**Abstract Submission for the Healthcare Ergonomics for Patient Safety (HEPS) Conference, Dublin, 18-20 June 2025.**

**Title:**

Integrating foundational Human Factors principles in healthcare simulation education: a consensus-building study

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**Abstract (max. 500 words):**

***Introduction***

In the clinical skills and healthcare simulation training environments there is strong interest globally in the integration of Human Factors (HF) theory, concepts and methods to aid the design of related educational activities and practices. While much has been published around the need for HF integration in simulation education very limited consideration has been given to identifying foundational concepts and approaches from the HF discipline that would have utility in “adding value” to everyday simulation scenario designs and activities. This study aimed to take the first steps in closing this gap and offer a set of candidate HF principles for active consideration by the healthcare simulation education community.

***Methods***

Phase 1

In January 2025, a small group of highly experienced and informed simulation educators and Human Factors specialists (n=10) worked together to initially identify and agree on a preliminary set of Human Factors principles and descriptors that could potentially inform the design of simulation education scenarios and activities. These were informed by previously published generalisable ‘tips’ on HF integration for healthcare educators, and on professional experiences in simulation-based education and HF operational practice.

Phase 2

Using existing professional networks in the United Kingdom and Ireland, a minimum of 20 experienced healthcare simulation education and Human Factors specialists will be recruited to review and where necessary, adapt and /or add to the candidate set of principles before reaching agreement on the inclusion of principles that are judged to be acceptable, feasible and impactful. A multi-method study will be conducted during February and March 2025 using Microsoft Teams meetings to build consensus, informed by both a modified-Delphi method (qualitative) and the application of a Content Validity Index exercise (quantitative).

***Results***

The Phase 1 study has resulted in the development of the following 12 HF principles, with descriptors (Table 1):

**Table 1. Preliminary HF Principles to inform healthcare simulation education and practice**

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| --- | --- | --- |
| **No.** | **Candidate HF Principle** | **Descriptor** |
| **1.** | Apply the iterative participatory co-design approach central to HF to strengthen your specific curriculum or program of simulation training. | *The HF approach is always to co-design work systems, processes, tasks, interfaces, products etc with those who will use these artifacts. It is strongly argued that healthcare education and training would benefit from a similar iterative approach.* |
| **2.** | Actively consider how HF design principles can be embedded in simulation developments where these are judged to have relevance and usefulness | *HF draws heavily on well-established participatory, human-centred, interaction and universal design principles that are embedded in international standards and codes of practice. Many of these foundational design principals (e.g. taking an empathic approach; ensuring the design accommodates a wide range of individual preferences and abilities.* |
| **3.** | Apply a ‘Systems Approach’ at all times in the design of simulation education activity. | *A holistic “systems approach” is implemented by HF at all times when diagnosing a problem, designing a solution, implementing, testing and evaluating that solution. The underlying assumption is that nothing in a workplace happens in isolation and that system elements (e.g. people, tasks, technology, physical spaces and culture) are always interacting. The design of simulation activity would benefit from consideration of similar system interactions that reflect the ‘real world’.* |
| **4.** | Ensure simulation education developments embrace the HF core concept which is to *jointly optimise* both system performance and the wellbeing of people | *HF always focuses on the Twin Aims, a foundational principle that means we recognise the interrelationships between closely related outcomes: system performance and human wellbeing. A well-designed checklist (to support and improve performance) will flounder in reality if it takes staff more time to complete (thereby impacting their wellbeing as it becomes an irritation) than the old system of work.* |
| **5.** | Ensure simulation teaching faculty are competent to deliver foundational HF theory and practice (knowledge and skills) | *Lack of relevant knowledge and skills is arguably the biggest challenge for embedding HF in simulation education. Moving to a Systems Approach is no small undertaking and a minimum level of theoretical knowledge and practical expertise (competency) is required.* *HF is an applied discipline and there is an argument for developing both pan-healthcare HF learning outcomes and a healthcare HF methods toolbox. There are many HF tools but some can be applied by novice learners (e.g. systems modelling and task analysis) and used to aid curriculum design.* |
| **6.** | Simulation education should explicitly recognise what HF is and what it is not | *In healthcare there is a history of confusing HF with non-technical skills training. Nontechnical skills training usually focuses on behavioural solutions using “technical” to mean “specialist,” rather than “technology-related”. This has resulted in the exclusion of a systems approach and has led many to the mistaken belief that aviation-style training (e.g. crew resource management) is HF, despite a lack of systems theory, HF integration, human-centred design or HF analysis techniques teaching. Knowing this enables simulation based educators to correct these misapprehensions and ensure a more accurate description of the HF discipline approach.* |
| **7.** | Ensure the design of simulation education should actively ‘explore proxies for human work’ in healthcare | *One way for simulation education to better reflect the complex reality of everyday work in healthcare is to actively explore proxies for human work (e.g. Work-as-Imagined; Work-as-Designed; Work-as-Disclosed; Work-as-Prescribed) so that educational scenarios are better designed and more meaningful for learners.* |
| **8.** | Consider how simulation curriculum design and content should be driven by learning outcomes to develop appropriate HFE competencies | *HF professional behaviour is guided by Core Competencies in the same way as clinical professional regulators. Performance elements include systems approaches to analyse, understanding risk management and developing robust HF interventions to improve systems performance and human wellbeing. Three levels are suggested for healthcare simulation professionals to integrate:*   * *Basic understanding of HF theory and practice and their role in the clinical workplace* * *Application of risk management practices within scope of own professional (and educational) domain* * *Knowledge of mechanisms for seeking professional guidance from a competent person (qualified HF specialist) for (re)design of systems and interfaces* |
| **9.** | Simulation education and practice should recognize that to err is not just human, but is highly desirable as part of a learning strategy to develop transferable skills in building resilient healthcare systems | *It is not possible to prevent all “errors” as they are considered a normal part of work (and learning) within complex sociotechnical systems. Consequently, the least effective approach to safety-related teaching is to advocate a zero-error approach, as even focusing on error reduction strategies is of limited value.*  *Learners need opportunities to consider safety (and other outcomes) in day-to-day routine, and emergencies. The focus should not necessarily be on outcomes, but on the system’s resilience to absorb inevitable errors, dampen impacts and deliver acceptable outcomes.*  *Exploring factors that mitigate risk requires opportunities to make errors in the simulation learning environment and follow the trajectory to the natural end. This may seem counter-intuitive but is a core HF approach to understanding why things go wrong in complex healthcare systems and how to respond, learn and improve more effectively. Having identified potential mitigations, systems can be re-designed, tested and evaluated. Embedding HFE principles in simulation education would thus support learners in learning from ‘errors’ through supported educational activities.* |
| **10.** | Build on what is already developed, tested and evaluated | *It is likely that much simulation education has “human factors” teaching, even if it is focused on “non-technical skills” or “patient safety” training. A first step should review whether content includes the HF fundamental principles in collaboration with qualified HF specialists.*  *By identifying what is taught (and where), gaps between this and a more robust HF educational model can be defined. For example, a non-technical skills training scenario could be given a backstory, perhaps showing how robust application of a systems framework such as the SEIPS model had identified communication as a “person factor” critically underpinning a specific process.* |
| **11.** | Take an interprofessional education (IPE) perspective to curriculum design and content | *Healthcare is largely delivered by teams, so it makes sense that HF activity occurs within curriculum spaces where professions interact. Realistic stakeholder mapping and engagement is key, including, for example:*   * *Systems actors: healthcare staff, patients (service users), carers, etc. For IPE, this is often the only group involved but may be the least able to effect change.* * *Systems experts: including HFE professionals* * *Systems decision makers, such as senior executives and managers, with immediate power to effect change.* * *Systems influencers; political bodies, policymakers, regulators, etc.*   *Effective IPE is challenging, partly because robust research is limited. We suggest that using HF as a focus for assessed IPE activity may address obstacles to designing curricula underpinned by the systems approach.* |
| **12.** | Build HF capacity and capability creatively and continuously amongst the healthcare simulation community | *There is a skills gap with respect to HF expertise in healthcare internationally. In developing an effective implementation strategy for HF-based curricula, we need to enrich the numbers at all levels, but related educational development should, where feasible, include input from qualified and regulated HF professionals to ensure both credibility and that professional standards are adhered to. One answer is to enrich the expert pool by healthcare disciplines building collaborations with other disciplines.*  *Accredited shorter courses have been developed and are used to raise HF awareness. In the UK, for example, a growing number of healthcare organisations are funding postgraduate academic training for a small number of “champions” with responsibility for supporting others in HF practice and educational provision. Simulation educators should be a priority group to target.* |

***Conclusion***

This study led to the development of a preliminary set of 12 HF principles for integration within all stages of healthcare simulation education and practice. Further co-design, testing and evaluation work is required with diverse groups of simulation-based educators to inform the robustness of these and potentially additional HF principles that would benefit from being integrated within simulation education.

**Method of presentation:**

Oral presentation of 15 minutes

**Please select the theme of the session most suited to your presentation.**

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