

See one, do one, teach one: re-thinking the teaching of procedural skills in medicine

Daniel Kroft, BSc (Hons)*

Max Rady College of Medicine, University of Manitoba
727 McDermot Avenue, Winnipeg, R3E 3P5

Abstract

“See one, do one, teach one” (“SODOTO”) is an educational model used for training residents and medical students in procedural skills. However, evidence is mounting that current training models, such as SODOTO, may not be producing adequate competencies particularly with procedural skills. Therefore, attitudes have recently began shifting towards “competency-based” frameworks. This article explores the usefulness of the SODOTO framework, and reports on key developments in possible future models of medical education.

Keywords: medical education, procedural skills, resident training, competency-based training

For the past century, “see one, do one, teach one” (“SODOTO”) has been a guiding principle in medical education for procedural learning. This teaching strategy was first espoused by William Halstead in the wake of the first residency training program at Johns Hopkins. SODOTO supplanted the prior practice of self-directed learning, or apprenticeship under a senior physician.¹ SODOTO has practical advantages over many “more traditional” educational models. For example, it is known that being actively involved in one’s learning (i.e. witnessing a procedure rather than solely reading about it in a textbook, or hands-on practice rather than solely visualizing the technical steps) has been shown to increase the efficiency with which learning takes place. Further, SODOTO leverages the fact that the more sensory modalities are involved in a learning experience, the higher the rate of retention.² In contemporary times, SODOTO is a common method by which to learn routine procedures.

Over the years, the SODOTO method has evolved alongside technology. “Seeing one” was once limited to a student standing at a physician’s side or gazing down from an operating room gallery; now, with the advance of digital technologies, trainee observation has expanded to include surgical live-streams, pre-recorded video-tapes with voice-over explanation, and even virtual reality simulations. “Doing one” has also been revolutionized, with high-fidelity manikins that can speak, sweat, and bleed like a real patient, as well as computer and virtual reality simulations that can mimic a broad range of clinical situations, including surgical procedures.

While the methods of teaching procedural skills

have progressed in parallel with advancing technology, the framework for teaching these skills has not progressed to reflect our improved understanding of how students best learn. As Dr. Steven Lubet notes in his 2003 review of Dr. Atul Gawande’s work, the SODOTO model relies on a learning curve that can be unavailingly steep, and which, if not achieved, puts patients at risk.³ Indeed, evidence is emerging that the learning curve for young doctors may be inappropriately steep. In a report released by the Joint Commission for the Accreditation of Healthcare Organizations, adverse events that resulted in the harm or death of a patient were attributable to the root cause of inadequate training or orientation more than 50% of the time.⁴ In a British study of senior house officers (the equivalent of third-year residents), more than 50% reported having administered intravenous drugs multiple times despite feeling that they were inadequately trained to do so safely.⁵ Several other studies, including a survey of emergency medicine residents at Cambridge University, report similarly low levels of self-confidence in the participant’s own abilities to adequately perform procedural tasks.⁶ The results from these studies strongly suggest that there is room for improvement within our educational models. Perhaps it is time to move beyond the “see one, do one, teach one” model and onto one which better encapsulates the realities of how people learn and acquire skills.

Fortunately, there are already new models on the horizon. In a recent paper by Dr. Rodriguez-Paz of Johns Hopkins University, a new four-step model is proposed: “knows,” “knows how,” “shows how,” and “does.”⁴ Structured similarly to the SODOTO method,

*correspondence to: kroftd3@myumanitoba.ca

this model incorporates multiple rounds of monitored practice with consistent evaluation until the trainee becomes proficient. Only after proficiency is attained can the trainee go on to teach others. Dr. Joshua Lenchus created and tested a similar framework in his 2010 study of 52 internal medicine residents and 4 third-year medical students, in which he used a 12-step training curriculum to teach the study participants new procedural skills — specifically, minor procedures including lumbar puncture and central venous catheterization.⁷ Before any training took place, the participants' pre-existing knowledge and baseline procedural skills were assessed via a pre-instruction written test, as well as a pre-instruction procedural attempt on a manikin, with no immediate feedback given. After the pre-instruction checks for knowledge and skill level, participants were made to view instructional videos on the procedure, given a review of informed consent for the procedure, and lastly, given a review of aseptic technique. The trainees were then given the opportunity to perform the procedure on manikins under supervision by an attending physician who provided feedback to the trainees. After each practice, the students would review their procedural documentation and re-take the same knowledge-based test; however, this time their answers were reviewed and feedback was shared. In conclusion of the study, Dr. Lenchus found that the student's procedural knowledge significantly improved ($p < 0.001$) immediately after training, with test scores improving by 2-3 points (out of a possible 10-14 points).⁷

The concept of competency-based training has already gained traction, with many North American centres (including Manitoba) currently transitioning to a competency-based model for resident training. Moving towards a competency-based system that includes opportunities for continual practice and evaluation in low-pressure settings will not be easy; it will require substantial initial investments into training equipment such as manikins and models, as well as the installation of extra time into medical curricula that are already highly compacted. However, perhaps the most difficult challenge to overcome will be the re-training of resident teachers, faculty, and staff. In their editorial on competency-based teaching, Drs. Gorrindo and Beresin comment on the difficulty of re-training faculty to teach using novel methodology, especially within the context of budget cuts and "increased service demands and new administrative requirements" already placed on senior physicians.⁸ These issues — which are particularly salient in Manitoba's current political and economic climate — pose a significant challenge. As such, creative solutions will be required in order to fill this gap.

One excellent example of a forward-thinking training program is the student-staffed vaccination clinics at the University of Manitoba, implemented and run by Dr. William Libich. This program gives second-year medical students (on a voluntary basis) the opportunity to practice their injection skills by administering routine vaccines to the Faculty of Health Sci-

ences students at the university. These clinics offer a non-judgmental arena in which students can practice their skills under careful physician observation. These immunization clinics are similar to models proposed by Dr. Rodriguez-Paz and Dr. Lenchus. As a student who has both volunteered at and attended these clinics myself, I can attest to the positive effect on both my confidence and technical skill as a trainee, and the safe and professional environment as a recipient.

Other steps are being taken towards competency-based training. The College of Physicians and Surgeons of Canada has unveiled a plan to transition all residency programs into competency-based evaluation. Competency-based residency programs will have residents progress through stages of learning, each encompassing a detailed list of competencies ("Entrustable Professional Activities") that the residents must master before progressing to the next stage. The resident's level of competency must be assessed by an attending physician to confirm that a required standard of proficiency has been met. This may mean that students will need to undergo several rounds of practice and feedback to meet this standard — similar to the system proposed by Dr. Lenchus. Two residency programs at the University of Manitoba — Anesthesiology, Perioperative and Pain Medicine; and Otolaryngology, Head and Neck Surgery — have already transitioned to competency-based residency programs. Extending competency-based models into the training of medical students could prove an excellent way to improve the skills and confidence of junior trainees prior to entering their clerkship years — provided that logistical and financial challenges can be overcome.

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