Learning After the Simulation Is Over: The Role of Simulation in Supporting Ongoing Self-Regulated Learning in Practice

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Abstract

The complex and dynamic nature of the clinical environment often requires health professionals to assess their own performance, manage their learning, and modify their practices based on self-monitored progress. Self-regulated learning studies suggest that while learners may be capable of such *in situ* learning, they often need guidance to enact it effectively. In this Perspective, the authors argue that simulation training may be an ideal venue to prepare learners for self-regulated learning in the clinical setting but may not currently be optimally fostering self-regulated learning practices. They point out that current simulation debriefing models emphasize the need to synthesize a set of identified goals for practice change (what behaviors might be modified) but do not address how learners might self-monitor the success of their implementation efforts and modify their learning plans based on this monitoring when back in the clinical setting. The authors describe the current models of simulation-based learning implied in the simulation literature and suggest potential targets in the simulation training process, which might be optimized to allow medical educators to take full advantage of the opportunity simulation provides to support and promote ongoing self-regulated learning in practice.

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The importance of self-regulated learning (SRL) for ongoing practice improvement has been well established in health professions education as the complex and dynamic nature of the clinical environment often requires health professionals to assess their own performance, manage their own learning, and adapt their behaviors based on self-monitoring.[1] Zimmerman defined SRL as the development of "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals."[2] This learning process has been further refined by Sitzmann and Ely,[3] who suggested that the various processes involved in SRL can be categorized into *regulatory agency* (goal setting), *regulatory mechanisms* (e.g., planning, monitoring, learning strategies, motivation, emotion control), and *regulatory appraisal* (self-evaluation, attributions, and self-efficacy). The SRL literature supports the idea that this type of learning can occur in the context of clinical practice,[4] and authors, such as Regehr and Mylopoulos,[5] have asserted that it is through such processes that clinicians are able to systematically improve through reflection on their own daily practices.

Simulation training holds great potential to support and enable SRL in practice. In addition to its immediate and direct improvements in individual task-specific performance outcomes for individuals and teams,[6–10] simulation holds the possibility of pointing out areas that might be intentionally and strategically targeted for subsequent ongoing learning in the clinical context. Maximizing the value of such learning, however, requires explicit and intentional effort.[5] Brydges and Butler,[11] for example, explain that effective SRL requires the active creation of a plan, the selection of relevant cognitive strategies, and the adjustment of approaches and actions based on self-monitored assessment of one's progression of learning. To accomplish this, learners require both an environment that supports SRL and one that offers explicit guidance in how to enact SRL well.[12] This raises the question of whether simulation, as it is currently enacted in health professions education, is maximizing its potential value for supporting subsequent, ongoing SRL in the clinical setting. We note that the medical education community has begun examining the question of how to encourage and use SRL *within* a simulation training session.[13] As yet, however, it does not appear that researchers are exploring how medical educators might support learners in the use of SRL to enable their continued learning *beyond* the simulation experience. We suspect that, in large part, the reason for this lack of attention to learning after the simulation is over might be found in the construction of learning that is implicit in the simulation literature and in simulation practices. Thus, in this Perspective, we unpack the current constructions of learning in the simulation literature and explore the possible implications of an alternative construction that may more effectively prepare learners for ongoing learning in practice after the simulation is over.

The most straightforward model of learning through simulation seen in the simulation literature is manifested in the studies exploring the immediate impact of simulation on performance. Here, the assumption is that any increase in skill level seen immediately after the simulation represents the amount of learning that occurs from the training event itself.[14] With this framing of learning in mind, many training models

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are directed at maximizing performance gain at the time of the simulation, using techniques such as repeated opportunity for immediate and deliberate practice.[15,16] As an extension of this model of simulation-based learning, some authors, such as Barsuk and colleagues,[17] have emphasized the impact of decay on learning over time if skills are not explicitly maintained and have promoted the use of additional simulation "boosters" to maintain minimally competent skills. An example of this trajectory of learning and forgetting or losing skills with boluses of deliberate practice over time is the essentialized experience curve presented by Pusic and colleagues,[18] which we have replicated in Figure 1A. It is well demonstrated in simulation research that "booster" training supports skill acquisition and maintenance; however, the ideal interval between training sessions remains elusive,[19,20] as factors such as learner level, the cognitive load of the specific task of focus, and institution-specific resource constraints all influence the optimal timing.[19,21]

As a further elaboration on and refinement of this model of learning from simulation, some authors have pointed out that in addition to longer-term decay, performance tends to drop sharply after even a brief delay following training.[16,22] An essentialized version of this more elaborated learning and practice model is depicted in Figure 1B. Researchers focusing on this model of learning and practice suggest that the peak performance demonstrated immediately following training might, in fact, be an overestimate of the amount learned in the simulation.[22,23] In explaining the drop that occurs shortly after training, authors draw on the psychology literature that explicitly distinguishes between performance and learning.[22] Performance is defined as observable, measurable demonstrations of knowledge and behavior, which may fluctuate throughout training. Learning, by contrast, is defined as more permanent changes in understanding and skill, which are crucial for long-term application and knowledge transfer.[24] Proposed explanations for the difference between immediate performance and sustained learning have included inadequate skills acquisition (failure of learning) or difficulty with transferring skills from

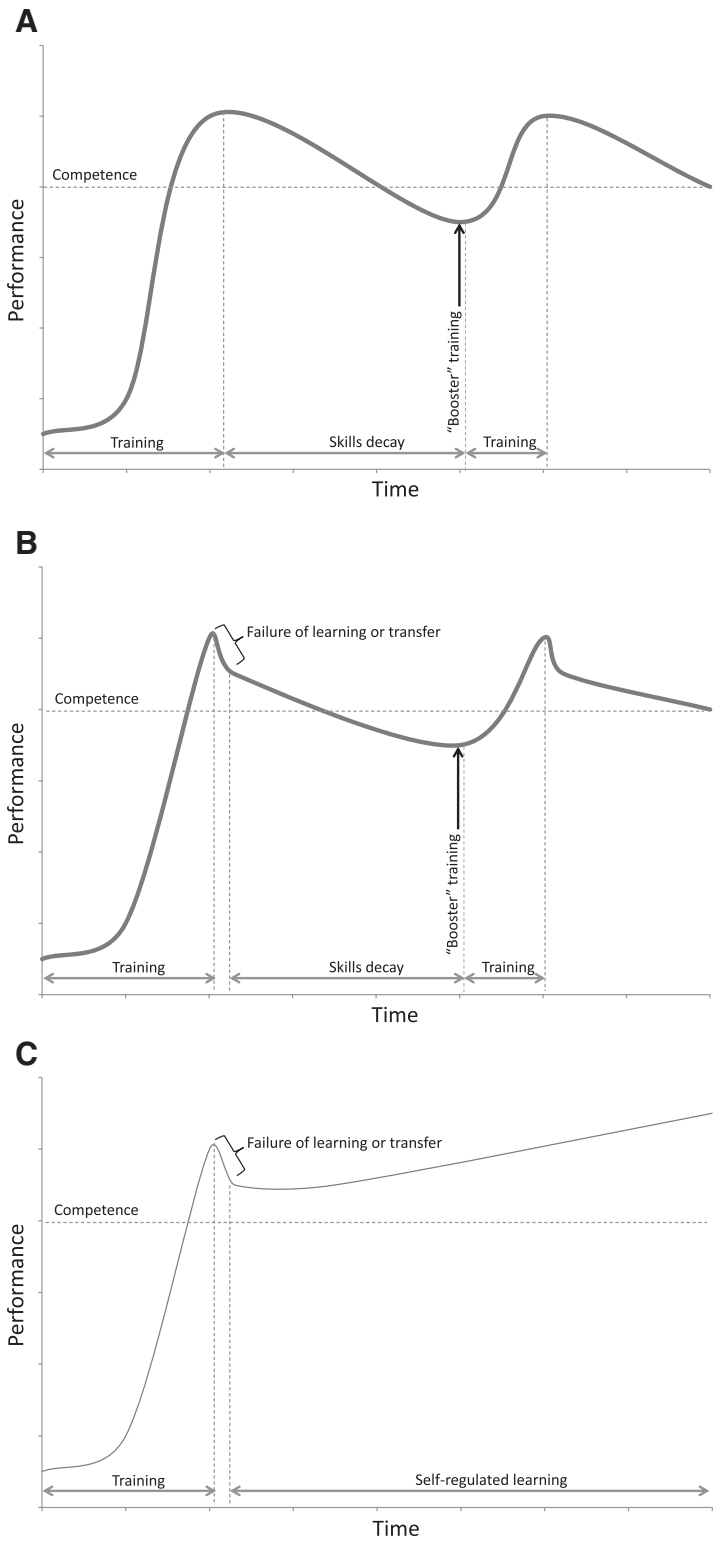

Figure 1 Essentialized depictions of the patterns of learning and performance from 3 models. (Panel A) Essentialized depiction of the model of learning from the current simulation literature that assumes decay of skill after training sessions and subsequent improvement with training "boosters." (Panel B) Essentialized depiction of the model of learning from the current simulation literature that assumes acute drop in performance due to failure of learning or skills transfer into the clinical setting followed by slower decay of skill than depicted in Figure 1A. (Panel C) Essentialized depiction of the simulation model of learning proposed by the authors. This model assumes the expected acute drop in performance due to failure of learning or skills transfer into the clinical setting, some decay of skill, and finally slow recovery and improvement of skill over time with application of self-regulated learning processes in practice.

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the simulation environment into clinical settings (failure of transfer). To address these issues, simulation developers have increasingly used educational manipulations that reinforce learning rather than mere performance in the simulation, such as the integration of mixed-practice learning conditions,[25,26] and have explored contextual factors, such as the optimization of simulation fidelity, on the assumption that using these educational manipulations will maximize the potential for skill transfer across contexts.[27]

Implicit in the 2 models of simulation-based learning discussed above is the assumption that learning occurs primarily as a result of the simulation context itself and that this learning then remains relatively stable or decays slowly after the simulation is over. Thus, current simulation studies focus largely on the transfer of learning into clinical practice (immediate learning outcomes) but do not seem to address how medical educators might optimize ongoing learning that could occur in the clinical context after the simulation is over (SRL processes). Interestingly, we could find no studies in the simulation literature that seemed to focus attention on the possibility that learning could continue to occur once the participants had returned to the clinical context as a direct result of learning that was stimulated by the simulation (Figure 1C). The only study we found that begins to broach the question of ongoing learning once outside of the simulation context was one that examined team-based simulation.[28] In this study, the goal of the simulation intervention was to train teams to debrief effectively once back in clinical practice. In examining emergency department debriefings after cardiopulmonary resuscitation (CPR) codes, the teams that had been trained to iteratively reassess their performance as a group following codes demonstrated more effective debriefing over time and with practice.[28] While the continued debriefing practice in this single study might, to some degree, serve as a team-learning strategy, overall the simulation literature does not seem to have clearly drawn the distinction yet between participants' plans to *enact what has been learned* in the context of their practice and how they are planning to *continue to learn* in the context of their practice in the future.

This focus on the learning that occurs as a direct result of the simulation rather than on fostering ongoing SRL after the simulation is over can also be seen in the formalized approach to simulation debriefings described in the simulation literature. For example, Cheng and colleagues[29] reviewed and summarized many of the simulation debriefing models used for team-based health care simulation. The major debriefing techniques they found typically use a series of steps, including (1) a description of events that have occurred, (2) an analysis of scenario performance, (3) recommendations for improved performance, and (4) a discussion of ways to consolidate the learning that has occurred in and from the simulation context.[30–34] These strategies aim to consolidate learning and performance goals from the simulation that participants plan to implement in practice but do not appear to have the explicit goal of making a plan for further iterative self-assessment and subsequent improvement moving forward. At present, debriefing models ask what participants have learned from the simulation and what they will do differently (their practice goals) but not how they will evaluate their own performance while trying to work on these practice goals and how they will create future learning plans based on the results of their implementation efforts.

It may be, of course, that learners are spontaneously developing such learning plans based on their simulation experiences. However, both the SRL literature[11–14] and medical education literature on self-directed learning[35,36] would suggest that such plans are likely to be ad hoc and suboptimal. Learners need guidance on how to create a learning plan, how to select appropriate cognitive strategies for learning, how to self-monitor progress, and, ultimately, how to revise ongoing learning efforts based on their own evaluation of how learning has or has not progressed.[11–14] Applying this idea to simulation, perhaps instead of targeting only the consolidation of learning in participants, medical educators should also be helping them to generate intentional plans to improve performance in an ongoing, iterative fashion in the clinical context. As an example, current debriefing strategies regularly prompt learners to discuss what they would like to do differently the next time and what they plan to work on in practice. Perhaps, however, medical educators should also be providing guidance for how learners should select specific strategies that might be employed to enact those goals, how they should assess their performance to know whether they were successful in "doing that thing differently," and how they should make a plan to perform even better the next time they encounter a similar situation in practice. We acknowledge, however, that these ideas are at best tentative and suggest that future research might explore the practicalities of implementing an SRL-based debriefing so that medical educators can refine their understanding of how best to focus simulation debriefings not only on a plan for improved performance outcomes but also on strategies to encourage and help participants form a plan for how they will *continue* to learn and improve once they have returned to clinical practice.

The current focus on outcome rather than process in simulation emphasizes the results of the learning that occurred in the simulation and likely does not take full advantage of its potential to encourage ongoing learning afterward. This approach does not capitalize on the idea that the workplace has the potential to be at least as rich a learning environment as the simulation.[37] If medical education's goal is to maximize the yield of every educational opportunity, both in training and in clinical practice, there may be a role for exploring this apparent gap in the simulation literature and maximizing the ability of simulation to help individuals effectively learn in and through work.[5] To create new evidence-informed interventions to improve simulation debriefing strategies moving forward, medical educators should look to develop a deeper understanding of *whether* and *how* learners engage in iterative SRL for practice improvement in the clinical context after simulation training. Doing so might help medical educators develop a better understanding of the phenomenon of SRL, highlight potential deficiencies in simulation debriefings in health care, and target future educational interventions to better support the integration of learning into practice. Ultimately, simulation may provide the perfect opportunity to foster the ability for individuals to learn *at* work, instead of simply learning *about* work.

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