Self-Efficacy Scale [7].

Pre-intervention Measures:

To assess students' self-efficacy before and after the intervention, the General Self-Efficacy Scale (GSES) by Sherer et al. [7] was employed. This scale measures three aspects of behavior: initiation (willingness to start a behavior), persistence (continuing to complete a behavior), and resilience (withstanding obstacles). The scale's validity and reliability have been established in Iranian studies [8]. The GSES comprises 17 items rated on a 5-point Likert scale from 1 to 5. For items 1, 3, 8, 9, 13, and 15, the scores for the options "strongly agree," "agree," "neither agree nor disagree," "disagree," and "strongly disagree" are 5, 4, 3, 2, and 1, respectively. For the remaining items, the scores are reversed. The minimum score on this scale is 17, and the maximum score is 85. A higher score indicates a higher sense of self-efficacy.

Additionally, before the educational sessions, the Cannulation Self-Efficacy Questionnaire was used to assess IV cannulation self-efficacy in both groups [9]. This questionnaire consists of five statements about IV cannulation. The statements are rated on a 6-point Likert scale (1=strongly agree to 6=strongly disagree).

Furthermore, before the start of the educational sessions, the Kolb Learning Styles Questionnaire was administered to assess the learning styles of the participants, including concrete experience, reflective observation, abstract conceptualization, and active experimentation. This questionnaire comprises 12 items, each with four response options. The response options are rated from 4 to 1 based on the individual's learning style. By marking the options for each question, the student indicates the extent to which each option matches their learning style, from most to least. The sum of the scores for each of these four options across the 12 questionnaire items yields four scores that represent the individual's learning styles (innovator, pragmatist, decision-maker, or planner). The validity and reliability of the Kolb Learning Styles Questionnaire have been established in Iranian studies [10].

Intervention:

The intervention group (n=8) received IV cannulation training in the clinical skills laboratory using the "Piton's Four-Step Approach." The sessions were conducted for small subgroups of four students with a 1:4 instructor-to-student ratio. An instructor (second author) provided instruction to each specific group according to a structured Peyton module to avoid any interference in teaching style. Emphasis was placed on independent practice of IV cannulation on a training arm model resembling a human arm. The training arm model (ARM P50) allowed access to multiple veins, including dorsal hand veins, cephalic vein, basilic vein, and median cubital vein. During practice, all students received feedback from the instructor. The control group (n=7) received conventional IV cannulation training based on the 'observe-and-do' teaching principle. In the control group, there was no specific instruction other than observing the instructor and listening to their explanations. The sessions were conducted for subgroups of four students by the instructor.

Outcome Measures:

All participants had a maximum of two attempts at IV cannulation. The total time required for a successful IV cannulation was recorded. Participants' performance in both the intervention and control groups was videotaped using CCTV cameras to capture all necessary details for accurate assessment.

Post-intervention Measures:

Students' performance after the intervention was independently assessed by two blinded video reviewers using a structured 26-item objective evaluation checklist. This checklist listed the steps required to perform peripheral venous cannulation, and each step performed correctly by the student was marked. The time required for successful IV cannulation was measured in seconds using a stopwatch, and the number of attempts required to achieve successful IV cannulation was also counted. (Successful IV cannulation was defined as the correct placement of the catheter in the vein and its securement with an adhesive dressing.)

Following the intervention, a checklist was employed to assess students' acceptance of diverse teaching methodologies and gauge their perception of instructors' motivational and instructional competence. This checklist comprised nine statements regarding teaching approaches, rated on a six-point Likert scale (ranging from 1, indicating "strongly agree," to 6, indicating "strongly disagree").

Data collected from participants were analyzed using SPSS software. The Shapiro-Wilk test was employed to assess the normality of data distribution. Normally distributed data were compared between the two groups using the t-Student test (assuming equal variances). For non-normally distributed data, the Mann-Whitney U (MWU) test was utilized. A significance level of 0.05 was adopted.

Results

The participants' mean age was 19.5 ± 1.03 years. Females comprised 71.4% of the participants. No participants in either group had a prior background in healthcare. Descriptive statistics revealed no significant differences in age, gender, or educational level between the intervention and control groups prior to the intervention (Table 1).

Table 1- Descriptive Statistics of Demographic Information by Intervention and Control Groups

		CONTROL		CASE	
	Item	Frequency	Respondent Frequency (%)	Frequency	Respondent Frequency (%)
GENDER	Female	5	71.4	8	100
	Male	2	28.6	0	0
	Not Answered	0	0	0	0
	Yes	0	0	0	0
HEALTHCARE EDUCATION BACKGROUND	No	7	100	7	100
	Not Answered	0	0	1	0
PLACE OF RESIDENCE	Esfahan	2	28.6	4	57.1
	County	5	71.4	3	42.9
	Not Answered	0	0	1	0
SOCIOECONOMIC STATUS (SES)	High	2	28.6	1	16.7
	Medium	5	71.4	5	83.3
	Low	0	0	0	0
	Not Answered	0	0	2	0
LEARNING STYLES	Innovator	1	14.3	0	0
	Pragmatist	0	0	1	16.7
	Decision-maker	4	57.1	5	83.3
	Planner	2	28.6	0	0
	Not Answered	0	0	2	0

Further analyses revealed that the two groups were also somewhat balanced in terms of learning styles and self-efficacy. However, there were small differences in some of the learning style subscales (e.g., concrete experience and reflective observation, abstract conceptualization, and active experimentation) between the two groups (Table 2).

Table 2- Descriptive statistics of the study variables by condition group

Item		Control				Case			
		mean	SD	Min	Max	Mean	SD	Min	Max
Learning	Concrete	36.14	4.81	30	43	33.75	5.68	23	43

		Mean	SD	Min	Max	Mean	SD	Min	Max
	Experience								
	Reflective Observation	47.71	15.27	35	71	38.75	5.73	30	47
	Abstract Conceptualization	40..43	6.19	29	47	37.13	6.22	25	45
Self-Efficacy	Active Experimentation	42.00	3.65	36	47	44.00	4.69	35	48
	IV Cannulation (before)	29.86	0.38	29	30	24.88	7.18	15	30
General Self-Efficacy (before)		72.00	6.95			65.13	7.97		
Age		19.86	1.07	18	21	19.25	1.04	18	21

SD = Standard deviation; Min = Minimum; Max = Maximum

The results of Table 3 and Figure 1 showed that the distribution of learning style scores in both the control and case groups was normal, with a 1% level of error. This result was based on the non-significance of the Shapiro-Wilk test (p>0.01) for both groups. Given the normal distribution of scores, an independent t-test was used to compare the mean learning style scores between the two groups. The results of descriptive statistics showed that the mean scores for the Concrete Experience, Reflective Observation, and Abstract Conceptualization learning styles were higher in the control group than in the case group. In contrast, the mean score for the Active Experimentation learning style was higher in the case group (M=44) than in the control group (M=42). However, the results of the independent t-test showed that there was no significant difference between the mean learning style scores in the two groups. This conclusion is based on two reasons: 1) the significance level of the test for each of the learning styles was greater than 0.01 (p>0.01) and 2) the absolute value of the t-statistic was less than 2.58 (|t|<2.58). Therefore, with 99% confidence, it can be concluded that the two case and control groups were equivalent in terms of the Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation learning styles.

Table 3- Results of Independent t-tests Comparing Learning Style Scores of Nursing Students before Intervention in Case-Control Groups

LEARNING STYLE	GROUP	N	DESCRIPTIVE STATISTICS	SHAPIRO-WILK NORMALITY TEST	INDEPENDENT T-TEST FOR COMPARISON
CONCRETE EXPERIENCE	Control	7	Mean = 36.14, SD = 1.82, Min = 30, Max = 43	W =0.801	t = 0.873, p = 0.398
	Case	8	Mean = 33.75, SD = 5.68, Min = 23, Max = 43	W =0.376	
REFLECTIVE OBSERVATION	Control	7	Mean = 47.71, SD = 5.77, Min = 35, Max = 71	W =0.029	t = 1.547, p = 0.146
	Case	8	Mean = 38.75, SD = 2.02, Min = 30, Max = 47	W =0.588	
ABSTRACT CONCEPTUALIZATION	Control	7	Mean = 40.43, SD = 2.34, Min = 29, Max = 47	W =0.441	t = 1.029, p = 0.322
	Case	8	Mean = 37.13, SD = 2.2, Min = 25, Max = 45	W =0.653	

ACTIVE EXPERIMENTATION	Control	7	Mean = 42.00, SD = 1.38, Min = 36, Max = 47	W = 0.871	t = -911, p = 0.379
	Case	8	Mean = 44.00, SD = 1.66, Min = 35, Max = 48	W = 0.035	

N: Sample size; **SD:** Standard deviation; **Min:** Minimum value; **Max:** Maximum value; **W:** Shapiro-Wilk test statistic; **p:** p-value for normality test; **t:** t-test statistic
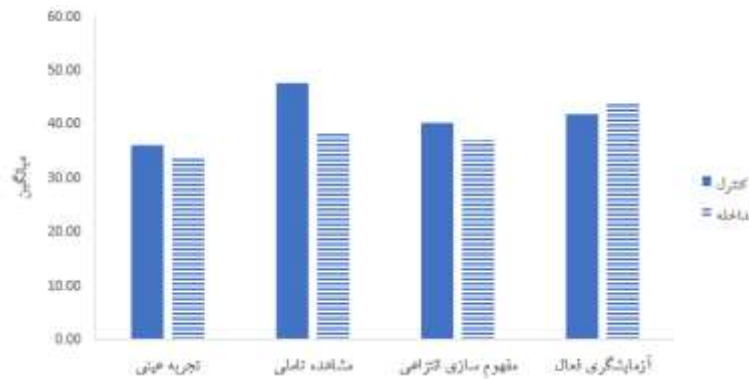

Figure (1): Distribution of learning style scores in the control and case groups

The results of Table 4 showed that the distribution of IV cannulation self-efficacy scores was not normal in both the control and intervention groups using the Shapiro-Wilk test at the 1% error level (P > 0.01). Therefore, the Mann-Whitney U test was used to compare the mean IV cannulation self-efficacy scores between the two groups.

The results of descriptive statistics showed that the mean IV cannulation self-efficacy score was slightly higher in the control group (86.29) than in the intervention group (87.24). However, the Mann-Whitney U test showed that there was no statistically significant difference between the mean IV cannulation self-efficacy scores in the two groups (P > 0.01). Therefore, with 99% confidence, it can be concluded that the two control and intervention groups did not differ in terms of IV cannulation self-efficacy.

Table 4- Mann-Whitney U Test Results for Comparing Pre-Cannulation Self-Efficacy Scores of Nursing Students in the Control and Intervention Groups

GROUP		N	DESCRIPTIVE STATISTICS	NORMALITY TEST WITH SHAPIRO-WILK TEST	MANN-WHITNEY U TEST FOR COMPARISON	
			(M ± SD)	Significance level	F	Significance level
IV CANNULATION SELF-EFFICACY	Control	7	29.86 ± 0.37	0.0001*	0.20	0.397
	Case	8	24.87± 7.18	0.002*		

The results showed that the mean general self-efficacy in both control groups decreased significantly after the intervention (Tables 5 and 6). However, the intervention group scored an average of 13.36 points higher in general self-efficacy than the control group (57.33), which was not statistically significant (ANCOVA, P = 0.419). These findings suggest that 47% of the change in general self-efficacy scores between the two groups was attributable to the Peyton-based educational approach, which was not statistically significant ($\eta^2 = 0.470$).

Table 5- Comparison of Nursing Students' General Self-Efficacy Before and After Intervention by Case-Control Groups

General Self-Efficacy	Control		Case	
	(M ± SD)	Shapiro-Wilk test significance level	(M ± SD)	Shapiro-Wilk test significance level
Before	72.00 ± 6.95	0.796	65.13± 7.97	0.393
After	33.57 ±11.73	0.230	36.13 ± 7.72	0.902

Table 6- Results of ANCOVA to compare general self-efficacy of nursing students in Case-Control groups

SOURCE OF VARIATION	DF	MS	F	SIGNIFICANCE LEVEL	EFFECT SIZE
CONSTANT	1	1424.919	25.964	0.0001**	0.684
GENERAL SELF-EFFICACY SCORE	1	584.030	10.642	0.007**	0.470
GROUP	1	38.483	0.701	0.419	0.055
ERROR	12	54.880	-	-	-

**Significance at 0.01 level

The results of the descriptive statistics showed that the intervention had a significant effect on student performance in all three indices of learning score, IV cannulation time, and number of successful attempts. The performance of the intervention group was significantly better than that of the control group. Table 7 shows the details of this comparison. The learning score in the intervention group was higher (mean 16.79) than in the control group (mean 10.45); the IV cannulation time in the intervention group (6.50 minutes) was shorter than in the control group (7.00 minutes); And the number of successful attempts in the intervention group (1.35) was better than in the control group (1.43).

Table 7- Descriptive statistics of research variables by intervention-control group

VARIABLE		CONTROL GROUP (MEAN ± SD), MIN, MAX	CASE GROUP (MEAN ± SD), MIN, MAX
PERFORMANCE	Learning Score	10.45 ± 2.21, Min = 8, Max = 14	16.79 ± 6.27, , Min = 12, Max = 32
	IV Cannulation Time (minutes)	7.00 ± 0.58, Min = 6, Max = 8	6.50 ± 0.53, Min = 6, Max = 7
	Number of Successful Attempts	1.43 ± 0.53, Min = 1, Max = 2	1.13 ± 0.35, Min = 1, Max = 2
ACCEPTANCE OF THE TEACHING MODEL		43.29 ± 5.59, Min = 34, Max = 51	48.57 ± 3.16, Min = 43, Max = 54

The results (Table 8) showed that the distribution of performance scores (including learning, time, and number of successful attempts) in both case and control groups, except for the performance score in the control group, were not normal at the 1% error level ($p < 0.01$). Therefore, the non-parametric Mann-Whitney U test was used to compare the mean performance in the two groups.

- The mean learning score in the case group (79/16) was significantly ($p < 0.01$) higher than the control group (10.45). This indicates that Peyton-based training significantly leads to improvement in students' learning performance compared to the traditional method.

- The mean performance time in the control group (7 minutes) was significantly longer than the case group (6.5 minutes). However, the Mann-Whitney U test showed that this difference was not significant (p > 0.01). This indicates that Peyton-based training does not significantly reduce students' performance time compared to the traditional method.

- The mean number of successful attempts in the control group (1.43) was significantly higher than the case group (1.12). However, the Mann-Whitney U test showed that this difference was not significant (p > 0.01). This indicates that Peyton-based training does not significantly reduce the number of successful attempts of students compared to the traditional method.

Table 8- The results of the Mann-Whitney U test to compare the performance of nursing students in the implementation of the procedure in case-control groups

PERFORMANCE	GROUP	N	DESCRIPTIVE STATISTICS (Mean ± Standard deviation)	NORMALITY TEST (SHAPIRO-WILK) significance level	F	MANN-WHITNEY U TEST FOR COMPARISON significance level
LEARNING SCORE	Control	7	10.45 ± 2.21	p = 0.283	3.5	**0.002
	Case	8	16.79 ± 6.27	p = 0.001**		
IV CANNULATION TIME	Control	7	7.00 ± 0.58	p = 0.024*	16	0.189
	Case	8	6.50 ± 0.53	p = 0.001**		
NUMBER OF SUCCESSFUL ATTEMPTS	Control	7	1.43 ± 0.53	p = 0.001**	19.5	0.336
	Case	8	1.13 ± 0.35	p = 0.0001**		

*p < 0.05 is considered statistically significant.

**p < 0.01 is considered highly statistically significant.

Table 9 showed that the distribution of students' admission scores from different teaching methods in both control and case groups was normal according to the Shapiro-Wilk test (P>0.05). Therefore, an independent t-test was used to compare the mean admission scores in the two groups. Statistical analysis showed that the mean admission score of students in the control group (43.28) was significantly lower than that of the case group (48.57) (P=0.039). With a 95% confidence level, it can be concluded that the Peyton-based teaching approach led to significantly higher admission scores than traditional teaching methods in students in the case group.

Table 9- Results of independent t-test to compare the admission scores of students from different teaching models in case-control groups

	GROUP	N	DESCRIPTIVE STATISTICS	NORMALITY TEST WITH SHAPIRO-WILK	INDEPENDENT T-TEST FOR COMPARISON
ADMISSION SCORES OF STUDENTS FROM DIFFERENT TEACHING MODELS	Control	7	43.28 ± 5.58	0.874	t = 2.96, P = 0.039*
	Case	8	48.57 ± 3.15	0.262	

* Significance at the 0.05 level.

Discussion and Conclusion

The results of the present study demonstrated that the performance of students who received IV cannulation skill training using the four-step Peyton approach was significantly better compared to the control group. The evidence suggests that this educational approach, due to its professional and structured nature, has an advantage over traditional nursing and clinical teaching methods, resulting in faster student performance when performing the learned skill for the first time [2, 4-9].

This study examines the Peyton approach as an innovative educational method for teaching nursing procedural skills. The key findings of this research include the distribution of demographic variables, general self-efficacy, student performance, and acceptance of the teaching model by the students. The findings of this study suggest that demographic factors such as age, gender, and socioeconomic status do not have a significant impact on the level of self-efficacy or learning style of nursing students. In the study by Inanloo et al. (2020), there was also no significant correlation between self-efficacy and demographic factors [6]. However, learning style can have an impact on students' academic performance. Students who use the decision-making learning style may have better academic performance than students who use other learning styles. These findings are consistent with the research of Sicilia et al. [7].

Table 2 results indicated that while the two groups were matched on many baseline variables, there were minor differences in some learning style subscales. These differences were not statistically significant ($p > 0.05$). In line with these findings, results from the study by Shirazi and Heydari (2019) showed that teachers should consider the dominant learning style of each class and use appropriate teaching methods based on these styles.[6]

Further analysis (Table 3) revealed that the diversity of learning styles (concrete experience, reflective observation, abstract conceptualization, and active experimentation) was similar across the case and control groups. These findings are consistent with the results of other studies [2, 4, 7] that have examined group equivalence in terms of learning styles, and they lend support to the internal validity of the present study.

Other studies have shown that the Peyton approach leads to better learning and retention of knowledge in students compared to the traditional teaching method [2, 4, 8]. Abdolrahman et al. (2023) also reported that students who were trained using the Peyton approach had greater self-confidence in performing nursing skills and experienced less anxiety compared to the group trained using the traditional teaching method.[7]

While matching the two groups in terms of pre-intervention general self-efficacy (Table 5) facilitated the interpretation of the results regarding the impact of the intervention, the mean general self-efficacy in both study groups had significantly decreased (by about half) after the intervention. This finding is in contrast to the results of other similar studies, in which students in the Peyton group reported greater confidence and satisfaction with their learning experience [7, 9]. The decrease in general self-efficacy may have various reasons. For instance:

Self-efficacy is a complex psychological concept that is influenced by various factors, including prior experiences, beliefs about one's abilities, and feedback from others [9]. The process of learning new nursing skills may have been associated with psychological stress, which in turn could have impacted students' general self-efficacy [10].

Or, nursing students may have had unrealistic expectations of themselves regarding the speed of learning new skills at the time of the study, and failure to meet these expectations may have led to a decrease in self-efficacy [11].

Alternatively, comparing themselves to their peers and feeling like they were not progressing as well may have led to a decrease in self-efficacy among nursing students.

The present study demonstrated that the intervention resulted in a significant increase in general self-efficacy in the intervention group compared to the control group (Table 6). This finding suggests that the intervention was effective in enhancing the nursing students' confidence and ability to perform their tasks. The moderate effect size of the intervention (47%) indicates a strong impact of this intervention. A systematic review study found that various educational interventions, including simulation-based education, problem-based learning, and interpersonal skills training, can lead to increased self-efficacy in nurse [12].

The results of Table 7 demonstrate the feasibility of the Peyton approach in teaching IV cannulation skills to nursing students. These findings suggest that the Peyton approach can effectively enhance nursing students' clinical skills in performing this procedure. These results are consistent with the findings of other studies in this area [5, 13, 14].

In addition, the results (Table 8) show that in terms of performance, the learning score of the intervention group was significantly higher than that of the control group ($P > 0.01$). This finding suggests that the intervention (Peyton

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approach) increased learning in the intervention group; And is consistent with a study conducted at Mansoura University School of Nursing (2019) entitled "The Effectiveness of the Four-Step Peyton Approach on the Performance of Nursing Students in Laboratory Skills Training," which showed a significant improvement in performance level after implementation of the four-step Peyton approach [5]. The study by Abdulrahman et al. (2023) also reported similar findings. This study found that the use of the Peyton approach in clinical nursing skills training led to increased performance, satisfaction, and self-confidence in students [7]. Awwad et al. (2019) also provide similar findings. In their study, the performance score of participants in both intramuscular injection and arterial puncture procedures who were trained using the Peyton approach was significantly higher than that of the control group [5].

According to performance metrics, the mean time to perform IV cannulation was 30 seconds faster in the intervention group compared to the control group. This suggests that the intervention significantly increased the speed of IV cannulation among nursing students. Additionally, the mean number of successful attempts was better in the intervention group (1.35) compared to the control group (1.43), supporting that the intervention reduced the number of unsuccessful attempts for IV cannulation among nursing students. While these differences were not statistically significant ($P > 0.01$), they indicate the potential of the Peyton approach to reduce time and increase the number of successful attempts in performing this skill.

Results (Table 9) showed that the mean score of acceptance of the teaching model in the intervention group (48.57) was significantly higher than the control group (43.29). This finding suggests that nursing students in the intervention group accepted the Peyton teaching model significantly more than the control group; And the Peyton teaching model can be an effective tool to engage and involve nursing students in the learning process. Greater acceptance of this teaching model can lead to increased motivation, focus, and deeper learning among students. These findings are consistent with the results of the study by Awadi et al. (2019), which showed that the Peyton four-stage approach can play an important role in improving students' clinical performance [5].

Limitations

One limitation of the present study was that the sample size was relatively small and only one skill was assessed, which potentially limits the generalizability of the study. Both educational approaches were manageable for the instructors. However, Peyton's four-step approach required more time compared to the traditional teaching approach.

Suggestions for further research

This study can provide information to help inform the nursing education literature with Peyton's four-step approach towards effective learning of nursing procedures for nursing students. It is suggested that future studies be conducted on larger groups and compare the effectiveness of this approach in nursing students with different levels of experience, educational background, and clinical skills.

Conclusion

The findings of this study can have implications for how procedural skills are taught to future generations of nurses. A careful comparison of Peyton's four-step approach with traditional nursing education methods can guide nurse educators, curriculum planners, and policymakers in selecting the appropriate teaching method for nursing procedural skills. If Peyton's four-step approach is widely implemented in nursing education programs, it can potentially lead to improved quality of nursing education and ultimately improved quality of patient care.

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Conflict of interest

The authors declare no conflict of interest.

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