Original Article

# Evaluation of Feedback-based Education Effect of IV Insertion Skills to Undergraduate Nursing Students

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## Abstract

**Background & Objective:** Studies show that students lack sufficient clinical skills during the nursing apprenticeship course despite their strong theoretical knowledge. Feedback-based education is one of the teaching methods used for this group of students. The present study aimed to determine the effect of feedback-based education on first-semester nursing students' skill of IV insertion.

**Materials & Methods:** In this clinical trial, the subjects were selected by convenience sampling and randomly divided into two 20-member intervention and control groups. While feedback-based education was provided to the subjects in the intervention group, the participants in the control group received conventional education. A researcher-made checklist was filled by all participants immediately after the education process and at the end of the semester and the two groups were compared in this regard. Data analysis was performed in SPSS version 19 using paired t-test and independent t-test. In addition, a P-value of 0.05 was considered statistically significant.

**Results:** The results revealed a significant difference between the intervention and control groups immediately after the education process (t=2.71, P=0.04). However, this difference was not significant at the end of the semester (four months later) (t=1.79, P=0.12).

**Conclusion:** According to the results of this study, while feedback-based education significantly improved the nursing students' skill of IV insertion in short term, this improvement was not permanent. It is recommended that more studies be conducted in this area.



## Introduction

Clinical education has a special place and importance in the nursing profession. The objective of the nursing education program is to train nurses who can play an effective role in providing health and improving the life quality of people in the community (1). Nursing students work in complicated environments, where technology and performance are repeatedly changed. Therefore, nurses require more competencies to provide quality care to clients. The clinical environment provides an opportunity for nurses to learn experimentally and convert their theoretical knowledge into diverse mental and psychological-motor skills that are required for patient care (2). Studies show that students enrolled in the nursing apprenticeship course lack sufficient skills for clinical environments regardless of their strong theoretical knowledge (3). In this regard, Fasihi-Harandi (2003) declared that 88.9% of nursing students had problems in the area of clinical nursing education (4). Meanwhile, evidence suggests that graduates lack the necessary skill for doing clinical work (3, 5). In this respect, instructors play a clear role in successful student education and linking theoretical and clinical education (3). Students memorize information in theoretical classes but fail to use them in practice, which is an outcome of a lack of use of novel approaches (6). Therefore, these individuals are required to gain the necessary ability to enter the clinical environment.

Several studies have indicated a relatively deep gap in the conventional nursing education trend and clinical care performance, such that the current clinical educations are unable to establish clinical skills and

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abilities in students (3). Today, novel approaches have attracted the attention of experts in charge of this area. In these inclusive methods, the interests and abilities of students are emphasized, and the teacher attempts to strengthen students' listening, speaking, reading, writing, argument, comparison, adaptation, analysis, construction and creativity skills and provide the curriculum content based on these items (7). New teaching methods include brainstorming, syntactic teaching, problem-solving, mentorship, indirect teaching, role-playing, feedback-based training, and exploratory teaching. Feedback-based training method is one of the novel teaching methods used to achieve optimal clinical performance (6, 7). In the operational definition of feedback in clinical education, Ridder (2015) writes: "in medical education, feedback is defined as specific information about the comparison between trainees' observed performance and a standard, given with the intent to improve the trainee's performance." In the absence of feedback from teachers and educators, mistakes remain unreformed, poor performance is not enhanced, and clinical competence is not achieved, which will result in a feeling of confusion among learners and trainees (8).

In education, feedback is not just a skill but a part of education and learning. In addition, the feedback includes a message from the teacher to the learner regarding their performance aspects (9). The role of feedback has been assessed in various studies; for instance, Haghani & Fakhari (2014) claimed that 80% of practical clinical skills are taught to students through feedback. Meanwhile, less than 17% of students considered feedback to be effective (10). In a research by Hewson et al. (2012), only eight percent of students were extremely satisfied with the feedback and 80% claimed that they did not receive feedback (11). One of the most important skills of nursing students is the insertion of an IV line. According to Miri et al. (2013), the nursing education course failed to train students in terms of intravenous catheter insertion due to its short period (12). Meanwhile, insertion of an IV line is one of the basic nursing skills (13). Limited studies have addressed the frequency of practicing this skill required to achieve mastery in this regard. However, these studies have been based on the personal experiences and opinions of nursing instructors or students and have not used objective indicators based on proficiency (12).

Various studies have been conducted on feedback on different care techniques, yielding conflicting results. For instance, Johnson et al. (2016) performed a research to determine the effect of feedback on the performance of chest compression by basic life support trained clinical staff. According to the results, the feedback provided from an automated training device was sufficient to produce an improvement in performance in chest compressions in CPR (14). In another research, Ahmadi et al. (2015) reported that the immediate and planned feedbacks during the training offered to students improved the clinical training trajectory and increased the participants' skills (15). In another research, Rosenthal et al. (2003) declared that the use of feedback in medical education had no effect on rates of intravascular device-associated bloodstream infections (16). Given the conflicting results obtained in the area of the effect of feedback on education, it seems that more studies are required in this regard. In addition, with regard to the importance of learning the insertion of an IV line by nursing students and given the concerns about the lack of human resources and standard clinical education equipment (17), it is crucial to take measures to improve the nursing students' skill of IV insertion. With this background in mind, the present study aimed to determine the effect of feedback-based education on nursing students' skill of IV insertion in Isfahan University of Medical Sciences.

## Materials and Methods

This quasi-experimental research was performed on 40 first-semester nursing students during September-December, 2018. The sample size was determined at 15 subjects per group based on the mean formula and

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similar studies (18) at α=0.05 and 80% test power. However, considering a 10% attrition, 20 subjects were allocated to each group.

$$n = \frac{(z1 - \frac{\alpha}{2} + z1 - \beta)^2 (S_1^2 + S_2^2)}{d^2}$$

A total of 44 first-semester nursing students were selected by convenience sampling. Nevertheless, four individuals were removed from the research due to a lack of eligibility. Afterwards, the samples were randomly divided into two intervention and control groups applying online software (Figure 1). The inclusion criteria were informed consent, being a first-semester nursing student, and lack of nursing educational background. On the other hand, the exclusion criterion was absent on the training day. Data were collected using a demographic characteristics questionnaire, which involved age, gender, grade point average (GPA) and education of IV insertion skill, and a researcher-made questionnaire of skill of an IV insertion. The checklist was designed based on the book of Clinical Nursing Skills by Mousavi et al. (2013) with the guidance of teachers of nursing principles and techniques at the Nursing and Midwifery School of Isfahan (19). The checklist encompasses 20 items scored in the range of 0-20. In fact, the items with higher significance are scored 1.25 and the rest of the items are scored 0.8. The validity of the mentioned checklist was confirmed by 10 experts in the field. In addition, the content validity ratio (CVR) and content validity index (CVI) of the tool were estimated at 0.85 and 0.89, respectively. In addition, the reliability of the instrument was confirmed at a Cronbach's alpha of 0.82.

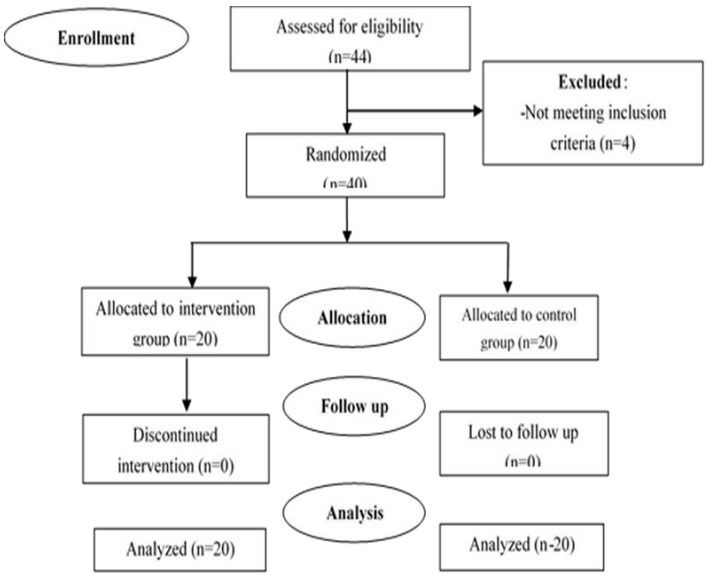


**Figure 1: Research sampling framework**

Intervention

The present clinical trial was performed on two intervention and control groups. The training was carried out in both groups on the same day and hour. First, the participants filled the demographic characteristic questionnaire. Then, the first researcher divided the students into two 10-member groups alphabetically. The research setting was the clinical skills center of the Nursing and Midwifery School of Isfahan, which has 10 special clinical education classrooms. The subjects of the control group were trained in the first and second rooms (10 individuals per classroom), whereas the participants in the intervention group received education in the third and fourth classrooms (10 individuals per room). Given

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the fact that the education of the research groups occurred simultaneously and at the same time, the participants were divided into different classrooms to avoid information leakage. In each group, the first author carried out the education process for two hours.

Education of Students in the intervention Group (Feedback-based Education)

First, the first researcher taught the IV insertion process practically on a model. During the session, the researcher explained the technique, and the participants watched a video about IV insertion. At the end of the session, students practiced the process on the model, during which the first researcher videotaped the performance of each student. At the end of the practice, the recorded video was shown to the students. Each participant's performance was assessed by themselves and their weaknesses and strengths were expressed. Afterwards, the video was evaluated by other stents. In the end, the researcher directed all the comments and made the necessary points to improve the students' performance. The process was carried out for all intervention group members. During the feedback process, the researcher played the role of a facilitator and gave constructive comments to improve students' behaviors while emphasizing their strengths and correcting their mistakes.

Education in the Control Group (Conventional Training)

Students attended the clinical skills center at a certain time and date. In this group, the participants received conventional education at the school. The first researcher taught the skill of IV insertion on a model. Afterwards, a student performed the process on the model voluntarily and their mistakes were pointed out during the process and other group members only watched. It is notable that the model used in the two groups was similar. The silicone model was constructed at the clinical skills center and the research and education development center of Isfahan University of Medical Sciences. Notably, the model had seven veins with different thicknesses. In addition, the model had the minimum amount of liquid leakage and was created based on a real hand. The IV insertion checklist was filled by all participants immediately at the end of the educational sessions. Afterwards, the subjects' performance was evaluated by another instructor of the nursing department, who was blinded to the educational program, at the end of the semester (four months after the process and before the related exam).

Data Analysis

Data analysis was performed in SPSS version 16 (SPSS Inc., Chicago, IL, USA) using the Kolmogorov-Smirnov test (to evaluate the normal distribution of quantitative variables), descriptive statistics (frequency, percentage, mean and standard deviation) (to describe and classify the data), Fisher's exact test and Chi-square (to compare the mean demographic characteristics and clinical data), independent t-test (to compare the two groups), and paired t-test (to compare each group before and after the intervention regarding the score of IV insertion skill). It is worth mentioning that a P-value of 0.05 was considered statistically significant.

Ethical Considerations

This article was approved by the ethics committee of Isfahan University of Medical Sciences (code of ethics: IR.MUI.REC.1395.3.392). In this research, we adhered to the principles of the Declaration of Helsinki (2002). The participants' participation or lack of participation had no impact on the education process. In other words, participation in the research was voluntary and the subjects were allowed to withdraw from the research at any time. In addition, they were ensured of the confidentiality terms regarding their personal information.

## Results

In this study, the mean age of the subjects in the intervention and control groups were reported to be 21.21±2.12 years and 22.20±18.8, respectively. In addition, 50% of the subjects were female. According

to the results, the two groups were homogenous and there were no significant differences between the groups (P>0.05) (Table 1). A comparison of the intervention and control groups showed a significant difference regarding the IV insertion skill immediately after the intervention (P=0.04). Meanwhile, this difference was not significant at the end of the semester (P=0.12). Moreover, a comparison of IV insertion scores of students in the intervention group immediately after the training sessions and at the end of the semester showed a significant difference in this regard (P=0.04). Th is difference was also significant in the control (P=0.03).

**Table 1: Demographic information of research participants**

| Variable | | Intervention group | Control group | P-Value |
|---|---|---|---|---|
| **Age** | **Mean ± SD** | 21.21±2.12 | 22.20±18.8 | *T=2.32, P=0.32 |
| **GPA score** | **Mean ± SD** | 17.65±2.30 | 17.98±2.68 | *T=2.89, P=0.62 |
| **Gender** | **Female** | 10 (50) | 10 (50) | **X2=1.67 |
| | **Male** | 10 (50) | 10 (50) | P=0.50 |

*Independent T-test. ** Chi-Square

**Table 2: Comparison of the mean score of IV insertion skill immediately after the intervention and at the end of the semester between the two intervention and control groups**

| Time / Group | Immediately after | At the end of the semester (after 4 months) | P-Value |
|---|---|---|---|
| **Intervention group** | **16.81±2.50** | **14.93±3.81** | ***T=2.71, P=0.04** |
| **Control group** | **17.65±2.30** | **9.16±1.92** | ***T=2.15, P=0.03** |
| ****P-Value** | **T=2.33 , p=0.04** | **T=1.79, p=0.12** | --- |

*paired t-test. ** Independent T-test.

## Discussion

The present study aimed to evaluate the effect of feedback-based education on nursing students' IV insertion skills. According to the results, there was a significant difference between the groups regarding the score of IV insertion skills immediately at the end of the education process. Meanwhile, this difference was insignificant at the end of the semester, which means that the subjects of the two groups learned the IV insertion skill at the end of the semester. In a research by Ahmadi et al. (2015), providing immediate and planned feedback during nursing students' apprenticeship courses improved their skills and corrected the trajectory of clinical education (15). According to Esmaeili et al. (2016), using formative assessment along with written feedback improved the arterial blood gas interpretation skills in ICU nurses (20). In another research by Uhm et al. (2015), the use of feedback-based education improved the communication skills of medical students (21). In the foregoing study, the communication skills of students were videotaped and the videos were shown to the students, which improved their skills. In this regard, our findings are in line with the results of the present study.

According to Fowler et al. (2016), providing written feedback improved radiology students' clinical performance (22). In another research by Yousefvand et al. (2015), formative assessment and providing feedback on learners' education led to further improvement of self-efficacy and self-regulatory learning strategies of intervention groups (students). Therefore, methods of providing feedback on teaching and learning were effective (23). It seems feedback can reinforce successful learning and leads to the identification and correction of learning errors.


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According to the results of various studies, while medical teachers stated that they frequently provided feedback to learners, students had a contradictory claim in this regard (24, 25). This might be due to learners' incorrect perception of the description, objective and methods of feedback provision. In a research by Boehler et al. (2006), practical feedback improved the performance of medical students (24). According to Yazdani et al. (2014), formative assessment and giving feedback improved the ECG interpretation skills among cardiovascular residents and enhanced their learning (26). In a study, Guadagnoli et al. (2002) evaluated the relationship between knowledge of results and motor learning in Parkinsonian patients. According to the results, 50% of those receiving feedback had a better learning performance in the posttest stage. However, this difference was statistically insignificant (27), which is incongruent with our findings. This lack of consistency between the results might be due to the difference in the type of education and participants, such that nursing students were assessed in the present study while Parkinsonian patients were evaluated by Guadagnoli. Moreover, our findings are consistent with the results obtained by Hamilton et al. (2019) and Bastiaansen et al. (2018) (28, 29). According to the results of the aforementioned studies, feedback-based education had a positive effect on physical activities and depression relief among patients. The fact that feedback-based education was used for nursing students for the first in the present research distinguishes our findings from the results of other studies. It is notable that this type of education was used for patients in the foregoing studies. In a research, Ijgosse et al. (2018) compared the effect of laparoscopy education on surgical residents by two conventional and feedback-based methods. According to the results, there was no significant difference between the two learning groups regarding the number of errors (30), which is inconsistent with our findings. This lack of congruence between the results might be related to the educational content, as well as the type of students and their skills.

One of the major drawbacks of the present study was its low sample size. Another limitation was conducting the intervention on students of one university (Isfahan University of Medical Sciences). In addition, the research groups were not homogenous, which could be another limitation of the research. Therefore, it is recommended that more studies be conducted in more than one center to increase the generalizability of the results.

## Conclusion

According to the results of the present study, while the use of feedback-based education had a significant effect on nursing students' skill of IV insertion in short term, its impact was not permanent. It seems that more studies are required in this area.

## Acknowledgments

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## Conflicts of Interest

The authors declare that there are no conflicts of interest.

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