

EDITORIAL

Symphony or cacophony? Challenging the primacy of prebriefing, simulation engagement and debriefing in the design of simulation-based learning

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Simulation educators often conceptualise simulation as a sequence of *phases*: the prebrief, simulation engagement and debrief. Standards and instructional recommendations are often organised around this tripartite structure and research frequently evaluates techniques within each phase as if they were discrete, modular elements. Yet, despite the intuitive appeal of such tidy categories, the evidence base for phase-specific ‘best practices’ is surprisingly mixed. This raises the spectre that our prolonged commitment to phases as a guiding principle for simulation may not be aligned with how actual learning unfolds in simulation. Rather than considering the ‘phases’ of simulation as independent components of a whole, we propose it may be worthwhile to consider how all components of simulation can work together as an interdependent expression of a single enterprise: instruction and learning.

In their scoping review on instruction and guidance in healthcare simulation, Bevis et al. [1] highlight the constraints of viewing simulation primarily through the lens of *phases*. The authors’ review argues for the critical importance of understanding the effects of instruction and guidance on simulation-based learning *during* simulation engagement. The review catalogues a wide range of strategies used to scaffold learning during simulation engagement, including the use of human and computer tutors, verbal guidance, collaboration scripts, modelling, physical guidance, intelligent tutoring systems and even pause buttons. Importantly, these strategies are conceptualised as instructional scaffolds that bridge learners from their current state of knowledge and ability towards a desired state of greater knowledge and ability.

While the pedagogy described by Bevis et al. focuses on simulation engagement, their conceptual arguments for scaffolding are not confined to any single ‘phase’ of simulation. Each of the instructional strategies described in the review can be applied to the prebrief, simulation engagement and debrief. These phases can serve

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as a helpful heuristic that simplifies and focuses simulation design and operation, encouraging educators to consider each time point separately and in a step-by-step fashion. However, in doing so, simulation educators and researchers should pause to ask themselves: what are the consequences of privileging temporality in simulation instructional design? Does a phase-specific design approach eclipse effective pedagogy?

From phases to pedagogy

Dividing simulation into isolated phases (prebriefing, engagement, debriefing) has not successfully explained how or why simulation-based learning works. Though prebriefing and debriefing have received significant attention in the simulation-based learning literature, it is not clear how they relate to effective learning outcomes such as gains in knowledge and skills. Debriefing, for example, is often espoused as ‘the heart and soul’ of simulation or argued to be ‘where the learning happens’. However, systematic syntheses of debriefing conclude that while many approaches are beneficial, the comparative effectiveness of specific debriefing frameworks remains underdetermined [2,3]. Prebriefing has more recently been emphasised for its role in setting the stage for learning (e.g. performance expectations, psychological safety) and has become enshrined in international standards as an essential component of simulation-based learning. Like debriefing, reviews of prebriefing literature provide little clarity about what works or why [4,5]. Further, the simulation engagement phase has grounded our community’s efforts to create ever more realistic simulators and to encourage learner engagement and the suspension of disbelief. Yet, as with prebriefing and debriefing, there is little evidence that greater realism or higher ‘fidelity’ translates to superior learning outcomes [6,7]. Taken together, each of these areas of scholarship, largely organised around the heuristic of simulation ‘phases’, have achieved little success in clarifying how and why simulation-based learning works (i.e. learning mechanisms).

Better learning outcomes may hinge more on **how instruction is orchestrated across phases** than within them, which requires holistic educational strategies. Educators may find greater educational value in adopting instructional strategies that are agnostic to or even transcend the notion of phases; for example, focusing on how a simulation design activates learners’ prior knowledge, how feedback is triggered and timed, how cognitive load is managed – all key strategies identified in Bevis et al.’s review. Just as an orchestra conductor must consider the symphony of sounds created by each section of instruments to create the optimal listening experience, simulation educators and researchers must consider how each component of simulation (including phases) can be coordinated to yield the optimal learning experience.

A strict focus on phases may inadvertently encourage educators to adopt a more reductionist and modular design strategy that ignores constructivist learning principles. Contemporary recommendations and guidelines (e.g. INASCL [8], SSH [9]) explicitly call for educators to attend to the qualities and requirements of simulation’s phases. For example, educators may be instructed to ensure the

prebrief includes a statement about psychological safety, the simulation engagement phase encourages a sense of disbelief, and the debrief applies a plus-delta framework for feedback delivery. These design elements can distract from what we argue are the more critical aspects of simulation design, namely, crafting targeted and meaningful learning objectives and selecting design features (including instructional strategies) that assist learners in achieving these objectives. These latter aspects of design address the constructivist nature of simulation-based learning, which requires insight into learners’ current level of understanding and educational needs and calls for tailoring simulation design accordingly. Thus, while honing each individual component of an orchestra or simulation *may* result in an enjoyable symphony or improved learning outcomes, we argue it is more likely to result in a cacophony or suboptimal learning outcomes if the experience and needs of the learner are not centred.

Beyond ignoring constructivist needs, a phase-specific approach may not translate to all types of simulation-based learning. Take, for example, the prebrief for a procedurally oriented surgical simulation; while the goals of a conventional prebrief delivered before a scenario-based simulation engagement remain relevant, they may be better achieved via multiple short prebriefs built into cycles of procedural simulation engagement (i.e. repeated practice, switching roles).

Simulation phases remain a beneficial framework for guiding simulation design, logistics and administration; however, like all frameworks, they are limited. The framework of phases can help novice simulation educators and scholars organise their thinking and design decisions in a stepwise fashion. It can also deemphasise the coordination across these steps, which may limit the ability for simulation to effectively meet the needs of learners (e.g. tailored learning objectives), exclude clinical skills that operate at alternative tempos (e.g. surgical skills) and constrain our ability to clarify what aspects of simulation-based learning work and why.

The primacy of meaning making in expertise development

Ultimately, when educators compartmentalise simulation design, they risk creating a fragmented experience disconnected from their ultimate goal: developing learners’ expertise. If the tripartite structure of simulation phases risks encouraging siloed thinking, what should replace it? We propose shifting our primary lens from *phases* to **expertise development**. From this perspective, *all aspects of simulation-based learning should be geared towards scaffolding and guiding learners towards expertise by facilitating meaning-making*. This reframing foregrounds three instructional questions that cut across all time points of simulation:

1. **How will learners’ relevant prior knowledge be activated?** Reviews of prebriefing consistently point to orientation, goal alignment and psychological safety as enablers of engagement. However, how might we also surface learners’ mental models and individual goals to

positively influence in-simulation actions and post-simulation reflection and learning? These functions should be designed to reverberate throughout simulation engagement and debrief, rather than remaining confined to the prebrief alone.

2. How do we enable opportunities for impactful feedback and reflection?

Rather than the delivery of the 'right answers' or feedback or reflection at a fixed point, simulations can create moments where learners are more receptive to feedback, thereby promoting deeper reflection and learning [10]. Educators should consider how simulations can be used to engineer novel opportunities for feedback and reflection (or leverage existing opportunities) that are often impossible to access in lectures or brief exchanges in a busy clinical setting. This will require learners and faculty to embrace gaps in knowledge and make productive use of uncertainty, both of which depend on building strong educator–learner relationships.

3. How will we ensure that learning persists and transfers?

For knowledge and skills to be retained and to be flexibly applied (i.e. the transfer of learning across contexts), we must ensure simulation creates the necessary learning conditions. Much of the learning sciences has focused on the importance of challenge and effort to robust learning, which argues for active learning and reflection through strategies like retrieval practice, spaced practice or mixed practice [11]. If our goal is to develop future healthcare professionals who are capable of adapting to novelty (i.e. exhibit adaptive expertise) in addition to solving routine problems, educators should consider how simulation design supports conceptual understanding that underpins adaptive expertise [12]. Further, research studies should measure the effects of simulation interventions on retention and transfer outcomes.

These questions invite us to approach simulation design as a holistic instructional system rather than three sequential compartments. At all times, simulation educators should embrace the constructivist ideal of meaning-making and aim to activate learners' prior knowledge, create moments for feedback and reflection that refine understanding, and consider how the design of simulation experiences can build durable and flexible learning. These principles of meaning-making apply to all simulation-based learning experiences, including team-based, surgical or interpersonal skills. While each learning context can introduce unique instructional considerations that educators must adapt to, these principles remain constant. Adherence to these principles, rather than adherence to phase-specific design recommendations, will better equip educators to create more effective learning experiences through their simulation designs.

When considering meaning-making through simulation design rather than phases, we can consider alternative strategies that affect learning across and beyond phases. What happens in a prebrief undoubtedly will affect what occurs during simulation engagement, which will in turn

affect what occurs during a debrief. Further, the events of a simulation can go on to shape what future learning opportunities learners seek out and how these experiences unfold [13]. Furthermore, how a simulator itself is designed will impact how learners behave and interact during simulation engagement [14]. Grounding our simulation designs in meaning-making can help us address these complementarities across all these features and phases of simulation design and open new opportunities for instructional design and for researchers to clarify how simulation design ultimately relates to more effective learning outcomes.

The case of productive failure: a worked example

One pedagogical approach that would benefit from a holistic approach to simulation design across phases is productive failure. Productive failure describes a suite of instructional strategies that encourage learners to generate their own solutions to a challenging problem (often failing) prior to receiving guidance and instruction towards a canonical solution to the problem. Studies across the general education literature, and now in health professions education, espouse its benefits for long-term retention and transfer [15–18]. These benefits stem from the opportunities for learners to activate prior knowledge on a topic, highlight the deep structure (i.e. key features) of a problem and identify the gaps in their understanding through failure [19].

Effective application of productive failure in simulation requires coordination and alignment across simulation phases. The prebrief may require additional assurances to support psychological safety; simulation engagement may require less direct instructor support and thoughtfully designed activities that encourage exploration and problem-solving; and the debrief will require expert facilitation to help learners understand where their approaches went wrong and why, and reaffirm that this 'failure' was a normal part of the educational approach and was productive for their overall expertise development.

However, more critical than coordination of phases are considerations for how an educator designs the entirety of the simulation experience to facilitate productive failure. To ensure appropriate activation of prior knowledge, meaningful challenges (just beyond a learner's current level of understanding) must be created that allow for multiple potential solutions. To ensure a learner appreciates the deep structure of a problem and their own knowledge gaps, instructors must provide thoughtful feedback to be delivered after failure, ideally in a manner that builds upon learners' prior solutions. Focusing on meaning-making through faithful delivery of a productive failure intervention will require careful attention to very different elements of simulation design than those typically highlighted by phase-specific design recommendations. It will require considering the mechanisms of learning that facilitate meaning-making across all time points of the simulation learning enterprise, and tailoring the experience for specific learners based on their past experiences and expertise.

Implications for research and practice

The drawbacks of a phase-specific approach to simulation design may also explain why we, as a simulation community, have struggled to address the mystery that shrouds the role of effective guidance and instruction in simulation-based learning [20]. Reframing how we conceptualise simulation design to more holistically emphasise meaning-making carries several implications for how we approach simulation research and education. We offer the following suggestions for how others may use this approach to reconsider conventional practices in simulation to advance both simulation theory and practice.

1. **Study instruction and learning regardless of 'phase':** instead of testing isolated techniques (e.g. debriefing method A vs. B), investigate how instructional strategies that support meaning making play out across all facets of simulation design.
2. **Measure learning processes alongside outcomes:** beyond performance scores, track process measures, such as prior-knowledge activation, guidance, feedback timing/quality and opportunities for conceptual articulation. The instruction-and-guidance scoping review provides a useful taxonomy to operationalise and studying such measures.
3. **Design for durability and adaptivity:** simulation design should incorporate variability, uncertainty and conceptual prompts that press learners towards robust conceptual understanding and adaptive expertise in addition to routine expertise. That is, to use instructional scaffolds (beyond prebriefing) to support exploration without sacrificing psychological safety. This may include incorporating multiple mannequins with different features or designing simulators that aim to reveal conceptual relationships important to a task (e.g. using transparent skin during instruction for needle technique skills to reveal underlying anatomy) [14].

Conclusion

Prebriefing, simulation engagement and debriefing remain a useful trichotomy for the logistics of simulation design, but as an instructional theory, these temporal divisions obscure a central truth: **effective simulation is the orchestration of instruction across an experience to cultivate durable and flexible learning.** Designing and researching simulation holistically can make our resource-intensive work more pedagogically potent while giving educators the nimbleness needed to meet complex learning goals. Lessons from how instructors have approached **guidance and feedback** during simulation engagement can offer insights into instructional strategies that support learning through all aspects of simulation and beyond. Educators and researchers can free themselves of the constraints that simulation phases place on design, and in doing so, embrace their full creativity to design simulation experiences that emphasise meaning-making through all means (and time points) available.

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Disclaimer

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Note

This editorial was written in response to a scoping review published in the *Journal Healthcare Simulation* by Bevis et al. [1]. The lead author of this editorial approached three authors of the scoping review, challenging us to expand our thinking about the phases of simulation.

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