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The conceptual bridge between Simulation-Based Education and Transformative Simulation

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ABSTRACT

Simulation in healthcare has evolved from a focus on individual skills training to a broader set of applications spanning education and cultural and systems-level change. Yet conceptual clarity remains lacking, particularly in how Simulation-Based Education (SBE) and Transformative Simulation (TfS) relate, given that they stem from different philosophical orientations and theories. This essay proposes a conceptual bridge between these two purposes of simulation, grounded in the meta-theory of transformative pedagogy. While SBE draws on diverse theories and concepts to support learning, TfS emphasizes collaboration, systems thinking and user engagement to drive collective understanding, insight and change. We use a metaphor of a bridge to illustrate the passage for a bi-directional model showing how SBE can lead to transformation and how TfS insights can be educationally embedded. This offers a cohesive structure positioning simulation as a tool for individual, interprofessional and cultural and systems-level development and reform.

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What this essay adds

- **Conceptual clarity**: introduces a theoretically grounded distinction between Simulation-Based Education (SBE) and Transformative Simulation (TfS).
- **Bridging model**: proposes a bi-directional model, where transformative pedagogy serves as a conceptual bridge linking SBE and TfS.
- **Integrated purpose**: demonstrates how simulation can simultaneously serve individual learning and cultural and systems-level transformation when designed with both education and change-oriented intentions.
- **Interrelated domains**: identifies four domains – Person, Organization/Context, Socio-cultural and Health – interrelated and interacting to influence education and practice.
- **Intentional design**: advocates for simulation design that is purposefully aligned with educational and cultural and systems-level goals, enabling more impactful and sustainable outcomes across healthcare settings.

Introduction

Healthcare simulation has long been valued for its ability to authentically replicate a clinical scenario, with early emphasis placed predominantly on fidelity (physical, environmental and psychological) and the simulator itself [1–3]. In recent history, simulation was primarily used to develop procedural and technical skills in controlled environments. However, as the healthcare landscape has grown more complex, so too has the scope and purposes of simulation, transitioning into a multifaceted methodology – from education and professional development to cultural change, policy influence and systems-wide improvements.

This articulation is timely as healthcare grapples with tensions between education and training, performance and inquiry, and standardization and adaptability – each shaping simulation design and delivery.

This essay seeks to address that gap by examining two terms that together offer a robust and inclusive framing for simulation in healthcare: Simulation-Based Education (SBE) and Transformative Simulation (TfS). These concepts are grounded in distinct theoretical foundations and together span the broad spectrum of simulation applications in contemporary healthcare. By exploring their distinctions and intersections, this essay aims to provide greater conceptual clarity for a more intentional, theoretically informed use of simulation.

To support conceptual clarity across the spectrum, we draw on a wide but purposefully selected range of theories and concepts. These are not exhaustive, reflecting specific orientations of SBE and TfS – whether towards structured educational aims, cultural and systems-level intentions or both. This theoretical breadth is a necessary feature of the evolution of simulation, reflecting its expanding scope and complexity.

Simulation-Based Education

SBE is a well-established and purposeful method within health professions education. Commonly defined as a method that 'replaces or amplifies real experiences with guided experiences' p. i2 [4], it is often described as a structured instructional method [5–8]. At its core, SBE may replicate elements of real-world practice through guided activities designed to achieve defined learning outcomes.

SBE supports the development of learners' knowledge, technical skills, interpersonal skills (such as communication), intrapersonal skills (such as stress coping or decision-making) and confidence for clinical practice [9]. Pedagogical foundations are primarily rooted in instructional design and outcome-based education, characterized by structured, goal-oriented learning [7,10]. These outcomes are frequently informed by curricular priorities, general and targeted needs assessments and analysis of systems vulnerabilities, such as recurring safety incidents or persistent challenges in teamwork and communication. SBE is often used to prepare staff to perform effectively within existing systems and practices [11].

SBE includes learning objectives covering knowledge, attitudes and skills, and incorporates a diverse range of meta-theories and educational concepts, including but not limited to those described in Table 1.

While SBE is often described as a structured instructional method, its application in practice spans a broad spectrum – from standardized training aimed at ensuring procedural fluency, to more exploratory and reflective designs grounded in constructivist and transformative pedagogies. This spectrum reflects SBE's evolution and growing recognition that simulation can support technical mastery, carer performance and critical engagement, and it is here that SBE and TfS can be brought into constructive dialogue.

Concomitantly, there is an ongoing conversation in the literature about the distinctions – and tensions – between training and education. Training is often oriented towards specific tasks, competencies or behaviours, and is typically designed for consistency, measurability and standardization. Education tends to emphasize inquiry, adaptability, judgement and professional identity formation. SBE occupies this spectrum, often blending them to suit context and purpose, and when done well, drawing on pedagogical theories to design intentionally. We consider simulation-based training to be a subset of SBE and therefore have adopted SBE in this essay.

Many simulation experiences seek to prepare learners for clinical performance, and to work optimally in imperfect, dynamic and evolving healthcare systems – developing professionals who can navigate complexity, think critically and contribute meaningfully to change. The use of simulation for both formative learning and system-responsive education is increasingly reflected in the design of contemporary SBE curricula [22].

Transformative Simulation

TfS is a concept in healthcare simulation that positions simulation as a tool 'to transform health and care

Table 1: Key theories and educational concepts in SBE

Theory	Typical application within SBE-oriented design
Experiential Learning (Kolb) [12]	**This theory conceptualizes** learning as a cyclical process of experience, reflection, conceptualization and experimentation. **In SBE design, this informs** structured scenario enactment followed by guided debriefing. This supports active, reflective learning and knowledge integration.
Behaviourism and Stress Inoculation Theory [13]	**This theory conceptualizes** learning as observable behaviour change shaped through reinforcement and repetition. **In SBE design, this informs** structured practice, behavioural marking and marking templates, feedback and graduated exposure to stressors. This supports measurable competence development under controlled conditions.
Social Cognitive Theory (Bandura) [14]	**This theory conceptualizes** learning as occurring through observation, modelling and social interaction. **In SBE design, this informs** team-based activities and structured role modelling. This supports self-efficacy, role clarity and adaptive behaviour.
Constructivism and Zone of Proximal Development (Vygotsky) [15–17]	**This theory and concept conceptualizes** learning as knowledge construction through guided support within the learner's zone of proximal development. **In SBE design, this informs** scaffolded scenarios and progressive complexity. This supports cognitive growth and capability expansion beyond current ability.
Sociomateriality [18]	**This theory conceptualizes** learning as emerging from the entanglement of people, tools and environments. **In SBE design, this informs** attention to spatial, technological and material conditions. This supports understanding of environments.
Cognitive Scaffolding [19]	**This theory conceptualizes** learning as supported progression through structured guidance and cueing. **In SBE design, this informs** task structuring and cue provision to manage cognitive load. This supports decision-making in complex or unfamiliar contexts.
Unifying Theory of Emotional Learning [20]	**This theory conceptualizes** learning as shaped by affective states that influence attention and memory. **In SBE design, this informs** the creation of psychologically safe yet appropriately challenging, risk-managed environments. This supports meaningful learning and performance regulation.
Transformative Learning Theory (Mezirow) [21]	**This theory conceptualizes** learning as a process of critical reflection leading to perspective transformation. **In SBE design, this informs** values-based scenarios that challenge assumptions. This supports identity development and shifts in professional worldview.

through collective insight, understanding; and learning' p. 2 [23–25]. Although the concept is relatively new, the use of simulation to change practice directly has been evolving for some time [26–29]. TfS is an umbrella term that emphasizes collaboration, critical reflection and co-constructed meaning and action. It brings together practitioners, stakeholders and those affected by care processes through purpose-driven experiences designed to drive healthcare transformation, and cultural and systems-level change.

At the heart of TfS is a taxonomy of seven Simulation-Based Intentions (SBIs) – a structured framework of simulation lenses that are purpose-driven and evidenced by a synthesis of literature [23]. Each SBI is underpinned by relevant theories or conceptual models that align with its intention as a design lens (Figure 1). Examples are included in Table 2. This approach aligns with Kneebone's concept of select, abstract and represent, whereby simulation deliberately foregrounds particular aspects of practice [30]. Within TfS, the SBIs function as lenses through which designers select and illuminate what is most pertinent to the simulation's purpose, with theoretical alignment making these choices explicit.

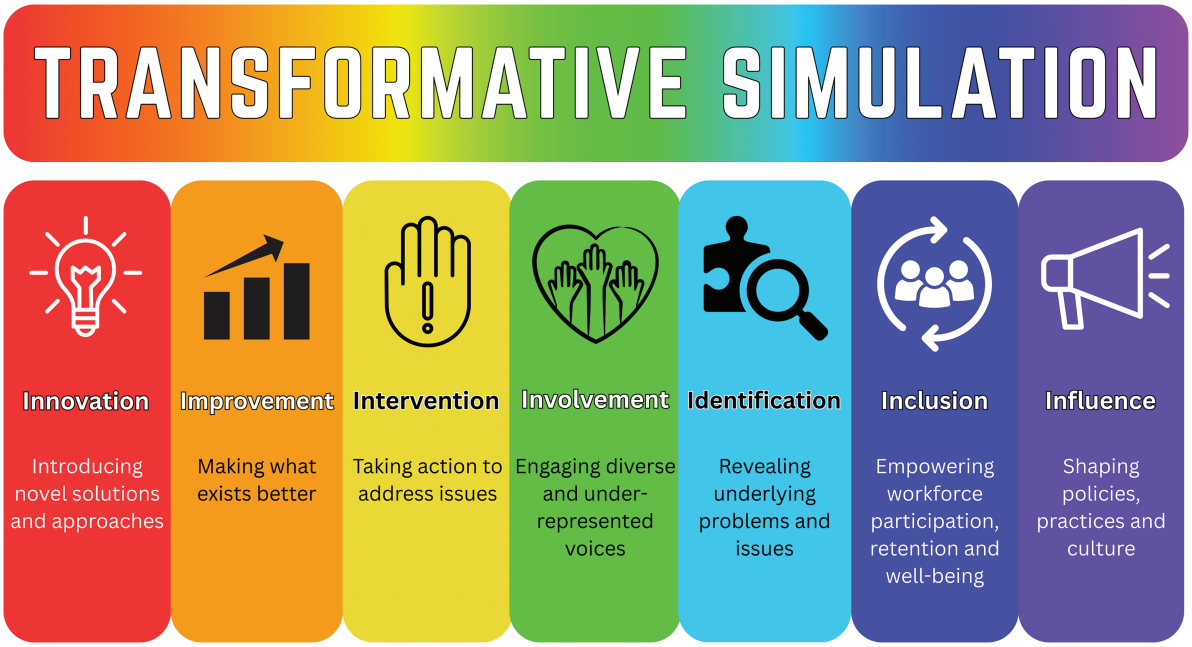
Simulation-Based Education and Transformative Simulation

SBE and TfS stem from different philosophical orientations and theories. SBE is guided by an instructional or facilitative lens, informed by theories or educational concepts that together guide the design of a learning event for the participant to achieve specific outcomes. It is learner-centred, offering structured experiences designed to build competence and confidence through targeted learning activities and assessment.

TfS operates through a cultural and systems change-oriented lens, drawing on theories of change, safety, engagement and collective insight. It pursues broader, purpose-driven intentions in healthcare improvement, innovation, intervention, involvement, identification, inclusion and influence. Rather than focusing on learner(s), TfS is discovery-centred – prioritizing curiosity, collaboration and shared understanding among participants to surface insights that can enable and drive meaningful transformation in healthcare [41,42]. Unlearning is often an outcome.

Some forms of SBE prioritize clearly structured knowledge and skill acquisition, emphasizing clarity, consistency

Figure 1: TfS and the seven Simulation Based Intentions. This figure presents the seven SBIs that underpin the TfS framework – each reflecting a distinct purpose for using simulation to drive cultural and systems change in healthcare. A broader mapping of how theories relate to each SBI has been developed by the ASPiH Transformative Simulation Special Interest Group. See website for resources: https://aspih.org.uk



and measurable performance outcomes, with realism and replicability acting as core markers of effectiveness [43]. It is frequently utilized as an educational method across the learning continuum, from students to experienced practitioners, particularly where clearly defined objectives and standardized conditions are essential for building competence or ensuring safe practice [44].

A growing trend in contemporary SBE interventions is to acknowledge the limitations of standardization alone and actively seek to foster adaptive, reflective and systems-aware practitioners [34]. These approaches draw on transformative and constructivist theories, using simulation not just to develop competence and confidence but also to encourage deep engagement with uncertainty, complexity and change.

Within today's dynamic and fast-evolving healthcare environments, certainty is increasingly problematic and adaptability has become critical. While SBE aims to enhance patient outcomes by improving individual or team performance, there is limited empirical evidence that these improvements consistently translate into clinical practice [45,46]. Some scholars have also noted that reduced exposure to variability in standardized learning environments may limit learners' development of adaptive behaviours [47,48], and hinder transfer of training to clinical settings – where unpredictability, emotional complexity and systemic dynamics are more pronounced [49].

TfS, by contrast, relies heavily on the collective knowledge, expertise and contributions of those embedded within the healthcare system – whether through professional roles, lived experience or stakeholder influence. As such, it is often perceived as less accessible or applicable to those with limited exposure to healthcare, such as students or full-time educators. However, this perception may be shifting in light of the growing expectations placed on students to understand and shape systems, not just function within them [50,51].

TfS is inherently designed to have a direct and immediate impact on practice – through inclusive design, systems thinking and collaborative change-making through shared mental models and reciprocal illumination [52]. However, whilst relatively new in recognition yet with growing evidence, like SBE, it lacks robust empirical evidence demonstrating its long-term effectiveness or widespread implementation outcomes. Both approaches share the challenge of demonstrating sustained transformation beyond the simulation setting.

The literature suggests that SBE and TfS are often employed concurrently in healthcare settings, though their integration is not always conceptually or practically well-defined. For example, Lutgendorf and colleagues [53] developed a multidisciplinary *in situ* simulation for postpartum haemorrhage with multiple intentions: assessing existing hospital protocols (improvement), evaluating team performance (inclusion), shaping operational readiness (influence) and identifying opportunities for systems improvement (identification). Although these appear to address systems-level targets rather than educational objectives, SBE principles were used to strengthen competencies in managing obstetric emergencies, while TfS elements supported exploration of team dynamics, staff engagement and protocol development. Reported outcomes included increased team confidence, quicker preparation of simulated blood products, and a downward trend in postpartum haemorrhage cases. However, the systems-level improvement goals were ultimately reported as secondary to

Table 2: Key theories and conceptual models in TfS

Theory	Typical application within TfS-oriented design	Aligned SBI(s)
Human Factors Theories [31]	**These theories conceptualize** safety and performance as emerging from interactions between people, systems and environments. **In TfS design, this informs** the identification and mitigation of latent safety threats, workflow inefficiencies, usability issues and workforce strain; through system-level simulation. This supports safer system redesign and operational resilience.	Identification
Place-building Theory [32]	**This theory conceptualizes** environments as shaping identity, culture and meaning. **In TfS design, this informs** simulations that explore how physical and organizational spaces influence professional identity and practice. This supports cultural reflection and sustained transformation.	Influence
Participatory Design Theories [33]	**These theories conceptualize** change as co-created through stakeholder collaboration. **In TfS design, this informs** the active involvement of staff, patients and stakeholders in co-designing simulation scenarios and solutions. This supports ownership, shared purpose and inclusive transformation.	Inclusion
Culture Theories [34]	**These theories conceptualize** norms, values and power structures as shaping organizational behaviour. **In TfS design, this informs** simulations that surface hidden assumptions and power dynamics. This supports cultural awareness and system-level influence.	Influence
Six-Step Stakeholder Engagement [35]	**This model conceptualizes** meaningful change as dependent on structured involvement of diverse voices. **In TfS design, this informs** systematic inclusion of stakeholders throughout the simulation process. This supports broader participation and collective insight.	Involvement
Lean Principles [36]	**This theory conceptualizes** improvement as the elimination of waste and alignment with value. **In TfS design, this informs** simulations that test process flow and identify inefficiencies. This supports continuous improvement and operational optimization.	Improvement
Relational Coordination Theory [37]	**This theory conceptualizes** performance as dependent on high-quality communication and relationships across roles. **In TfS design, this informs** simulations that examine cross-disciplinary collaboration and communication patterns. This supports system functioning and inclusive teamwork.	Inclusion
Proven Process Documentation [38]	**This theory conceptualizes** reliability as dependent on explicit, replicable procedures. **In TfS design, this informs** capturing and standardizing simulation-derived process insights. This supports intervention stability and operational embedding.	Intervention
Theory of Change [39]	**This theory conceptualizes** transformation as driven by explicit causal pathways linking actions to outcomes. **In TfS design, this informs** mapping simulation activities to intended system-level impacts. This supports strategic intervention planning and measurable change.	Intervention
Implementation Science [40]	**These theories conceptualizes** innovation uptake as dependent on readiness, context and scalability. **In TfS design, this informs** simulations that assess adoption, feasibility and sustainability. This supports scalable innovation and long-term system integration.	Innovation

educational outcomes. This reflects a misalignment between the simulation's broader transformative intent and the way its impact was evaluated, likely due to the absence of a clearly articulated theoretical framework distinguishing SBE from TfS.

This pattern is echoed in broader analyses. McGaghie and colleagues' [54] seminal paper evaluating the impact of simulation on translational patient outcomes, recognized simulation's potential to catalyse clinical change but

concluded that such translation rarely occurs effectively. This is largely attributed to the absence of rigorous translational science methodologies embedded within simulation design and evaluation. Therefore, systems-level insights often emerge as incidental byproducts of instructional simulation, rather than as intentional drivers of design.

Despite considerable advancement in the field since 2011, this observation continues to hold weight. A literature review of TfS [23] reported simulation initiatives supporting cultural and systems-level change frequently lacked clear theoretical underpinnings or demonstrated misalignment between stated intentions, design approaches and reported outcomes. These findings are echoed in two further publications. A scoping review of simulation for latent safety threat identification found that 'inconsistent application of systems theory and variable methodological transparency limit learning and generalisability' p. 1, calling for more explicit theoretical foundations and closer alignment of simulation purpose with educational and organizational goals [55]. Similarly, a study exploring synergies between human factors and *translational simulation* concluded that much of the potential in this space remains unrealized due to persistent gaps in theory-practice integration [56]. These patterns suggest that, despite individual exemplars, the field still struggles to consistently embed robust cultural and systems-oriented frameworks in simulation design. As such, McGaghie's assertion continues to offer a useful provocation – one that reinforces the need for conceptually and methodologically grounded approaches.

Furthermore, while simulation-derived data can inform practice change, particularly when interpreted by experienced practitioners, its transformative potential remains underutilized. In the context of quality improvement (QI), Brazil and colleagues [57] stated that identifying which simulation activities are more 'focused on QI and which are more educationally focused' p. 86 may be beneficial. *Clarifying a simulation's core intent is essential to ensure that opportunities for deliberate cultural and systems-level learning, as well as the empowerment and amplification of diverse voices, are recognized, prioritized and meaningfully acted upon, rather than being reduced to incidental or anecdotal insights, completely missed or not followed through.*

More recently, Torres and colleagues [58] offered a student-centred perspective of TfS. They critically reviewed and interpreted each of the TfS SBIs through the lens of incremental levels of transformation, as summarized in Figure 2.

A recent study in Australia explored how senior healthcare leaders in a large metropolitan facility viewed simulation as a tool for organizational change and how it aligned with leadership priorities [59]. While leaders valued simulation for diagnostic functions, particularly its use in the identification of latent risks through realistic system testing, they placed even greater emphasis on its relational and cultural change power: enabling involvement and inclusion, building resilience and helping develop shared mental models across teams. However, the authors also observed that when a simulation's intention isn't aligned with its design or delivery, its ability to influence clinical practice is weakened – reinforcing a core TfS principle: coherence between intention and design. Clipperton et al. [59], concluded that their findings aligned strongly with the SBIs of TfS. This further supports TfS as a cultural and systems-level framework that explicitly connects purpose, intentions, theory and design, delivery, data and debriefing to enable meaningful and coherent transformation.

These examples illustrate a recurring pattern: simulation is frequently described as serving both education and cultural and systems-level purposes, yet the alignment between stated intention, theoretical grounding, design logic and reported outcomes remains inconsistent. Without an explicit, coherent articulation of purpose, simulation risks being evaluated through partial lenses that obscure its broader transformative potential.

While SBE typically articulates predefined learning outcomes to evaluate success, cultural and systems-level insights are often reported as secondary or unintended outcomes. In such cases, the Return on Investment (RoI) is primarily framed through learner achievement, rather than broader organizational or cultural outcomes – limiting recognition of its RoI and impact. This suggests that simulation for change is often not designed with change as its central intent – even when that potential exists. Consequently, the mechanisms needed to translate insights into action, such as stakeholder follow-up, policy dialogue or systems feedback loops, are often absent or recognized only after the opportunity for timely influence has passed.

SBE is well-established and highly effective for developing clinical competence and confidence, particularly in controlled environments. Contemporary SBE often incorporates adaptive and reflective elements, supporting learners to respond to complexity. TfS, meanwhile, places adaptive capacity and collective insight at the centre of its design logic but faces its own challenges in implementation often due to a lack of broader recognition. However, a recent publication by Weldon and colleagues [42] illustrated the potential of TfS as a governance-ready framework across an entire healthcare organization in Scotland with encouraging cultural and systems-level impact.

Rather than privileging SBE over TfS or vice versa, the question becomes: can these approaches be brought together in purposeful and complementary ways? If so, when, how and to what effect?

The conceptual framework for intersection: distinct purposes along a spectrum

Transformative pedagogy as a bridge

We conceptualize SBE and TfS not as competing approaches, but as distinct orientations situated along a spectrum of simulation purpose. We propose transformative pedagogy as a bridge that connects SBE with TfS, offering a bi-directional pathway to deliberately integrate and contrast individual or team-based learning with collective cultural and systems-level change. Rooted in social constructivism and critical pedagogy [60–62], transformative pedagogy is an

Figure 2: Adapted SBIs from a student perspective [56]. This figure explores how each of the seven SBIs can be applied in educational contexts. While developed within the TfS framework, these intentions also offer value for SBE when mapped to learner engagement, identity formation and educational equity. Each row links an SBI to a specific educational

Innovation	as a driver of innovation in medical education
Improvement	supports ongoing skill refinement and professional development
Intervention	bridges the gap between theory and practice
Involvement	engages students actively, rather than making them passive learners
Identification	helps students identify themselves as future healthcare professionals
Inclusion	promotes inclusion by ensuring that all students—regardless of background—have equal access to hands-on learning
Influence	has a strong influence on students' learning experiences

educational philosophy that promotes deep, perspective-altering learning and social empowerment.

Transformative pedagogy requires a shift from prescriptive, outcomes-driven simulation towards a higher-order, critically reflective model. Here, learners are invited to interrogate and reframe existing assumptions, values and power dynamics – developing new perspectives through the process of transformation [63]. Transformative pedagogy seeks to develop practitioners who are skilled, critically aware and capable of driving change [64]. Such transformative pedagogy explicitly connects individual growth with a vision of social accountability and systems improvement, raising awareness of learners to issues of injustice and enabling them to become agents of social change [65].

Some SBE, particularly that addressing social justice and equity, is already beginning to draw on this foundation. Examples include decolonizing simulation practices that centre the experiences of displaced individuals [66] and scenarios that engage with power structures and social discourse through the lived experiences of simulated patients [67].

Integrating transformative pedagogy into SBE may lead to benefits channelled towards transformative ends. With transformative pedagogy, a scenario is not only an educational exercise but a catalyst for critical reflection and perspective change. The simulation process itself, from briefing through the scenario to debriefing, can be designed to mirror stages of transformative learning [68]. For example, a randomized trial in nursing education found that debriefing guided by Mezirow's transformative pedagogy produced significantly greater gains in students' problem-solving, critical thinking and reflexive capacities compared to conventional debriefing methods [69].

While much SBE remains rooted in instructional paradigms, emerging forms, particularly those engaging with social justice or complexity, are increasingly informed by transformative pedagogy. These developments illustrate how elements of contemporary SBE already resonate with TfS principles [41].

Although transformative pedagogy shifts the simulation focus from instruction to facilitated reflection, its primary emphasis often remains on the individual's in-the-moment experience. Thus, although it brings SBE towards transformation, it does not inherently address the collective systems-level change that lies at the heart of TfS.

This raises further questions:

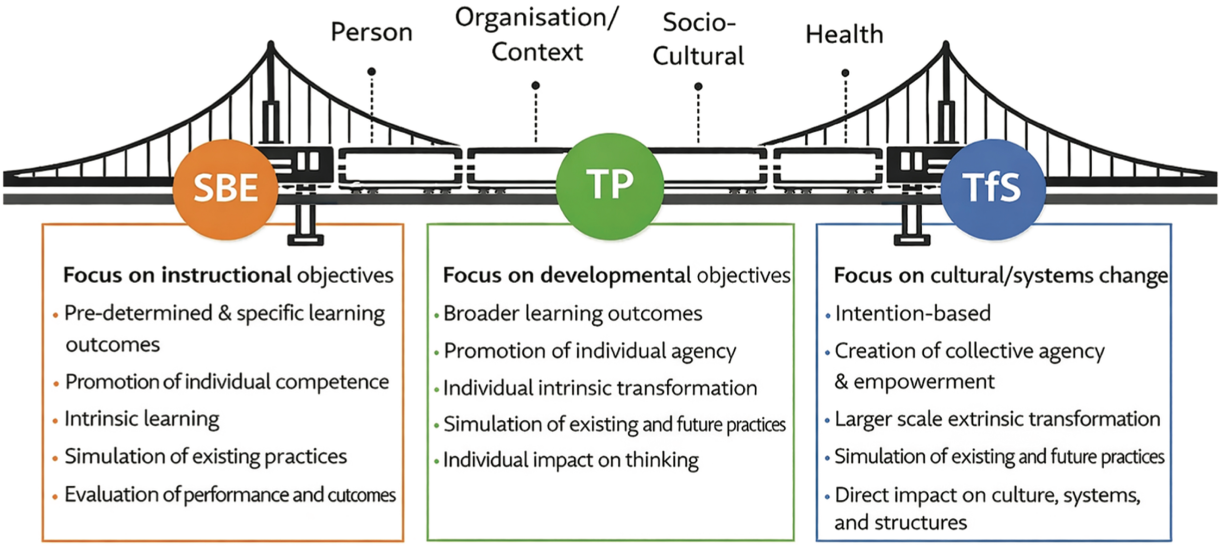
- What might emerge if transformative pedagogy and TfS were explicitly and intentionally combined?
- What if simulations were designed to deliver both meaningful learning outcomes and interventions that target real-world healthcare transformation?
- How can simulation simultaneously serve as a tool for individual and collective agency, enabling participants to learn and to reshape systems through the blending of critical reflection, lived experience and reciprocal illumination?

By integrating the frameworks of transformative pedagogy and TfS, simulation can transcend traditional educational silos and become a participatory tool to address complex, real-world healthcare challenges. Such integration can engage participants in democratic, critical reflection while preparing them to actively enact meaningful cultural and systems-level change. This approach aligns the individual learning experience of SBE with the collective, cultural and systems-level impact envisioned by TfS, by empowering participants as active agents of change. Learners who undergo transformative educational experiences are more likely to question dysfunctional routines, advocate for safety and equity and lead QI initiatives in their workplaces [65,70].

This integrated model generates a bi-directional spectrum: from individual transformation to cultural and systems-level change and vice versa, through a bridge of dynamic transformation. We propose two interrelated pathways through which this integration can occur:

1. From SBE to transformation: simulation-based educational experiences, when intentionally designed through a transformative pedagogy and TfS lens, can

Figure 3: Illustration of the SBE – transformative pedagogy – TfS bridge. This figure presents a conceptual bridge that positions transformative pedagogy as a central framework linking SBE and TfS. The bridge spans four levels of transformation. The image represents a dynamic landscape in which design, theory and purpose are aligned



evolve into transformative experiences that produce both intrinsic (personal) and extrinsic (practice-based) change orientations.

2. From TfS to learning: insights and changes identified through TfS can be translated into pedagogically grounded simulations (SBE), supporting wider dissemination, reinforcement and sustainability of the change through future training and education; resulting in a model of emergent learning outcomes that come from contemporary real-world practice.

Figure 3 conceptualizes the progression from SBE to TfS, with transformative pedagogy (TP) serving as a bridging spectrum. On this spectrum, four interrelated levels of transformation can take place: Person (individual pedagogical or professional growth); Organization/Context (institutional and stakeholder change); Socio-cultural (systemic and cultural evolution); and Health (as both an outcome and dynamic process shaped through learning and care).

Integrating educational goals with the broader need for cultural and systems-level change marks an important evolution in the role of simulation in healthcare. Rather than serving only instructional purposes, simulation is increasingly seen as a strategic mechanism for aligning healthcare education with system priorities such as cultural transformation, social accountability and QI. While promising examples exist, intentional and systematically designed approaches remain limited, and many simulation activities still lack alignment with the complex, adaptive nature of modern healthcare systems [71–75].

Translational Simulation is one influential approach that explicitly connects simulation to health service priorities and patient outcomes. Brazil and Reedy [75] highlight the importance of articulating clear purpose, drawing on conceptual foundations from QI and organizational learning, and ensuring processes align with intended systems-level outcomes. Their examples – ranging from infrastructure testing to cultural shaping and rapid pandemic response, illustrate how simulation can move beyond instructional paradigms towards system-oriented exploration and improvement. Within the SBI taxonomy, Translational Simulation fits within systems-oriented interventions mainly focused on identification and improvement. We see Translational Simulation as a critical element in the broader TfS SBI taxonomy.

Conceptual models that integrate transformative pedagogy with TfS offer additional structure for bridging education and practice. They support movement from passive, skills-based learning to participatory, inclusive approaches that build critical reflection and change-oriented thinking. Ultimately, integrating SBE and TfS aims to cultivate a 'transformative healthcare workforce' equipped not only with technical and interpersonal skills but also with the leadership, advocacy and systems-thinking capabilities needed to address root causes of inequity and drive meaningful, sustainable change [76].

For simulation to contribute meaningfully to cultural and systems redesign, its conceptual foundations must be as intentional as the cultures and systems it seeks to influence. Simulation should therefore serve not only as a tool for learning within existing structures but as a space to question and reimagine them. Achieving this vision requires confronting institutional inertia and rethinking how healthcare education and service delivery intersect. A central challenge lies in balancing instructional goals with the open, democratic ethos of TfS. While SBE develops defined competencies, TfS encourages engagement with ambiguity, collaboration and social complexity. Without careful integration, this dual-purpose risks weakening skill acquisition or limiting transformative potential. Purposeful design is needed to support both aims, particularly as simulation becomes entwined with digital and AI-enabled systems. Clear intent and theoretical alignment will help ensure ethical, coherent practice. Ultimately, such

an approach positions simulation as a participatory, transformative practice capable of shaping future healthcare systems.

Conclusion

In this essay, we have argued that bringing SBE and TfS into an intentional relationship – grounded in transformative pedagogy – offers a compelling way to align individual learning with the urgent demands of cultural and systems-level change. This integrated model reframes simulation as both a site of skill development and a catalyst for critical reflection, social accountability and structural change. We have used the metaphor of a train on a bridge, able to travel on tracks in either direction with carriages comprising – Person, Organization/Context, Socio-cultural considerations and Health.

As AI increasingly shapes healthcare education and systems design, the need for coherent, ethically grounded simulation frameworks becomes even more pressing. Purpose-driven approaches such as TfS help ensure that technological advances support human-centred, culturally aligned progress rather than reinforcing existing limitations. Realizing the full promise of blended SBE and TfS models will require rigorous empirical study and thoughtful integration into training programmes so that transformative aims complement, rather than compete with, competency-based requirements. By adopting flexible, adaptive and change-oriented approaches to simulation, educators and institutions can prepare practitioners not only to navigate complex systems but also to reshape them – advancing patient care, equity and healthcare system resilience for the future.

Declarations

Authors' contributions

Sharon Marie Weldon conceived the manuscript, led the conceptual development of the work, coordinated the author group, drafted the manuscript, and led the revision process. All authors contributed to the theoretical development, conceptual refinement, interpretation of literature, and critical revision of the manuscript. The final manuscript reflects a collaborative and iterative process across the author group. All authors reviewed and approved the final version for publication.

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Ethics approval and consent to participate

None declared.

Competing interests

Sharon Marie Weldon is President of the Association for Simulated Practice in Healthcare (ASPiH) and co-leads, with Andy G. Buttery, the Transformative Simulation Specia Interest Group (SIG).

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