

Interprofessional Procedure Training for Medicine and Nursing Students

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Abstract

Introduction: Recognizing the need for interprofessional education for trainees, the University of Kansas Schools of Nursing (SON) and Medicine (SOM) created interprofessional procedure workshops to foster collaboration, communication, and learning with and from other disciplines. The first workshop focused on venipuncture and peripheral intravenous catheter (PIV) insertion. **Methods:** An interprofessional work group including SON and SOM faculty developed a PIV procedure training workshop based on the “learn, see, practice, prove, do, maintain” framework. SON faculty and graduate nursing students provided support and mentoring during the training sessions. Nursing students acted as peer coaches for their medical student colleagues with the help of an evidence-based, standardized, deliberate practice guide. The document broke the procedure into phases—planning, preparation, insertion, and postinsertion care—and provided scaffolding for the beginner through assessment. **Results:** On survey, most students felt the program was beneficial and met the learning objectives. After the sessions, medical students completed a PIV assessment, and nursing students completed a reflection on the experience. These postsession assignments for each group confirmed that the learning objectives had been met. **Discussion:** The interprofessional PIV workshop was one module in a longitudinal interprofessional curriculum providing training for SON and SOM learners. One goal of this curriculum was to achieve higher graduate competencies in procedural skills and interprofessional practice. Additionally, in developing the workshop, a deliberate practice guide was created that provided an educationally sound and best-practice procedure to be standardized to all university learners on campus.

Keywords

Interprofessional Education, Peripheral IV Training, Skills Training, Procedure Training, Peer Teaching, Interprofessional Collaboration, Procedure Standardization

Educational Objectives

By the end of the session, students will be able to:

1. Describe how performing a peripheral intravenous catheter (PIV) insertion is an overlap in scope of practice between medical and nursing professionals.
2. Communicate with other health professional students during a collaborative learning activity.
3. Demonstrate confidence in inserting a PIV independently and safely (medical students only).
4. Demonstrate effective teaching techniques (nursing students only).

Introduction

The Association of American Medical Colleges (AAMC) and American Association of Colleges of Nursing (AACN) have published competencies for undergraduate students. Recently, procedure training was added to the AAMC competencies. Licensing and accrediting bodies universally acknowledge the need for interprofessional education for trainees and professionals. Recognizing these standards, the University of Kansas Schools of Nursing (SON) and Medicine (SOM) created interprofessional procedure workshops to foster collaboration, communication, and learning with and from other disciplines. The first workshop focused on venipuncture and peripheral intravenous catheter (PIV) insertion.

The first purpose of the venipuncture and PIV workshop was to deliver an interprofessional procedural curriculum to first-year medical and junior nursing students to help improve interprofessional practice competencies upon graduation. The second purpose was to begin to align and standardize procedure training among professional students

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across campus to achieve higher graduate competencies in procedural skills.

The educational objectives were developed under the umbrellas of two of the Entrustable Professional Activities (EPAs)¹ set by the AAMC and two of the Essentials of Baccalaureate Education for Professional Nursing Practice² set by the AACN. Specifically, objectives 1 and 2 addressed Core EPA 9/BSN Essential VI, objective 3 addressed core EPA 12, and objective 4 addressed BSN essential IX.

Establishing venous access is fundamental for patient care and fits into the third block of our medical school curriculum: Inflammation, Blood, and Immunity. Although only some physicians may be required to place PIVs in their clinical practice, handwashing, obtaining patient consent, aseptic technique, palpation of veins, and sharps safety are all broadly applicable skills. During the session, it would intentionally be noted that these skills are transferrable to the more complex procedures medical students learn later in their education. Because nurses frequently place PIVs in the patient care setting and nursing students learn this skill very early in their curriculum, the skill easily lends itself to an opportunity for interprofessional education.

The interprofessional PIV workshop provided a standardized approach for initial training and deliberate practice opportunities for novice learners. Nursing students, with the help of a deliberate practice guide and structured session, practiced as peer coaches for their medical student colleagues. Using nursing faculty, students, and staff allowed for sharing of resources. Nursing faculty led the session and provided live demonstrations and videos for each section of the procedure as the exemplar. Graduate nursing students served as experts and offered support and mentoring to small groups throughout the workshop.

The World Health Organization's 2019 definition of interprofessional education is "when students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health."³ Our curriculum addressed a gap in the literature by providing opportunities for interprofessional peer teaching where students learned from each other, in addition to learning with each other. Most curricula seem to provide opportunities for interprofessional students in immersive simulations where they learn with each other but the peer coaching role is less formalized.^{4,5} Other examples of interprofessional learning may include role-playing.⁶

We were unable to identify any curricula in *MedEdPORTAL* in which procedural skills training involved interprofessional peer teaching. However, we were able to identify a curriculum addressing procedural training of medical students for PIV line placement.⁷ The student-to-expert ratio in Romeo and colleagues' session was 1:6, whereas ours was 1:4. They used paired peers, although not as peer coaches, and the activity was not interprofessional. There was an evaluation performed with a checklist after completion of the session. Our curriculum offered additional practice times before the evaluation of performance. It also included practice on task trainers, as well as on each other.

Two other resources addressed more advanced learners in advanced PIV insertion practice.^{8,9} Those learners already had the basic PIV insertion skill set and were practicing their skill in a more advanced setting. These resources could be considered as curricular additions after our curriculum. We provided immersive simulation opportunities requiring PIV insertion throughout the curriculum.

Methods

Curricular Structure

The deliberate practice guide was created to provide standard evidence-based teaching of the procedure for all university learners on campus. Therefore, the guide was created by compiling the previously used SON assessment checklist, checklists from the Venipuncture and Peripheral IV module of the American College of Surgeons/Association for Surgical Education's Medical Student Simulation-Based Surgical Skills Curriculum,¹⁰ and the Lippincott Advisor procedure from the University of Kansas hospital procedures database.¹¹ SOM and SON expert faculty recommendations and consensus were sought.

The deliberate practice guide (Appendix A) provided a scaffolding framework for both learners and instructors. The document broke the procedure into phases: planning, preparation, insertion, and postinsertion care. For each phase, the steps were listed in the left column and were the necessary steps for assessment of competency of the procedure. Each step was further described by more detailed, behaviorally anchored actions in the middle column. Finally, instructional tips and tricks, along with visual aids, were in the right-hand column. The right-hand column not only allowed for self-directed study and practice but also provided standardized teaching for peer coaches and instructors.

We structured the curriculum to align with Sawyer's "learn, see, practice, prove, do, maintain" framework for deliberate practice¹² (Table 1).

Learn: Medical students viewed a PowerPoint presentation (Appendix B) before arriving. The presentation covered venous anatomy of the arm, indications and contraindications for PIV insertion, assessment of the PIV site, and complications. Medicine and nursing students reviewed the deliberate practice guide before coming to the session. Nursing students had learned the teach-back method in a classroom setting for a different course in their curriculum and were asked to apply it during the session.

See: Videos (Appendices C-E) and the deliberate practice guide (Appendix A) for PIV insertion were included in the prelearning. Videos and live demonstrations were also provided in the practice session.

Practice: The training session was structured according to four procedural phases: planning, preparation, insertion, and postinsertion care. The steps of each phase were demonstrated (by either live instruction or expert video) to ensure that all students recognized the exemplar for each step. After the entire group had walked through the procedure once together, students worked in small groups for deliberate practice. Medical students followed this initial training session with a second practice session a week later.

Prove: Medical students were assessed on their skills using the first column of the deliberate practice guide as the checklist.

Do and maintain: These phases were carried out in clinical and simulation opportunities. Several interprofessional simulation opportunities with nursing and medical students requiring

placement of a peripheral IV during management of an unstable patient were provided after this event.

Given that the SON students had completed PIV training and assessment previously, they were in the do and maintain phases of the framework and categorized as advanced beginners on the Benner model.¹³ Because teaching was one way to reinforce learning,¹⁴ these students provided peer coaching during the workshop to progress their skill acquisition from advanced beginner toward competent.

Session Logistics

Each year, 175 first-year medicine and 114 first-year nursing students participated in the training sessions. Students were scheduled for the sessions by faculty from their respective programs. Eight sessions were held between October 25, 2017, and November 21, 2017, and between October 23, 2018, and November 14, 2018, with approximately 14 nursing and 21 medical students in each session. Also present were five graduate teaching assistants facilitating tables and one nursing professor leading the session. The SON faculty was a full-time faculty member with 5 years of simulation and procedural training experience. Graduate teaching assistants were experienced (2-5 years) registered nurses enrolled in a doctoral program at the university's nursing school.

Students arrived at the practice lab on their assigned date and time. They sat six per table, with three or four medical and two or three nursing students at each table. They were asked to pair or triple with at least one student from both professions in each small group. The lead faculty and graduate teaching assistants were each assigned to a table for supervision of coaching. The tables were set with four stations (see Appendix F). Each station

Table 1. Mapping Learners' Progress Using Sawyer's Framework

Learning Stage	Description of Learning Stage	Nursing Students	Medical Students
Learn	Learning about the procedure via reading, videos, and online training	Coursework 4 weeks prior to the first workshop	PowerPoint presentation with prelearning
See	Demonstration by instructor	Provided faculty demonstration video and during lab session	Live and video demonstrations by faculty and nursing students
Practice	Formative assessment on simulator	Lab session with clinical faculty and a graduate teaching assistant providing close coaching and feedback; additional 2-hour open lab session for loose coaching and feedback	Provided 1.5 hours of practice time with nursing students; nursing faculty and expert graduate teaching assistants offered feedback; also provided a 2-hour practice session with medical faculty
Prove	Summative assessment on simulator	Assessed for skill competence 2-3 weeks prior to the first workshop	Assessed for skill competence
Do	Performance on human	Students are cleared to practice the skill in clinical rotations on real patients	Students are cleared to practice the skill in simulations
Maintain	Maintenance of skill through clinical practice supplemented by simulation as needed	Return to lab 3-7 weeks after assessment to train medical students	Not a skill required for maintenance; students should continue to understand fundamental principles of safety and interprofessional collaboration to apply in future practice

had a laminated deliberate practice guide, chux pad, IV task trainer with blood flow, two PIV devices per student, one IV start kit per student, and one butterfly device per student. Additional PIV devices, butterfly devices, and supplies to reset the IV start kits were on a cart in the room.

The PowerPoint presentation (Appendix B) used to guide the session was the same one provided as prelearning for the students. It offered notes for the faculty (also visible to the students in their prelearning) and prompted when to perform live demonstrations or play videos. The presentation followed the deliberate practice guide steps to keep students together through the first IV insertion.

The lead SON faculty began the session with introductions of self and the graduate teaching assistants. Students were asked to introduce themselves at their tables. To foster an environment that was transparent and supportive, we reiterated the following to all students: “Nursing students have already learned the skill but are not yet experts. To continue their progress toward expert, they will peer coach you, medical students, as you perform a PIV insertion.” We also explained how the medical students would continue their progress toward expert: “You [medical students] will get the first training on PIV insertion here and continue your progress with a second practice session before your assessment.”

Additionally, we explained how feedback would be provided:

Nursing students will be peer coaching using the teach-back method to affirm their instructions. While nursing students will be providing feedback to medical students about their procedural skill, medical students should provide feedback to the nursing students regarding their instruction. For example, was it clear or unclear, are they recognizing where you need more practice or moving too quickly? There is a GTA [graduate teaching assistant] or faculty at each table for you to consult if you are confused, get stuck, or have other questions. They may offer unsolicited feedback when they deem appropriate and will ensure accurate teaching of the procedure and enforce safe needle handling.

We outlined the shared learning objectives, putting emphasis on collaboration and communication, and reviewed the individual learning objectives for the students. We provided an outline of the session time, mentioned the survey to be completed at the end, and answered questions. Since the PowerPoint was the same as the one for the prelearning, several slides were skipped

or reviewed very quickly as a reminder before beginning the procedure.

The planning phase was demonstrated by the lead faculty. Time was allowed for students to practice the planning phase with their peer group/pair. After all students had had the opportunity to practice, the group’s attention was called back to the lead faculty.

During the preparation phase, as the lead faculty reached certain steps, there was a pause for practice in the small groups/pairs. For example, the tourniquet tie was demonstrated, and then nursing students were asked to assist medical students in tourniquet tying. Students tied a tourniquet on their paired peer and palpated a vein that they would cannulate. They were asked to get confirmation of a reasonable vein choice from the expert assigned to their table. Once all students had identified an appropriate site for PIV insertion, the group’s attention was focused back on the lead instructor. The remainder of the preparation of the equipment was reviewed by the lead faculty to ensure that important aseptic technique steps were emphasized. Nursing students were then instructed to walk their paired peer through the preparation of the equipment. Once all students were prepared for the insertion, their attention was brought back to the lead instructor.

For the insertion and postinsertion care phases, we played the PIV insertion and postinsertion care video (Appendix E). Students were asked to follow the deliberate practice guide to perform the insertion and dressing of the PIV. We initially provided students with supplies for two IV insertions and encouraged them to request additional supplies in order to practice as many times as they needed to feel confident.

We encouraged their practice to be focused on the steps in the deliberate practice guide. Therefore, we suggested one student follow along with the guide while another placed the PIV. If the student needed coaching, the guide could offer the next step with pictures. In groups of three students, one student was asked to observe and note any breaks in aseptic technique. Graduate teaching assistants and lead faculty supervised the tables of students to ensure that proper technique was used, sharps safety was evident, and students were participating to their fullest. The experts also reset the IV insertion kits with additional supplies and retrieved more PIV devices as needed.

Once all students had completed at least two PIV insertions, phlebotomy was reviewed as a large group. Use of the butterfly device was discussed, and the safety mechanism was reviewed. Each student used one butterfly device and two or three lab tubes to collect simulated blood. Although this skill was not

assessed, it was deemed important because it could be a skill these students would perform in clinical rotations.

Considering that both skills were completed after 1 hour and 30 minutes of the 2-hour session, students had 30 minutes to practice PIV insertion again, if desired. As students left the session, they were reminded to use their phones to scan the link on a whiteboard and complete a survey (Appendix G) about the experience.

Results

Survey

In the first year of implementation (2017), only 34 surveys (16 nursing and 18 medicine) were completed out of approximately 280 students who participated in the sessions. The survey (Appendix G) was under development by the simulation institute and released after the sessions had begun running. This resulted in just the latter groups being asked to complete the survey.

In 2018, survey data were collected at all sessions. Seventy-three of 177 medical students and 42 of 113 nursing students completed the surveys. Students were notified of the survey at the beginning of the session and asked to complete it on their phones as they were leaving the session. Departure time varied, as some students opted to stay and practice a bit more. These variables may have contributed to low survey completion.

The survey addressed learning objectives including skill acquisition (Table 2). The majority of students were extremely

or very confident in their ability to apply what they had learned in a clinical setting immediately following their first training session.

Other learning objectives were assessed via free text by asking, "What would be at least two things you liked or learned during this training?" Many students' comments included interprofessional collaboration and learning gained from teaching: "I learned about interdisciplinary roles and how important they are," "I enjoyed being taught by the nursing students as they had a great level of experience and knowledge on the topic," "I enjoyed collaborating with medical students," "I liked that we got to collaborate with medical students and also to see what different kinds of knowledge they have," "I liked getting to teach the skill and solidify my knowledge," and "Teaching people helps me learn."

Some comments provided insight for improvement of the educational sessions for the next academic year. In 2018, these comments included five requests for live demonstration of the insertion from the nursing student rather than video and two mentions of IV trainer (mannequin) quality; two students mentioned they would like to practice the skill once as a refresher before teaching it.

Postsession Assignments

Medical students completed their second practice session with hired physical exam teaching assistants (PETAs). The PETAs were all retired nurses and were required to come to one of the initial training sessions to standardize their technique. The left-hand

Table 2. Survey Results

Question	2017 ^a	2018 ^b
Orientation to the training environment.	Strongly agree/agree: 100%	Very well/moderately well: 100%
Instructor established a safe place to practice.	Strongly agree/agree: 97%	To a great extent/moderate extent: 100%
Difficulty of this training.	Just right: 89%	Just right: 91%
This simulation/training experience will improve quality and/or safety of care in the clinical setting.	Strongly agree/agree: 97%	Definitely yes/probably yes: 100%
I received helpful feedback and coaching during today's training.	Strongly agree/agree: 99%	Extremely helpful/very helpful: 94%
I am confident that I can apply what I practiced in this simulation/training to a clinical event.	Strongly agree/agree: 85%	Extremely confident/very confident: 76%
I would recommend this simulation/training to others.	Strongly agree/agree: 98%	Very highly recommend/highly recommend: 97%
How suitable was the length of time for this session?	Just the right amount: 74%	Just the right amount: 82%
The instructors were knowledgeable and supportive.	Strongly agree/agree: 97%	Extremely/very: 97%
What would be at least two things that you liked or learned in this training?	28 comments total: <ul style="list-style-type: none"> • Interprofessional collaboration, communication, or general appreciation for the interprofessional experience (14 comments) • PIV insertion, sterile/aseptic technique, hands-on training, and phlebotomy (16 comments) • Teaching or learning/improving own skill by teaching (5 comments) 	74 comments total: <ul style="list-style-type: none"> • Interprofessional collaboration, communication, or general appreciation for the interprofessional experience (39 comments) • PIV insertion, sterile/aseptic technique, hands-on training, and phlebotomy (35 comments) • Teaching or learning/improving own skill by teaching (20 comments)

Abbreviation: PIV, peripheral intravenous catheter.

^aN = 34 (18 medical students, 16 nursing students).

^bN = 119 (77 medical students, 42 nursing students).

column of the deliberate practice guide (Appendix A) was used as the assessment tool, and 98% of the medical students in the 2017 and 2018 cohorts passed their assessment on the first attempt.

After their session, nursing students were required to reflect on the experience. The reflection was focused on two things: self-improvement in challenging situations and teaching strategies to use in patient education. Many students mentioned they would use the deliberate practice guide more intentionally because it was difficult to come up with words to describe complicated steps on their own. Several of them reflected on challenges: a learner with a different learning style than their own, a conflict and how they could change their own behavior for a different result in the future. Others shared that teaching a psychomotor skill was difficult and hoped to have the opportunity to practice this with patients and nurses on their clinical units.

Discussion

Standardization and Interprofessional Work

The development of the deliberate practice guide for PIV insertion was the first step in standardizing procedure training across the campus. Using the same template and methodology, other procedures have been vetted. Using multiple resources and local experts to create the deliberate practice guide from which all students on the campus are to be taught helps ensure that they are learning to perform procedures in the same way and maintaining high standards of practice.

The role of BSN students as peer coaches seemed to reinforce skills and increase awareness of patient teaching challenges and strategies while providing an opportunity for interprofessional collaboration. We found that the session was well received by both groups of professionals, with qualitative feedback affirming the value of interprofessional education and collaboration.

Challenges

The large number of learners at each session required 18 task trainers to be set up on six tables. There was some necessary research and development regarding the setup of the task trainers. Although the task trainers were inexpensive, they were designed for very few PIV insertions before needing to have the blood replaced. The technologist team created a blood bag system with supply and drain lines to allow for a flush with multiple PIV insertions. This system also allowed for the full 10 mL of saline to be flushed into the PIV at the end of the procedure. Once the task trainers were set up, they remained on a cart for the duration of the PIV sessions

to allow for quick reset. Scheduling sessions close together to reduce the setup and teardown of the procedure room was helpful.

Keeping the schedule of PIV sessions close together presented a minor scheduling challenge. Given that this activity was interprofessional, a program director from each school met with the simulation center to discuss scheduling of the eight initial training sessions. Since the SOM was then revising its curriculum and these two large cohorts of students were a high priority of the simulation center, finding open and consistent times each week for both programs was less challenging than anticipated. The SOM also scheduled its second practice times and assessments with the simulation center. These events have been marked on future academic year calendars to ensure that they occur every year to provide sustainability.

The consumable supplies for 177 medical students to attend the initial training, practice session, and assessment (five to seven insertions per student) were costly. Identifying supplies that could be easily reused over multiple sessions helped reduce the cost. These supplies included the tourniquet and tape from the IV start kits, the extension tubing with its cap, and the saline flushes. Identifying supplies that could be reused throughout each session, such as the antiseptic agent in the IV start kit, allowed for savings as well. Some supplies were unable to be reused, such as the transparent dressing, gauze pad, and gloves. Having yellow plastic bins on each table for all items to be discarded in allowed the simulation center to sort what was kept and what was trash. Reusing supplies also reduced the environmental impact.

Limitations

The learning objectives of this session were not formally evaluated at the end of the session. We could tailor survey questions to more directly evaluate learning objectives. As mentioned earlier, we indirectly evaluated independent (nursing, medicine) objectives at later times and in different ways.

We did not assess students' compliance to reviewing the prelearning materials. Ensuring that students understood the prelearning may have improved their experience during the session. Their confidence to apply what they learned in the simulation setting may have been increased on the survey if all students had come into the setting with the same baseline knowledge. We have no way to identify if the students who were less confident were also the students who did not review the prelearning materials.

We had a low response rate on the survey because students were dismissed from the lab as they felt confident in their practice. We could improve survey rates by having all students remain in the room for the entire session and complete the survey together at the end. We could consider offering points or a grade related to the experience for survey completion.

Conclusion

Recognizing scope of practice and curricular overlap has allowed the University of Kansas SON and SOM to create interprofessional education opportunities that will continue throughout the curriculum. Participating in this curriculum will support graduates in preparations related to more complex psychomotor skills and interprofessional collaboration required for safe patient care. These opportunities allow for faculty to teach across programs and share resources among schools, subsequently providing modeling of interprofessional collaboration to students and a level of sustainability for the interprofessional program. We theorize that the more positive structured interaction the students have in their academic training, the more willing and better prepared they will be to work in interprofessional teams when they graduate. Institutional support for dedicated simulation personnel and funding for adequate numbers of supplies for deliberate practice are critical.

Appendices

- A. PIV Insertion Practice Guide.docx
- B. PIV Insertion Presentation.pptx
- C. PIV Planning Phase.mp4
- D. PIV Preparation Phase.mp4
- E. PIV Insertion and Postinsertion Care.mp4
- F. Procedure Training Event.docx
- G. Postevent Survey Questions.docx

All appendices are peer reviewed as integral parts of the Original Publication.

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All identifiable persons in this resource have granted their permission.

Ethical Approval

Reported as not applicable.

References

1. *Core Entrustable Professional Activities for Entering Residency: Curriculum Developers' Guide*. Washington, DC: Association of American Medical Colleges; 2014.
2. American Association of Colleges of Nursing. *The Essentials of Baccalaureate Education for Professional Nursing Practice*. Washington, DC: American Association of Colleges of Nursing; 2008.
3. World Health Organization. *Framework for Action on Interprofessional Education & Collaborative Practice*. Geneva, Switzerland: World Health Organization; 2010.
4. Gill AC, Cowart JB, Hatfield CL, et al. Patient safety interprofessional training for medical, nursing, and pharmacy students. *MedEdPORTAL*. 2017;13:10595. https://doi.org/10.15766/mep_2374-8265.10595
5. Kutzin J, Ng G. "Red in the face" interprofessional simulation case scenario. *MedEdPORTAL*. 2011;7:8408. https://doi.org/10.15766/mep_2374-8265.8408
6. Grey C, Constantine L, Baugh GM, Lindenberger E. Advance care planning and shared decision-making: an interprofessional role-playing workshop for medical and nursing students. *MedEdPORTAL*. 2017;13:10644. https://doi.org/10.15766/mep_2374-8265.10644

7. Romeo R, Blasiole B, Chalifoux T, et al. A clinical procedures course for medical students. *MedEdPORTAL*. 2016;12:10524. https://doi.org/10.15766/mep_2374-8265.10524
8. Spofford C, Miska P. Introduction to pediatrics: a patient with difficult intravenous access. *MedEdPORTAL*. 2015;11:10036. https://doi.org/10.15766/mep_2374-8265.10036
9. Beck J, Khan A, Davis AB. The decompensating pediatric inpatient simulation scenarios: case 4 – septic shock. *MedEdPORTAL*. 2013;9:9426. https://doi.org/10.15766/mep_2374-8265.9426
10. ACS/ASE Medical Student Simulation-Based Surgical Skills Curriculum: venipuncture and peripheral IV. American College of Surgeons website. <https://learning.facs.org/content/acsase-medical-student-simulation-based-surgical-skills-curriculum>. Published March 2012.
11. IV catheter insertion. Lippincott Procedures website. <http://procedures.lww.com>. Published 2017.
12. Sawyer T, White M, Zaveri P, et al. Learn, see, practice, prove, do, maintain: an evidence-based pedagogical framework for procedural skill training in medicine. *Acad Med*. 2015;90(8):1025-1033. <https://doi.org/10.1097/ACM.0000000000000734>
13. Benner P. *From Novice to Expert: Excellence and Power in Clinical Nursing Practice*. Menlo Park, CA: Addison-Wesley; 1984:13-34.
14. Koh AWL, Lee SC, Lim SWH. The learning benefits of teaching: a retrieval practice hypothesis. *Appl Cogn Psychol*. 2018;32(3):401-410. <https://doi.org/10.1002/acp.3410>

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