

A description of simulation-based techniques relevant to education and practice in health and care
Technology Enhanced Learning (TEL)



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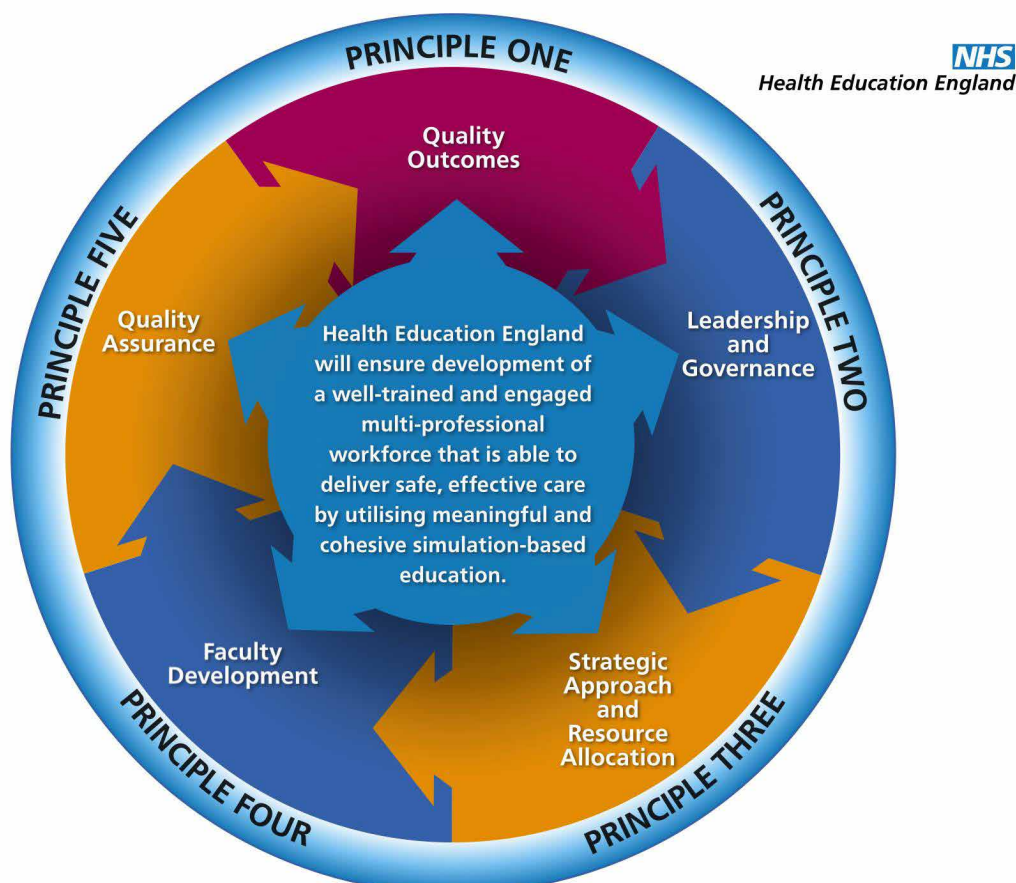
Background and purpose

The past 20 years has seen a rapid growth in the different types or techniques of simulation that can be used in the health and care sector, with considerable developments in the use of new immersive technologies. All of these adopt the same underpinning principles in respect to offering different forms of experiential activity that can be undertaken as an individual, as a multi-professional team, or as an organisation.

The value of using any of these techniques is described in terms of achieving specified intended outcomes in a manner that might not be so readily or safely reached using other forms of educational or practice-based approaches.

This document describes the different types of simulation and immersive learning modalities that are currently available or being considered for use in the health and care sector. Many of these educational techniques can also be applied to assist organisational learning and to provide innovative patient and public education opportunities. It is not intended as a definitive source of information but offers a basic guide to help inform health and care leaders, managers, practitioners, learners and patients about the current simulation and immersive learning technology landscape and potential future developments.

Part of a series of publications produced by Health Education England's Technology Enhanced Learning (TEL) team, this document is aligned with its simulation and immersive learning technologies workstream. Other documents including the HEE National Framework for Simulation-Based Education, an associated toolkit, and the strategic vision for the application of simulation to health and care can all be found on the HEE website: [HERE](#)



A definition of simulation and different immersive learning technologies in health and care

There are many definitions of simulation, or simulation-based education / learning pertinent to health and care. Professor D M Gaba, in his article 'The Future Vision of Simulation in Healthcare (2004)¹', states 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.'



Photo by Tim Cooper on Unsplash

This requires further consideration as a result of the emergence and continuing development of new digital technologies within this field, many of which seek to simulate different aspects of the real world experience. Broadly speaking, these immersive technologies fall into three types:

Virtual Reality (VR): A computer generated simulation of a three-dimensional (3D) environment that can be interacted with, in the real world, by using special equipment (for example, headset and/or gloves with responsive sensors).

Augmented Reality (AR): An interactive experience between real-world objects that is enhanced by computer generated information. These objects may be enhanced by multiple perceptions.

Mixed Reality (MR): Merging of real and virtual worlds to produce new environments and visualisations where physical and digital objects co-exist and interact in real-time. This includes single user interaction with digital objects, such as holograms. It also includes multiple users interacting and collaborating with each other using the same digital object.

Blended Learning

These techniques and technologies are increasingly being considered as important components within blended learning programmes in all walks of education and training. This involves designing and providing access to a style of education that supports learning via electronic and online media as well as traditional face-to-face teaching. There are clear opportunities to use simulation and immersive technologies to enhance the experiential component of these programmes or curricula, whether accessed remotely or as face-to-face activities.

What are some of the different techniques or approaches available?

Broadly speaking, simulation-based techniques can be divided into mental and / or verbal rehearsals without specific adjuncts, or more practical activities requiring interaction with a physical or electronic device or another person. A brief description of each type of activity is offered below to help illustrate these different activities.

Part-task trainers

These can be physical replicas of a body part or a screen-based representation, or a combination of the two. These are used most often to help train specific skills or tasks which are new to the individual practitioner.

Examples include devices to help train intravenous cannula insertion, skin suturing, and resuscitation skills.



Advanced procedural trainers

These physical or screen-based devices are designed to help train and assess safe performance of clinical procedures that require a series or sequence of tasks to be completed in order to be successful.

They can also provide different levels of challenge according to experience of the learner. Some devices can produce objective feedback on the performance without needing a tutor or supervisor present.

Examples include devices to support endoscopy training and a wide range of surgical or interventional radiology techniques.



Full body (patient) manikins

These manikins are intended to replicate patients more completely in form and function. Some are designed to offer close anatomical and / or physiological modelling, often used in combination with patient monitoring adjuncts and other consumables used in the clinical setting.

These simulators can be used within simulated or real clinical environments ('in-situ simulation') and provide useful opportunity for individual or team-based training exercises to help develop broader professional capabilities, teamworking skills or orientation to new work procedures, protocols and environments.



Simulated or standardised patients (including use of actors or role playing)

This form of simulation involves interaction between learner(s) and another person who plays the role of the patient, a family member / carer, or a colleague (for example).

This form of simulation is a powerful way to focus on training or assessment of key communications skills, such as consultations, taking consent, breaking bad news, or speaking up. In high stakes assessments this involves professionals as the simulated patient (or other role) whilst at the other end of the spectrum it can involve students or staff role playing different roles themselves.



Immersive learning technologies

In addition to the advanced procedural trainers described above, there are many new and emerging uses of different immersive learning technologies that are becoming more readily available. These include the use of virtual reality (with headsets or multi-screen projected images), augmented reality, and incorporation of artificial intelligence within devices to enhance decision-making in diagnostic or interventional contexts.

Some of these technologies cross over between the educational and clinical care setting and are used to help plan or assist in aspects of clinical care. Examples include 3D imaging or printed anatomical models that are specific to an individual patient's pathology and used to rehearse a complex task or procedure prior to performing it on the patient.



Mental / verbal rehearsal and 'serious gaming'

Everyone is used to thinking ahead when planning to undertake a particular task or piece of work. These mental rehearsals, which can be verbalised out loud if involving a team-based task, can be structured to follow a checklist or cognitive aid in some circumstances and performed at the convenience of those participating with little (if any) need for specific adjuncts or resources. Some of these exercises build on the concept of 'serious gaming' and increasingly make use of new technologies such as smart phone applications (apps) to help structure and explore decision-making and consequences in a safe way.

This concept can be undertaken at scale if wishing to design or test an organisational response to specific circumstances, such as a fire evacuation drill or responding to an external major emergency.



In-situ simulation

Some simulation activities are deliberately designed for delivery within the workplace or clinical setting. This provides a realistic environment for individual or team-based training and can provide opportunity to orientate or clarify how participants interact with equipment, information technologies, or one another when required to perform specific tasks or drills. This approach is commonly used to physically rehearse emergency drills within teams and can be used to test new policies, protocols, and guidelines.



What are the benefits of using simulation in health and care?

The principal benefits of using simulation in its different forms to help train, assess or improve different aspects of professional capabilities or organisational learning are multiple:

- Simulation-based activities can be designed and personalised or made bespoke to individual, team or organisational development needs
- Training activities allow the transition from novice to a specified level of competence to be demonstrated in a managed approach without risking harm to patients or relying on serendipitous exposure to learning opportunities in the clinical setting
- Complex, infrequent or hazardous tasks, procedures or drills can be rehearsed at planned intervals to maintain a level of familiarity and capability
- Some immersive or simulated learning activities can be accessed at times that are convenient to the learner and not reliant on the presence of a trainer / educator, whilst other activities can be accessed in the clinical setting to rehearse or prepare for specific procedures or team-based emergency responses
- Appropriately designed activities can be repeated at intervals or provided in different locations or at scale in a consistent, reliable manner if resources are available
- Simulation activities can be designed to help create or 'stress test' existing local or national protocols and safety systems as well as promote staff wellbeing within the workplace

These benefits and the opportunities they might provide if applied across the health and care system are described further in the 'Enhancing education, clinical practice and staff wellbeing: A national vision for the role of simulation and immersive technologies in health and care' which is available on the website [HERE](#)

What are the limitations of using simulation in health and care?

Using simulation to improve patient safety and the learner experience might be viewed as a panacea. It does, however, have some limitations that need to be noted:

- Equity of access to simulation resources is unevenly distributed across different staff groups and professions as well as between clinical settings, organisations and geographies. Hence, some pockets of excellence or innovation are not necessarily shared more widely or easily reproduced at scale
- Patient and public involvement in the design and evaluation of simulation-based activities is limited, even in its application to learning outcomes that are directly relevant to patient experience and safety of care
- Some simulation-based activities are reliant on faculty and / or technical support that may not be readily available due to other clinical or educational commitments
- Simulation-based activities can easily be perceived as costly, either in design and delivery overheads or related to time away from clinical service for learners and faculty
- The evidence base that helps define effective high-quality simulation-based activities is building rapidly but currently remains incomplete and limited in terms of demonstrating impact and value at a system level
- The rapid development and availability of new or innovative learning technologies or techniques can easily obscure the focus that needs to remain of identifying clear learning or organisational needs and pursuing the most effective and efficient methods to address these goals

In summary

This document has set out to describe the spectrum of simulation-based activities or techniques that are available to the health and care system. There are many benefits that simulation has to offer to enhance workforce development and transformation, staff wellbeing, patient safety and quality of care. These are described further in the HEE national vision for the role of simulation in health and care. The limitations described or gaps in evidence should be considered as a challenge to all stakeholders who wish to improve the health and care service in terms of quality of access and delivery and outcomes of care.

Undoubtedly the pace and scale of change in simulation-based modalities will continue in the coming years, offering new opportunities and a diversity of resources. The HEE National Framework for Simulation-Based Education provides the principles that need to be applied to ensure existing and new simulation-based educational or patient safety improvement interventions are designed and implemented in an effective, robust manner and are outcomes-driven from the outset.

Further reading

The [HEE TEL website](#) contains a number of additional documents that are related to our simulation programme. This site will be updated regularly and linked to specific resources on the Learning Hub that are intended to support different workstreams of the simulation programme.

In the UK the [Association for Simulated Practice in Healthcare](#) (ASPiH) is the multi-professional learned body that is open to membership from educators, practitioners, researchers, students, managers and patient or public representatives.

One useful additional resource is the [international dictionary for simulation in healthcare](#), edited by the international Society for Simulation in Healthcare (SSH).