Simulation in Exercise Science and Physiology—No Longer a Luxury but a Necessity

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ABSTRACT

The depreciation in placement opportunities has placed pressures on university academics for some time now. Today, the coalescence of this supply issue and the global health pandemic have forced the consideration of alternative placement options. Simulation-based learning experiences (SBLEs) is one such approach, providing students with a diverse range of clinical experiences in a safe and well-placed manner. The documented effectiveness of these experiences in preparing the future health care workforce has been strong, but exists largely in medicine and nursing spheres. SBLEs have been recognized in Australia as providing a commensurate education experience to that of a traditional practicum hour resulting in a portion of total practicum hours being accrued by this activity. In March of this year, the Exercise & Sports Science Australia, accrediting body for exercise science, exercise physiology, and sports science, has lifted the restriction on mandated hours that can be apportioned to simulation-based placement. This "green light" will enable more academics to explore the opportunities within simulation-based learning, although the question regarding being able to deliver quality educational experience remains. This commentary provides an overview of key peer-reviewed literature and simulation design recommendations. Despite being founded on nursing simulation best practice standards, the lessons learned could help direct simulation designers in exercise science and physiology curricula as they strive to meet a rapidly changing practicum placement landscape while maintaining quality teaching and learning environments. *Journal of Clinical Exercise Physiology*. 2020;9(2):83–88.

BACKGROUND

In Australia, in order to become credentialed, exercise scientists, exercise physiologists, and sport scientists need to complete an appropriate bachelor level degree qualification and satisfy certain accreditation criteria as established by the regulatory body. The accreditation criteria are commensurate with other practitioners across the medical and allied health professions and involve the demonstration of competencies consistent with professional standards via traditional class-based and work-integrated learning experiences.

Predominately, higher education institutions have carriage of the learning pathway for accredited exercise practitioners. The codification of the knowledge essential to address the prescribed competency-based standards is the central focus of curriculum in degree programs in the exercise science and physiology domains. In fulfilling its remit to present work-ready, entry-level graduates, university programs strive to scaffold learning across cognitive, affective, and sensory domains by using a range of traditional and nascent pedagogies. A simulation-based learning experience (SBLE) is a learning and teaching strategy that, in recent years, has become firmly established in higher education (1–3).

Simulation has been used in different education fields and settings for many years. It was initially driven by early 20th century adopters in aviation and military education and then joined in the later part of the century by the health care sector (4). The predominance of simulation in health care

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education and published literature is in the medical and nursing disciplines. Lessons learned from these disciplines continue to define and refine pedagogical approaches in the higher education sector of the allied health professions (5). However, some allied health professions have made their own significant contribution to the SBLE literature, notably speech pathology, audiology, and physiotherapy (6).

Specific to the context of health care, the SBLE is defined as:

> *An array of structured activities that represent actual or potential situations in education and practice. These activities allow participants to develop or enhance their knowledge, skills, and attitudes, or to analyze and respond to realistic situations in a simulated environment* (7).

SBLEs in medical and nursing education share the common drivers of quantum and diversity of clinical placements, the patient safety agenda, and educational imperatives (8). Simulating the clinical environment has been procured through the vehicles of low-tech simulators (including models and mannequins), simulated or standardized patients (SPs; individuals trained to role-play patients), computer-generated simulators, complex task trainers (high-fidelity tools integrated with computers), and realistic patient simulators (computer-driven full-length mannequins) (8,9). The SBLE facilitated nexus between the classroom and clinical environments spans many competencies from clinical and procedural skills, clinical decision making, and is patient-centered to interprofessional communication and teamwork (8,10,11).

SBLEs within medical, nursing, and allied health student education have documented effectiveness well. From practicum preparedness (8,12) through to replacement of clinical practicum hours (13,14), simulation has cemented its place within the tertiary education training sector.

Educators in the nursing profession have principally cultivated the guidelines and standards for simulation design. A national approach in the United States, led by the International Nursing Association for Clinical Simulation and Learning (INACSL), has engineered a suite of Standards of Best Practice: Simulation^{SM} Simulation Design (15) to guide and support SBLE designers. To our knowledge, only anecdotal evidence supports the transferability of these standards from nursing to allied health professions. The standards include the 11 key domains of needs assessment, measurable objectives, structure, design, fidelity, facilitation, prebriefing, debriefing and/or feedback, evaluation, preparation materials and resources, and pilot testing. Additional valuable simulation design beacons exist within nursing research, and they explore: the efficacy of SBLEs on elevating selected student competencies (16), features of SBLEs that represent greater return on investment for simulation designers (17,18), and SBLE methodology (19–21).

A review of the literature suggests that the integration of SBLEs in higher education is limited across the disciplines of exercise science, exercise physiology, and sports science. Of the handful of publications available for review, only exercise physiology education in aged care, musculoskeletal, neurological, and diabetes settings are documented (9,22,23). Insights into the SBLE design and resultant efficacy of student learning outcomes evidenced in these articles provide, at best, a glimpse into the prospect SBLEs hold for exercise science and exercise physiology. This paucity of educational accounts results in an inevitable underwhelming educational efficacy and design compassing. Direction therefore needs to be leveraged from learnings forged in the broader allied health congregation as well as the medical and nursing professions.

In Australia, Exercise & Sports Science Australia (ESSA), the accrediting body for exercise science, exercise physiology, and sports science, has for some time recognized SBLE as a viable modality through which students can obtain accreditation practicum requirements. Of the minimum of 140 h of practicum required for exercise science accreditation, 15 h can be completed in an SBLE. For exercise physiology accreditation, 40 h of a total of 360 h of practicum can be completed in an SBLE (24). The authors believe that, in some practitioner and academic circles, a view is emerging that recent changes in the health care landscape, elevated supply and demand constraints on practicum placements, and the advances in technology that underpin contemporary learning pedagogy, necessitate a revision of the quantum afforded to SBLEs in practicum experiences. Superimposed on top of this emendation narrative has been the seismic impact that the novel coronavirus (COVID-19) pandemic has had on exercise science and physiology university units of study. Universities have consequently seen a rapid evaporation of practicum opportunities across public and private placements as they adopt social distancing regulations imposed by governments. ESSA has responded to the looming placement vacuum by temporarily expanding the number of hours that SBLEs can contribute to practicum hours (maximum of 40 h and 80 h apportioned to exercise science and exercise physiology practicum, respectively, in 2020). ESSA's March 19, 2020, communiqué to the university sector outlined that SBLEs within exercise science "must have clear learning objectives and be able to demonstrate that the required outcomes have been met." For exercise physiology, "simulations should be high fidelity with clear learning objectives, problem solving components built into the scenarios, and contain a structured debriefing." This message has given the green light to educators and simulation designers to consider the SBLE as a legitimate placement alternative.

In these pendulous times, the authors believe that an opportunity exists to provide an overview of key SBLE design aspects to provide guidance to exercise science and exercise physiology simulation designers. This will ensure student SBLEs are at the very least augmenting the traditional practicum model and further bolstering the case to the accrediting body to ultimately expand the proportion of SBLEs that might be claimed by aspiring exercise science or exercise physiology practitioners.

The authors have been designing and delivering SBLEs within exercise science and exercise physiology university units of study since 2014. We hope that the cited articles in this commentary, coupled with the lessons learned in simulation design standards over the years, may be of value to educators and simulation designers who have stewardship of exercise science and physiology curricula.

LESSONS LEARNED

Needs Assessment

A needs assessment should be undertaken to establish the foundational evidence for an SBLE to occur (15). The systematic process should identify a need or gap in the education continuance, consider organizational capacity, relevant stakeholder feedback, and key learnings from other SBLE offerings and be founded on standards and guidelines from the accrediting authority. Consideration should be afforded to how SBLEs reside within a coherent, program-level curriculum structure. This design standard is used uniformly in exercise physiology curricula by the authors. For example, an environmental scan of placement supervisors identified that students entering placement lacked the necessary skill in subjective assessing of patients. Placement supervisors suggested that elevated student acumen at the commencement of placement would result in a more effective and efficient learning experience for the student. The recognized gap in student competency resulted in SBLEs being designed to increase the opportunity for students to develop the skills necessary to perform a subjective assessment prior to going on placement.

Measurable Objectives

The design of the SBLE should be founded on measurable objectives (15), more commonly known as learning outcomes in the university sector, that serve as a blueprint for the learning activity. Learning objectives can be broad and reflect the purpose of the SBLE. Broad objectives should be communicated to the participant early in the activity. Objectives can also be specific and measure participant performance against key competency criteria. A more covert and strategic position can be taken when communicating these objectives to the participant. Learning objectives should be scripted early in the design phase, and their realization during the learning activity and subsequent debriefing remains a key responsibility of the simulation facilitator (SF). The debriefing phase of an SBLE is where a guided and deep reflection of how the learning objectives were realized should occur. This design standard has been used in exercise science SBLEs where a broad objective of developing student communication skills when delivering an exercise intervention plan has been established. The broad objective was identified by the educator subsequent to a needs assessment. The objective was communicated to the student in the SBLE preparation materials (and underpinned by preparation materials and resources) and again by the SF in the prebriefing. Specific objectives relating to the demonstration of particular types of communication (e.g., verbal, nonverbal, listening) were observed by the SF during the SBLE and explored in the debriefing phase.

Structure

The structure of an SBLE should be predicated on the needs assessment findings with deep consideration given to resourcing capacity and the identified learning objectives (15). Participant encounters in the learning activity can be theoretical or conceptual and formative or summative. Participant engagement in the SBLE is optimized by including problem-solving activities and if each participant is accountable to the designated functions. SBLE structure should explicitly place safety as a key pillar for all involved (15). Learning activities should meet the participant at their level of skill “comfort” and support an achievable learning trajectory. Where SP methodology is used, the physical and psychological safety of the actor should feature (19). The operationalization of the structure standard across all exercise science and physiology SBLEs have proven essential when using SPs. Simulated patient coordinators are involved in finalizing the design of SBLEs with the result being improved standardization of role play, enhanced scripting and guides for SPs, and improved casting. When an SBLE structure makes provisions for objectives to be communicated and understood by SPs, the authors have seen that SPs can make a valuable contribution within student debriefing.

Scenario

A carefully conceived scenario provides crucial context to an SBLE (15). It should support the SBLE’s learning objectives and reside within future practice domains of the participant. Simulation designers should either possess or recruit contemporary industry experience to inform scenario development. Situational immersion of participants in the SBLE is achieved when the scenario involves a backstory and realistic start and end points. The level of detail in the scripting of the scenario is likely to vary depending upon the learning objectives and where the SBLE resides within a unit of study. SBLEs offered early in a program may need to be detailed and include cues to provide a framework for progression. A more free-flowing scenario structure for students nearing the completion of their unit of study may support higher-order skill and competency development. Scripting should be detailed enough to support consistency and standardization of the SBLE across a student cohort regardless of when, where, and by whom it is facilitated. In the authors’ experiences, when simulation designers commit to key scenario development principles, SBLE offerings can accommodate for the broad scope of exercise science and physiology practice. Furthermore, SLBE scenarios can be successfully crafted to house interprofessional and asynchronous cohorts.

Fidelity

With a backdrop of learning objectives, careful consideration of the physical, conceptual, and psychological components helps the simulation designer to designate appropriate fidelity or realism to a SBLE (15). The modality chosen (e.g., simulator, manikin, simulated patient) along with features including the environment, props, sounds, lighting, distractions, competing priorities, help to create a setting in which authentic learning is achieved. In exercise science and physiology settings, authentic SBLEs are the product of precise scenario planning (including features within a case scenario to ensure consistency with the diagnosis or presenting condition), structural configuration (including flow of the activity ensuring it is clear, logical, and authentic), and learning objectives (that are aligned with accreditation competencies). In the authors' experiences, appropriate levels of realism are key to the success of an SBLE. High levels of realism, which often come at considerable expense, are not always warranted. Simulation designers should focus on achieving the level of realism that is conducive to transporting the participant to a place where optimal engagement is achieved.

Facilitation

SFs are charged with significant responsibility in SBLEs. A participant's experience and resultant learning achievements can depend on the skill and experience of their supervising SF. As such, SFs should ideally have formal training in simulation-based pedagogy, be acquainted with all aspects of the SBLE beforehand (including learning objectives, cueing, and participant safety), be provided with an opportunity to engage with the simulation designers to clarify function, and participate in debriefing and evaluation with the simulation designer after an SBLE has been delivered. Addressing these factors will support a consistent approach across SFs, which is especially important when assessment tasks are linked to an SBLE. Simulation designers should consider the involvement of SFs in the design phase of the SBLE and structure the learning activity with access to SFs, SF experience levels, and SBLE budgets in mind.

Prebriefing

The prebriefing component of the SBLE occurs early in the learning activity schedule and is where elements of trust, safety, and the commitment to deep immersion are recognized (15). The prebriefing ideally should orient the participant to the broad and/or specific learning objectives of the SBLE, how the SBLE fits into the curriculum at a micro and macro level, how the SBLE supports aspects of work readiness, and the SBLE structure. Prebriefing can be SF led or delivered by prerecorded digital modalities. In the authors' experiences, a well-configured prebriefing helps to settle the participant into the tasks at hand and eases participant nerves and apprehensions that can negatively affect the experience. Simulation designers should afford sufficient time to prebrief to ensure all necessary components are covered. Designers should also script what the SF is to cover in the prebriefing, as this sets the scene for the remainder of the SBLE.

Debriefing/Feedback

Simulation designers need to apportion ample amounts of time to the debriefing section of an SBLE as, in the authors' experiences, this is where participants acquire the most valuable learnings. Debriefing should include a descriptive phase (where participants are asked to describe what occurred, how they felt, and what their challenges were), analytic phase (where participants explore what they did well and not so well and reasons for certain actions), and application phase (where participants reflect on what they would do differently and how they could improve) (16). SFs involved in SBLEs should have formal training in simulation-based pedagogy on account of their significant influence over the success of the SBLE. Similarly, SFs involved in debriefing should have formal training and pedigree in this component of the SBLE. At the very least, careful mentoring should be afforded to SFs in the art of debriefing when experience is limited. The authors believe the debriefing should be conducted at a granular level. Opportunities should exist for participant reflection to encompass activities both immediately after the SBLE and in the days following. In exercise science and physiology units of study, the SBLE debrief can involve students reflecting on experience and identifying key areas that will influence future practice.

Evaluation

The evaluation standard of an SBLE describes how the simulation designer establishes the educational efficacy of the learning activity (15). Feedback should not be quarantined to the SBLE participant but, where appropriate, extended broadly to include SFs, SPs, practicum supervisors, and industry representatives. Evaluation can be conducted formally via a valid and reliable measure as well as informal methods. The authors have appreciated the evaluative contributions from simulation designers from across the medical and allied health spectrum as well as educational design experts from disparate areas of the university.

Preparation Materials and Resources

Simulation designers should consider preparation materials and resources early in the design phase of the SBLE (when the structure and scenario are being conceived). Preparatory material should include the foundational knowledge necessary for the participant to satisfy the learning objectives of the SBLE (15). Preparatory materials should be delivered or made available to the participant for a reasonable period of time prior to the SBLE commencing. The authors have provided preparation material to participants anywhere from 2 weeks to 24 h prior to the SBLE. Participant consumption of these materials can be via course work, reading materials, watching videos, and/or completing a pre-SBLE quiz. The authors have been known to take an inversely proportional approach to the provision of preparatory materials and resources when designing SBLEs. Specific to exercise science and physiology cohorts, this would manifest in students early in a unit of study or with little or no SBLE experience receiving detailed preparation materials in the 2-week window leading up to an SBLE. For example, before a participant is required to perform a patient consultation, they are to watch a video recording of an experienced practitioner performing a patient consultation. Students nearing the end of their unit of study and having had exposure to SBLEs receive the bare minimum of preparation materials, for example, only communicating the broad learning objectives of the SBLE. This is done to authenticate the learning experience for the participant and align it as closely as practicable to the real experiences they will have as an early career practitioner.

CONCLUSIONS

Until such time as the exercise science and physiology professions have published literature to support or contradict the Standards of Best Practice (15), these standards should be considered a robust foundation for SBLE design. The expression *publish or perish* can be applied to SBLEs in exercise science and physiology professions. We are at a junction, a turning point. For SBLEs to optimally prepare students for placement and to enhance and replace clinical placement hours, the experience must be well designed and meet desired learning outcomes. Our governing body must firmly believe that SBLE offerings are of the highest standard, but without reporting in the literature, how can we add to the body of evidence? High-quality reporting is an essential component to progressing the SBLE within our profession. The authors have previously applied the Reporting Guidelines for Health Care Simulation Research: Extensions to the CONSORT and STROBE Statements (25) to their own work (6) and now call all simulation designers to apply these simple principles in the SBLE planning phase and subsequently in their reporting.

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