Unlocking the learning potential of simulation-based education

Abstract

Simulation is ubiquitous in the training of hospital-based doctors worldwide, often focusing on an individual level in traditional 'skills and drills'-based training. However, there has been an expansion in the use of simulation in healthcare practice and training. Simulation is being adopted into many disciplines that traditionally have not used this form of experiential learning. Moreover, simulation is increasingly being harnessed to enhance team and organisational learning in hospital-based practice. This article shares some insights into simulation-based education and makes the 'familiar unfamiliar' about this important method of learning. The aim is to broaden readers' outlook about what simulation has to offer beyond the classic notion of skills and drills-based training.

Key words: Education; Simulation; Training

Submitted: 4 October 2023; accepted following double-blind peer review: 16 October 2023

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Introduction

Simulation has a long history in the education of health professions. Whether in developing clinical skills to a more specialist level, or in skill maintenance, it is well established in the fabric of hospital-based educational practice. Simulation has played a vital role in some of the major milestones in medical practice. For example, as discussed by Geddes et al (2017), in 1965, Professor Frank Pantridge and colleagues developed the portable defibrillator for the management of out-of-hospital cardiac arrests. To ensure the effective use of the portable defibrillator via the 'mobile coronary unit', the team realised that they needed to train GPs in the skills of cardiopulmonary resuscitation. In response to this, they conducted a series of Sunday morning training sessions in cardiopulmonary resuscitation for GPs. They also used simulation or 'dry runs' to help refine the process and reduce call out times for the mobile coronary unit. Simulation continues to play an important role in the training of doctors and is becoming increasingly popular in many areas of hospital-based medicine.

This article explores some current concepts relating to simulation-based education and challenges assumptions about this common form of experiential learning. It considers the essential elements of what makes simulation an effective educational experience and its expanding scope in health professions education. Moreover, the authors hope to broaden horizons about what simulation has to offer in the professional development of doctors and teams, that goes beyond the classic notion of 'skills and drills'-based training.

What is simulation-based education?

When one considers what simulation is, David Gaba (a healthcare simulation pioneer) offers the definition that:

> **'Simulation is a technique—not a technology—to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner.' (Gaba, 2004).**

In essence, simulation offer learners an experiential form of learning through constructed experiences, compared to the more naturalistic contexts of work-based learning with real patients (Gormley and Murphy, 2023). In simulation, educators and other professionals,

How to cite this article:
Gormley GJ, Carr D, Murphy P, Tallentire VR, Smith SE. Unlocking the learning potential of simulation-based education. Br J Hosp Med. 2023. https://doi.org/10.12968/hmed.2023.0353

such as simulation technicians, craft a simulated experience. Such constructed, simulated realties can be offered in a wide range of formats, for example, in bespoke simulation centres or in actual clinical environments such as in situ simulation.

In these constructed realities, learners are guided by facilitators to help suspend disbelief and consider this experience as near to the real world as possible. Within this suspension of disbelief, learners are required to react to the situation that is presented to them; not just cognitively, but also in their actions and behaviours. The challenge of suspending disbelief and providing a realistic experience is a key concern of modern dramatic theory and practice. This is exemplified in the work of Russian actor–director Konstantin Stanislavski, who in the early 20th century developed the most comprehensive study of acting to date (Stanislavski, 2017). Fundamentally, simulation should be framed as a developmental activity rather than being judgemental (Gormley and Murphy, 2023). Such framing allows learners to reflect on their actions and be guided on how to enhance and transfer their capabilities to real world practice.

When conducting a simulation, multiple elements must come together in this constructed learning opportunity. Ahead of the simulation, educators are required to develop a simulation scenario that has clear learning outcomes and a plan for its delivery. The content of the scenario must align with current clinical practice and guidelines (Johnston et al, 2020). Technology is often used in such learning events, whether a manikin or working with a simulated participant (an individual who portrays the role of a patient) (Nestel et al, 2020). Just before the simulation occurs, a pre-briefing is required. Pre-briefings serve to establish a shared understanding of the purpose of the simulation and also to develop psychological safety (Somerville et al, 2023). Traditionally, the purpose of the simulation may have been hidden from participants, but current thinking suggests that the surprise element is not necessary, and may actually detract from learning (Monteiro and Sibbald, 2020).

Debriefing and deroling

Whether or not the learning outcomes are explicit, during a simulation learners react to the evolving situation that is presented to them. While facilitators are often present during this time, they can have a more passive or active role depending on the learning needs of the participants. For example, if a learner is struggling with the simulation, facilitators are able to alter the scenario to be less challenging for the learner and vice versa. Debriefings should always occur following a simulation (Nestel et al, 2017). During these guided learning conversations, learners are provided the opportunity to emotionally stabilise after what can be a challenging and emotionally intense situation (Eppich and Cheng, 2015). They are then encouraged to describe what happened to them during the simulation, sometimes using video feedback analysis to help with recall. Both learners and facilitators then turn their attention to areas that could be enhanced and ways to implement changes to future clinical practice.

Debriefing is usually done following a simulation, but to be effective debriefing must be preceded by deroling, to enable students to transition from the simulation and modulate any emotional residue from stressors encountered in the simulation (LeBlanc and Posner, 2022). Deroling involves an active process of self-reflection and awareness of the emotional impact of the simulation. Learners are supported to effectively change from the role they performed in the simulation to the next role they must perform in the debriefing, namely that of the learner. Deroling is therefore not merely a matter of cooling down as one would do after a workout in the gym, but rather a process of consciously changing from one role to another. At the time of writing, no model for deroling exists in the same way that models for debriefing exist and work must be done to develop the former in order to enhance the latter.

Principles of simulation-based education

A number of key principles underpin the practice of simulation-based education. First, it behoves educators to create a simulation reality that reflects the clinical workplace, including its inherent messiness and complexities. If not, there is the risk of creating a simulacrum which learners believe is ‘the real deal’ but bears little resemblance to the

originalities of the workplace (Johnston et al, 2020). Second, technology alone does not produce a transformative learning experience. Pedagogy (the science of learning) should never be overlooked in favour of technology (Gormley and Murphy, 2023). There is an increasing evidence base that is supporting the driving force of pedagogy in simulation-based education. Through supportive educator relationships, learners are encouraged to go beyond their comfort zone into a zone of learning (Vygotsky, 1978). In such zones of learning, learners are frequently entrusted with greater responsibilities than they typically encounter in the workplace (Gormley and Murphy, 2023). However, through supportive relationship with educators, they can scaffold their learning and develop their capabilities (Vygotsky, 1978).

Why do educators use simulation?

As simulation-based education becomes an increasingly prominent tool within medical education and training, the ways in which it is being used are evolving. Aligned with the wider curriculum, simulation-based education can be used in isolation or interwoven with other educational opportunities to complement both classroom and workplace-based learning. One particularly important application of simulation-based education is the rehearsal of high acuity and low occurrence events (Hakemi et al, 2023). Simulation offers an environment free of risk to patients, where healthcare professionals can practice infrequently used skills, enhancing preparedness and potentially saving lives in real-world scenarios.

Simulation for teams

Over recent years, the traditional focus of simulation-based education on individual skill development has been matched by a desire to unlock its potential for team training and systems testing (Weldon et al, 2023). Training healthcare teams using simulation-based education nurtures cohesion and collaboration, and allows interprofessional groups to reflect together on aspects such as team dynamics, task allocation and communication. Systems testing, a new frontier in simulation-based education, can help to identify latent safety threats (Reason, 2000) and contribute to the development of safer and more resilient systems. This has been particularly effective during the testing phase of newly built healthcare facilities, before patient exposure (Colman et al, 2019).

Simulation for personal development

Research has further expanded the potential impact of simulation; conversations relating simulation-based education to the interwoven concepts of identity development and social integration are starting to emerge within the educational literature (Gormley and Murphy, 2023; Tallentire and Smith, 2023). Simulation-based education can contribute in meaningful ways to identity development, through challenging stereotypes (including self-stereotypes) and promoting a genuine sense of belonging (Tallentire et al, 2022a). The opportunity for reflection provided by simulation-based education may allow the exploration of strongly held attitudes and beliefs that influence behaviours and interactions within the clinical workplace. As learners explore and develop their own identities, they may also consider the professional hierarchies and power dynamics inherent within healthcare teams, and consider how their self-image facilitates or inhibits their own workplace integration.

Simulation-based education offers an opportunity for social values, beliefs and norms to be reinforced in a deliberate and intense way, known as ‘cultural compression’ (Purdy et al, 2019). This offers an exciting opportunity to not only scrutinise and question prevailing social practices, but also articulate them to new members of the team, organisation or wider healthcare system in ways that promote integration (Smith and Tallentire, 2023). Using carefully crafted scenarios and debriefings, simulation-based education can allow cultural similarities and differences to be explored with sensitivity and respect. Furthermore, the shift in power dynamics that occurs in simulation-based education when a psychologically safe learning environment is cultivated can allow traditionally repressed or underrepresented voices to be heard. There is ample opportunity for the power of simulation-based education to be harnessed to better integrate both newcomers

and marginalised groups, and allow the exploration of challenging and emotive topics such as racism in healthcare (Roze des Ordons et al, 2022).

Simulation for uncertainty tolerance

Simulation may also have a role in helping clinicians to develop uncertainty tolerance, which is defined as how clinicians consider and respond to uncertain, ambiguous or complex situations. Uncertainty tolerance is becoming increasingly recognised as an essential skill for all healthcare professionals (Hillen et al, 2017; Lazarus, 2021; Stephens et al, 2022), with poor uncertainty tolerance linked to negative outcomes for patients and healthcare professionals (Patel et al, 2022). There is mounting evidence indicating that medical students and doctors in training face wide-reaching uncertainties, with few experiential learning opportunities to confront and navigate uncertainty (Stephens et al, 2022).

Simulation-based education is an effective educational intervention that can be used to foster uncertainty tolerance in healthcare students and professionals (Carr and Gormley, 2022; Patel et al, 2022; Tallentire et al, 2022b). Learners are guided by facilitators to reflect on how and why they made particular decisions, while acknowledging the cognitive, emotional and ethical aspects of uncertainty. Through this process, simulation-based education allows learners to explore how their own threshold of acceptable risk could impact on decisions about patient care (Scott et al, 2020; Tallentire et al, 2021; Carr and Gormley, 2022). Potential negative emotional responses from learners can be mitigated by experienced facilitators creating and maintaining a psychologically safe learning environment (Rudolph et al, 2014; LeBlanc and Posner, 2022). Such an environment facilitates scaffolded learning through conversations that help develop cognitive apprenticeship and ‘intellectual candour’, and thereby builds trust between all participants (Molloy and Bearman, 2019; Scott et al, 2020; Carr and Gormley, 2022; Patel et al, 2022).

As the technology of simulation-based education advances, so too do the opportunities for its use. Individual skill acquisition and rehearsal remain important aims of simulation-based education, complemented by its increasing prominence within the spheres of team training and systems testing. More recently, the potential for simulation-based education to influence professional identity development, social integration and uncertainty tolerance has been explored, and these remain exciting avenues for further study.

Where can simulation occur?

In conjunction with the reasons for doing simulation, the physical spaces in which simulation-based education occurs have also changed over time. When one thinks about simulation-based education, one often imagines a simulation suite full of technology. The technology enables immersive simulation experiences in, for example, a mock ward or theatre. It also enables focused training of procedural skills, for example by using part-task trainers for simulation-based mastery learning, a rigorous form of competency-based education which allows learners as many repetitions as required to achieve a specific standard (McGaghie et al, 1978).

In situ simulation

Simulation centres are expensive, and medical educators have explored opportunities to simulate in alternative environments. In situ simulation (which is simulation conducted within the real clinical environment; primary, secondary or social care) offers a possible solution. Advantages of in situ simulation include allowing teams who work together to train together, to test emergency responses using real equipment in the actual environment in which it is needed (Schofield et al, 2018), and therefore enabling the identification of latent safety threats (Patterson et al, 2013). However, any training within the clinical environment carries inherent risk to both patients and staff. Efforts to mitigate such risks include establishing ‘no-go considerations’ (Bajaj et al, 2018), using safety checklists (Brazil et al, 2022), and avoiding the introduction of fake drugs or equipment into the clinical environment (Raemer et al, 2018). With these risks in mind, simulation facilitators are urged to consider their reasons for choosing in situ simulation (Brazil, 2017), and to use classroom settings if more appropriate.

Classroom-based simulation

For those wishing to avoid both the simulation suite and the real clinical environment, ordinary classrooms can provide the setting for simulation-based education, for example in the form of tabletop games. Some examples include Lego bricks to promote active reflection (Hayes, 2016), board games to explore growth mindset adoption (Hopkins et al, 2023) and tactical decision games to reflect on prioritisation (Clarke et al, 2023). Serious games such as these may be considered as simulation under Gaba's definition, as long as they evoke aspects of the real world and allow for interaction (Gaba, 2004).

Building on the concept of serious games, escape rooms are also gaining popularity within simulation-based education. Escape rooms are puzzle rooms which involve elements such as clues, game-like components, problem solving and reflection (Anderson et al, 2021). In addition to these elements, healthcare simulation escape rooms include components of healthcare-simulation best practices, including a clinical focus, clear objectives, a custom pre-briefing and facilitated debriefing (Anderson et al, 2021).

Simulation and virtual reality

Beyond the realm of classrooms, virtual reality provides a gateway to simulation-based education within participants' own homes. Simulations may be accessed via computer screens or headsets. These can be integrated with physical models or other haptic devices to provide real-time feedback (Viglialoro et al, 2021). Furthermore, virtual reality models incorporating artificial intelligence can interact with users in a similar way to a patient, for example, enabling a student to practice their history taking and receive individualised feedback (Harder, 2023). The advent of virtual reality within healthcare simulation has vastly expanded the concept of where simulation should take place.

Healthcare simulation-based education, traditionally carried out in simulation centres, has now expanded into the clinical environment, classrooms, escape rooms and participants' homes. Considering simulation as a technique rather than a technology can help educators to reimagine many activities as simulation, and appreciate how simulation has become a normal and essential part of healthcare education that occurs all around.

Who participates in simulation?

Having appreciated that simulation can occur anywhere, its potential application for use by a number of different groups can be better understood. Within hospitals simulation-based education is often seen to be the domain of anaesthetists and surgeons. However, considering that simulation can happen anywhere, and can be used for a multitude of different purposes, it becomes clear that various different groups can benefit. Within the authors' own departments, novel uses of simulation have been seen for the following groups:

- Immersive simulation for refugee doctors to help them to integrate into the UK's healthcare service
- Recognition and management of domestic violence simulation training for GPs
- Simulation to empower nursing home care workers to take part in anticipatory care conversations
- Palliative care simulations with various healthcare professionals to help facilitate conversations around death and dying
- Simulations of multidisciplinary team meetings to help international medical graduates to better understand team roles
- Simulations of primary care teams in clinical emergencies to aid with better team responses and to create emergency 'grab bags' for future use in real emergencies.

Simulations may also involve non-clinicians, to train whole teams to work better together.

Simulation is not only available to wealthy participants. Initiatives such as the vital anaesthesia simulation training programme (Mossenson et al, 2021) have enabled the sustainable facilitation of simulation within low resource settings, by training local facilitators and mentoring them to deliver their own training sessions in countries all over the world.

By expanding one's horizons about what simulation-based education does, why it is used and where it can happen, it can be understood that simulation really is for everyone.

Key points

- Simulation has a long tradition in hospital-based practice, often with a focus on more 'skills and drills'-based training.
- In recent times there has been an expansion in the use of simulation in healthcare – with a greater focus on team and organisational learning.
- Simulation-based education can be used in isolation or interwoven with other educational opportunities to complement both classroom and workplace-based learning.

Conclusions

While traditionally simulation has often been considered only to relate to skills and drills-based training in acute skills, the authors hope that this article challenges this perception. Simulation has much to offer in many disciplines and areas in hospital-based medicine. With an increasing evidence base guiding the development of simulation, the authors believe that this is the 'golden era' of simulation. Despite its widespread use, wise and careful choices need to be made in how best to harness this resource intensive form of learning. Nonetheless, simulation has much to offer in the transformation of individuals, teams and organisational structures in hospital-based settings. Although Professor Frank Pantridge and colleagues may not have used the term 'simulation' in developing the use of the portable defibrillator, his team acknowledged the importance of constructing a learning reality to best prepare their response in caring for a patient. The authors hope that this article helps readers reflect on their understanding of simulation and encourages them to be part of the golden era.

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Conflict of interests

The authors declare that there are no conflicts of interest.

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