Title:
Comparative Effectiveness of Methods Used to Learn Peripheral Intravenous Catheter Insertion in Chinese Nursing Students

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Session Title:
Effective Teaching Tools
Slot:
I 08: Monday, 30 October 2017: 3:45 PM-4:30 PM
Scheduled Time:
4:05 PM

References:
Decker, K., Ireland, S., O'Sullivan, L., Boucher, S., Kite, L., Rhodes, D., & Mitra, B. (2016). Peripheral intravenous catheter insertion in the emergency department. *Australasian Emergency Nursing Journal, 19*, 138-142.

Keleekai, N. L., Schuster, C. A., Murray, C. L., King, M. A., Stahl, B. R., Labrozzi, L. J., Glover, K. R. (2016). Improving nurses' peripheral intravenous catheter insertion knowledge, confidence, and skills using a simulation-based blended learning program: A randomized trial. *Simulation in Healthcare-Journal of the Society for Simulation in Healthcare, 11*, 376-384.

Saxena, M. (2010) Re-conceptualizing teachers' directive and supportive scaffolding in bilingual classrooms within the neo-Vygotskyan approach. *Journal of Applied Linguistics and Professional Practice, 7*, 163-184.

Abstract Summary:
This study provided evidence that using a virtual method of learning peripheral intravenous catheter insertion was as effective as learning the skill using the intravenous arm manikin under faculty supervision. Using the virtual method with timely feedback allowed for independent learning and resulted in reduced faculty time and effort.

Learning Activity:

LEARNING OBJECTIVES	EXPANDED CONTENT OUTLINE
1. The learner will be able to compare and contrast core components of the virtual method of learning peripheral intravenous catheter insertion with the intravenous arm manikin method under supervision of faculty.	Describe core components of the virtual and arm manikin methods of learning peripheral intravenous catheter insertion

2. The learner will be able to evaluate the effectiveness of integrating informatics and technology into nursing education to improve learning outcomes of students while reducing time and effort invested by faculty.	Present results and apply outcomes to advance the use of effective learning methods for students practicing fundamentals of nursing

Abstract Text:

Background, Purpose, Hypothesis: Peripheral intravenous catheter insertion (PICI) is an important clinical skill for nursing students in China to learn and master. Students need hands-on practice to perfect the skill. Historically, after learning principles of best practices for PICI in a classroom setting, students practiced this skill using an intravenous arm manikin under the supervision of faculty. Although using the arm manikin method was effective in improving clinical outcome learner objectives, extensive time and effort were invested by faculty in scheduling and monitoring students during after-hour practice sessions with the manikin. Use of technology in the classroom and virtual methods of learning practical skills are transforming nursing education around the globe. Evaluating the effectiveness of using technology including virtual learning methods has broad implications in the advancement of evidence-based nursing education.

The **purpose** of this study was to determine the effectiveness of using a new virtual method of learning peripheral intravenous catheter insertion compared to the existing intravenous arm manikin method on outcome learner objectives of students enrolled in a fundamentals of nursing skills laboratory course in China. **Specific aims** were formulated to (a) evaluate the effectiveness of the new virtual method of practicing PICI compared to the existing method of practicing PICI using an intravenous arm manikin under the direct supervision of faculty for nursing students enrolled in a fundamentals skills laboratory course in China and (b) evaluate the effect of the new virtual method of learning PICI compared to the existing intravenous arm manikin method on improving knowledge and comprehension of patient-safety principles and concepts of PICI. Compared to students randomized to the existing intravenous arm manikin method, students randomized to the new virtual method of learning PICI were hypothesized to (a) demonstrate equivalent performance scores on PICI and (b) demonstrate equivalent knowledge and comprehension of key principles or concepts of patient safety related to PICI.

Framework: The theory of scaffolding instruction was used to guide this study. Scaffolding instruction is used to describe on-going support for students engaged in an active learning process that considers practice with feedback in skills building. After receiving instruction of a skill, students need practice to master the skill. The more feedback and support students receive during practice sessions, the better they will perform the skill.

Method: A cross-section, two-group, randomized clinical trial was used. The convenience sample consisted of 68 undergraduate freshman baccalaureate nursing students aged 19–21 years enrolled in a nursing fundamentals course at Wuhan University in China. None of the students received any previous training in PICI. All students received classroom instruction on the principles and concepts of intravenous infusion before being randomized to one of two groups using numbers produced by an Excel program. Group 1 ($n = 33$) was randomized to the virtual method of learning and group 2 ($n = 35$) was randomized to the intravenous arm manikin method. Students in group 1 used a computerized virtual learning system to practice PICI as many times as they wished over a two week period with the goal of obtaining a score of 100. Students in group 2 used an intravenous arm manikin to practice PICI in a clinical skills laboratory under the guidance and supervision of nursing faculty by appointment over a two week period of time. A standardized PICI skills checklist was used to evaluate performance and assess comprehension of PICI-related patient-safety principles and concepts including: checking the patient's identity, washing one's hands, wearing a mask, timing of C-belt (tourniquet) use, recalling five rights of medication administration during insertion, citing the sequence of steps, and demonstrating professional behavior, as observed by the faculty evaluator who was blinded to group assignment and learning method. Scores for the PICI checklist had the potential to range from 0 to 100. Data analysis consisted of using the independent

sample *t*-test to compare the group scores of the total PICI test and *Chi-square* to compare the excellence rates, pass rates, and distribution of scores, including the error rates of PICI-related patient-safety principles and concepts between the two groups.

Results: PICI checklist scores for group 1 ranged from 59–98 (M = 80.45; SD = 11.94) and group 2 ranged from 59–95 (M = 78; SD = 11.63), with no statistically significant difference indicated between groups (t(66) = 0.859, p = 0.394). When comparing the score distribution of the two groups, 87.9% students in group 1 passed the test with 30.3% of the students scoring more than 90%; whereas 82.9% of students in group 2 passed the test with only 17.1% of students scoring more than 90%. There was no significant difference in *chi*-square of pass rate (x^2 = 0.34, p = 0.735) and excellence rate (x^2 = 1.64, p = 0.258). When comparing the error rate of PICI-related patient-safety principles and concepts between the two groups, students in group 1 performed better than students in group 2 in two areas: (a) citing the sequence of steps (x^2 = 8.66, p < 0.01) and (b) in demonstrating professional behavior (x^2 = 11.2, p < 0.001).

Conclusion: PICI outcomes of students using the new virtual method of learning PICI was deemed effective and considered to be equivalent to that of students using the existing intravenous arm manikin method. In addition, students using the new virtual method demonstrated increased knowledge and comprehension of patient-safety principles and concepts of PICI. Findings have global implications for using virtual learning methods in fundamentals of nursing skills laboratories. Although we acknowledge a cost savings in using the new virtual method, additional research is needed to estimate the cost savings of having students practice with the virtual learning system over practicing with faculty.