

Procedural Simulations and Reflective Practice: Meeting the Need

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Abstract

The medical profession continues to learn about the ways in which simulations can help to improve education and training. In addition, simulation is constantly evaluated regarding the many ways it can help to improve the abilities of surgeons throughout their course of training and practice. The goal of this study is to review the importance of reflection on clinical practice in situating surgeons as lifelong learners and explore the role that simulation can play in that process. As surgical trainees work to acquire basic necessary skills, simulations are often used to help new learners with such things as knowledge of procedural steps and development of psychomotor techniques. However, the following is an important question: can simulated procedures still play a role for more advanced learners to continue their professional development beyond the basics?

Keywords: education, simulation, reflective practice

THE MEDICAL PROFESSION continues to learn about the ways in which simulations can help to improve education and training. Further simulation is constantly evaluated regarding the many ways it can help to improve the abilities of surgeons throughout their course of training and practice. In addition to procedural knowledge, a new study by Madani et al. in *Annals of Surgery* suggests that skills required by surgeons in the operating room also include psychomotor skills, declarative knowledge, interpersonal skills, personal resourcefulness, and advanced cognitive skills.¹ The goal of this paper is to review the importance of reflection on clinical practice in situating surgeons as lifelong learners and explore the role that simulation can play in that process.

As surgical trainees work to acquire basic necessary skills, simulations are often used to help new learners with such things as knowledge of procedural steps and development of psychomotor techniques. However, the following is an important question: can simulated procedures still play a role for more advanced learners to continue their professional development beyond the basics? To answer this question, we first need to think about the importance of reflective practice for learning and the global roles that simulations can serve in clinical learning and how they may benefit more advanced learners.

The Importance of Reflection on Practice for Learning

Effective reflection on practice emphasizes both questioning and investigating one's practice toward the goal of better understanding as well as improving performance. For

professionals, reflection on practice can help to maintain one's professional health and competence and the ability to engage in professional judgment through developing this ability through practice. Experience alone is not sufficient for learning, reflection on experience is essential. Reflection challenges professionals to broaden perspectives on commonly encountered as well as novel scenarios.² Expertise is increased through developing the ability to recognize how past experience relates to newly encountered situations.³ As such, the quality as well as quantity of time spent practicing and developing expertise by reflecting on one's practice in applicable contexts influences the development of expertise. In particular, reflecting on and adapting one's cognitive processes related to the domain of practice and mentoring or support in this process have been found to facilitate change in professional practices.^{4,5}

For learners, reflecting on decisions with a more knowledgeable colleague or mentor can facilitate the process of self-assessment and change.⁶ This facilitates what Schön describes as "reflection-on-action," in which a person has the opportunity and ability to frame and reframe a problem encountered in practice to reflect on alternate approaches or decisions that may have been fruitful in that situation.⁷ Reflection on failed approaches can be a tool to facilitate learning and transform past failures into future successes.⁸ Reflection is important to alleviate poor performance by allowing learners to self-identify goals for improvement.⁹ Reflection has been found to enhance professional development¹⁰ in fields such as teacher training and military tactics.

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However, reflection is sometimes more of a descriptive than a prescriptive notion,¹¹ which is why it is important to define reflection on practice in medical education.

Reflection on practice in medical education

Mamede and Schmidt conducted research suggesting that reflection on practice regarding difficult clinical problems in medicine has a five-factor structure: deliberate induction, deliberate deduction, testing, openness to reflection, and metareasoning.¹² Simply put, what this structure indicates is that some physicians are more likely than others to deal with difficult problems in their practice through reflection on their decisions and behaviors. Further, reflection on practice has a multidimensional structure, which must be taking into consideration when trying to facilitate reflection. For example, openness to reflection influences the extent, to which learners will engage in investigation or testing of their initial ideas or decisions. A second useful way to think about reflection on practice is as reflective thinking for learning. In this regard, reflective practice is targeted toward making sense of the situation to develop knowledge that facilitates efficient application of clinical techniques and skills.¹³ Reflection on practice can be used at many levels of medical education, from medical students to practitioners.

For medical students, reflection during the learning process has been found to be associated with self-perceived competence, self-regulated learning, and perceived meaningfulness of learning.¹⁴ Reflective practice may also lead to the successful transfer of clinical and technical skills to other procedures.¹⁵ Reflective practice has also been successful for teaching focused forms of care,¹⁶ as well as communication skills.¹⁷ In addition, interventions training and promoting reflective practice have been used to prepare physicians to be self-directed, lifelong reflective learners.¹⁸ However, reflective practice was found to be negatively correlated with physician age and experience,¹⁹ indicating that reflection on practice may decline as surgeons progress in their careers.

For surgeons to continue to learn and continually reflect on their practice, there needs to be some frame of reference for reflection. Procedural simulations can serve that role as a place for learners to reflect in a safe environment and for the development of intersubjectivity between a more-knowledgeable facilitator and the learner.²⁰ Learners can ask questions about potential deviations for what is presented in the simulation, and the simulator can be a good venue for helping to recall and reflect upon previous problems or challenges.

Background on Current Roles for Simulation in Medical Education

Simulators can be used to teach technical and procedural skills^{21,22} and can also be used to assess both gross and fine psychomotor skills.^{23,24} They can be used to assess cognitive and decision-making skills²⁵ as well as improve nontechnical skills, such as leadership and communication.²⁶ Simulations can be used to simulate events, such as traumas or natural disasters. They can also simulate operative cases and bedside procedures, or other clinical decision-making environments.²⁷ Simulations can be used to practice clinical skills both individually and as a team²⁸ and have been found to positively impact clinical competence.^{29,30} With all of these scenarios, the focus of simulation is often learners who are

novice to a clinical situation, skill, or way of thinking. However, imparting basic technical and procedural knowledge is only a small part of medical education. Decision-making, critical thinking, and attitude related to problem situations are highly important and are gaining increasing attention.¹⁵ Research on learning in complex environments suggests that reflection on practice can address many of the necessary learning objectives in medicine and surgery. Reflection on practice can also facilitate learning throughout one's life as a professional by allowing the opportunity to review individual choices and available options. In particular, simulation can be used to reduce error in complex, unpredictable situations by allowing a safe, but meaningful, context for reflection. This is often accomplished through the use of cognitive simulation.³¹

Cognitive simulation

Cognitive simulations provide scenarios, in which learners must make meaningful and situated connections among skills and knowledge and the decision-making processes that guide action. Research has shown that cognitive simulations help learners integrate these elements, making them meaningful, actionable, and persistent.^{32,33} There are many kinds of cognitive simulation in medical education, and they are used for a wide range of training purposes. Most cognitive simulations seek to replicate the challenges and demands of clinical practice and provide a safer way to help learners rehearse skills, gain confidence, and develop their abilities in case management, critical thinking, decision-making, and other important aspects of professional practice.³⁴ For these reasons, cognitive simulation has been proposed as an intervention to reduce cognitive errors in areas such as diagnostic reasoning and clinical decision-making.^{35–37}

In a surgical context, one issue with procedural simulators is that they are not always able to capture the nuances of operative cases, which make them more complex. However, procedural simulators can also be used as cognitive simulations. For learners with great technical experience in operative management, procedural simulations can help to trigger thoughts about their practice, including prior complications, difficult situations, or hypothetical scenarios that they may encounter in practice. This is important, given the significant evidence of the utility of reflection on practice for learning.

Simulation for Reflection on Practice

Reflection can inform change and learning when working with simulations. Simulation environments can give clinicians freedom to examine and critique their decisions and to consider more possibilities than those that were initially apparent in the moment.³⁸ They can allow for a reframing of the problem to consider it from different perspectives and create self-directed learners.²¹ Simulators can be used to match a previously similar-presented problem from memory or to create a hypothetical situation based on past experience. These instances facilitate the development of surgical expertise.³⁹ Simulations can also allow for a distancing function to assist with self-reflection. Since errors in practice can be difficult for the surgeon, procedural simulation allows for reflection on potential errors or decisions, of which one is unsure. Procedural simulation allows for reflection on cases and decisions to occur in a safe environment that gives leeway for considering options and getting the opinion of others that allows

one to both further knowledge and become a better practitioner. Thus, no matter how good the simulation, if reflection is not taking place, optimal learning is not being achieved.⁴⁰

One additional benefit to the use of simulators for reflection is that the simulator provides a concrete platform for reflection, helping to ground the reflective process. That is, learners do not have to rely solely on memory—they can reflect on previous actions *while performing the action* because they are in an environment, in which there is no risk to a patient. Perhaps, in addition to reflection on action (what I have done) and reflection in action (what I need to do),⁷ there is also reflection through action (what I am doing) with a focus on how this relates to future practice. Procedural simulations are an ideal platform for reflection through action.

Encouraging Reflection on Practice When Learning with Simulations

How can we encourage reflection on practice when working with simulations? Certainly, in medical training and continuing medical education, the value of reflection on practice for physicians is gaining more focus and now becoming more appreciated.³⁸ Early introduction to the reflective approach is advantageous, especially when paired with simulation.⁴⁰ However, support is needed to facilitate reflective practice as many learners and practitioners do not automatically engage in this process. The literature describes at least three types of people: nonreflectors, reflectors, and critical reflectors. Nonreflectors do not critically appraise their thoughts or ideas. They may talk about topics or situations relevant to their practice, but they do not attempt to appraise their skill or knowledge in these areas. Reflectors give indications of their thinking process and evaluate their current knowledge around a topic or situation as they work toward a deeper understanding. Critical reflection takes reflection one step further in that learners actively work to adopt a new perspective or way of doing something based on the results of their reflection and their current state of knowledge or practice.⁴¹ The goal is to facilitate critical reflection.

Engaging in critical reflection can be done around simulation, particularly if the environment around the simulation is designed in such a way as to support reflection on practice. For example, the combination of simulation and multimedia resources designed to support learning and reflection have also been successful in helping to facilitate self-directed learning.⁴² Procedural simulation environments should be designed in such a way as to increase practice of and motivation to immediately reflect on performance.⁴ This can be done with things such as performance metrics that offer immediate feedback.⁴³ Nevertheless, experience with simulation and performance feedback alone is not sufficient. One needs to make use of this experience for change to occur. Therefore, curricula around procedural simulation should encourage and motivate the learner to reflect on practice. One way to accomplish this would be through scaffolding or support of the learning process by instructors by asking reflection questions or for explanation of reasoning behind decisions or prompting to think about how the case relates to other cases that have been done. To teach reflection skills and reap the learning benefits of reflective learning with simulation, educators must be prepared to define what reflection should look like and what the learning goals of reflective practice are. Learners will

generally require some instruction on how to be reflective on their practice as well as how to create a plan for change based on their experience. To this end, the simulation environment should be emphasized as a safe space for reflecting on reasons for both successes and failures and how the lessons learned should inform future practice.⁴⁴

Conclusion

Studies suggest that simulation may be able to replace clinical time for learning in some contexts without compromising the development of clinical competencies.⁴⁵ Simulators and simulation environments will require greater depth in terms of the ways clinical and procedural skills are taught, cultivated, and enhanced if they are going to adequately allow for the teaching and practice of skills, particularly those requiring further learning opportunities due to the loss of clinical exposure.⁴⁶ Awareness and reflective practice are encouraged for learning medical practice as well as reducing cognitive and diagnostic errors in both those studying medicine and practicing physicians.⁴⁷ Reflection guidelines and feedback on reflection can help to improve reflective practice and ability.⁴⁸ Procedural simulation can help with this by allowing a safe, yet, relevant venue for reflection at all levels of practice.

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