# **Using Simulation and Immersive Technologies to support Education, Learning and Training**

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## **Introduction**

**This brief reference document aims to introduce this topic and to describe some of the technical tools, software and general considerations involved in supporting the delivery of learning employing multiple virtual world and real world learning modalities. It is intended to assist anyone considering developing or accessing learning and simulation resources involving immersive technology, particularly learners and trainers in HEE NW.**

Technology and simulation should support and supplement existing learning methods to provide education and training. E-learning is a very useful and easily accessible educational tool and can be accessed on computers, laptops, smart phones, wearable devices, and other tools. It provides vast amounts of literature and information in written and other formats including videos, animation, and interactive video media. Newer technology can work in conjunction with e-learning and independently allowing greater interactivity and has introduced the virtual world alongside the real world thus making it possible to obtain an immersive experience that is a safe learning environment for the user to support safe patient care.

The newer devices providing access to Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) are becoming more technically advanced, user friendly, and less cumbersome; they can provide an immersive experience. As costs are reducing immersive technology has become more accessible where appropriate. The devices and applications that use these are growing at a fast pace with increasing evidence of their benefits in education, learning and training / practice in healthcare supporting safe patient care.

The various forms or types of immersive technology content can be collectively termed ‘Extended Reality’ (XR); this term encompasses the forms described below:

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| VR | Is virtual action in a virtual environment. VR places individuals in another location. It entirely occludes the user’s natural environment. The content is 100% digital. |
| AR | The visible natural world is orientated with a large digital content. It does not disengage from natural world. The digital content overlays real world. |
| MR | A virtual object set against the real world. Removes boundaries between the real and virtual world using occlusion by the viewing angle. It allows the interactive virtual elements to integrate and interact with the real external environment. |

## **Developing New Learning Resources**

There are exciting opportunities to develop learning resources using immersive technologies. While these new technologies have the potential to make remote learning resources that are innovative, engaging and scalable, content is key. To produce resources that provide relevant and evidence-based guidance for healthcare professionals the planning process is vital including project management, as is collaboration with subject matter experts and wider stakeholders throughout and consideration for roll-out plans including robust evaluation.

**Pre-development phase**

Time spent planning can save significant revision and extra work later. Specific considerations:

**What exists already?** If you are planning to create any new content or resources, we would ask you to consult the wealth of available resources first (see section 4 for links to catalogues) to reduce unnecessary duplication and to encourage shared learning and development between simulation and clinical teams within different regions. Any newly created material should aim to meet gaps within existing available resources, or instead might meet a particular local / regional learning need.

**Intended learner:** Will your resource be relevant to a select specialty group, cross specialty or even multi-professional? Also consider training grade or experience level. Where practical aim for maximum scalability nationally. You may wish to engage with intended learners in scoping work.

**Theme:** What area(s) will you focus on? Some examples:

|  |  |
| --- | --- |
| * Clinical skills | * Leadership |
| * Clinical management | * Multi-patient scenarios |
| * Communication | * Use of equipment |
| * Human factors | * Surgical techniques |

**Aims and Learning Objectives:** After deciding the intended learner and theme, what are the overall aims of your resource and what specific learning objectives do you have? We suggest mapping to existing curriculum competencies where possible (GMC / specialty curricula). This should increase the relevance and uptake of your resource. Consider how you will use debriefing elements to prompt reflection and increase learning and development.

**Development type:** How will you develop your resource? There are various options depending on the skills and time available within your team. All three options will require sufficient capacity from your team, in planning, filming, editing, reviewing, and rolling out the resource.

* In-house development: Your team may already have the skills, knowledge, and equipment / software to be able to develop a learning resource using immersive technology.
* Co-development option: Your team, ideally already having some expertise in this area, would be supported by Technology Enhanced Learning (TEL) to develop new content. Equipment and software can be leased from TEL; the leasing process is currently under development.
* VR developer: You would commission a VR developer to film and develop a resource. You will need to provide sufficient support to that team. TEL can provide advice and signpost to VR commercial developers that have experience in developing medical simulation resources.

**Project Management**

Depending on the project scope, a significant amount of project management may be needed throughout your project.

Considerations within project management include:

* Who will be part of your core project team?Who are your other advisors or stakeholders? You might involve this wider group during scoping exercises, consultation on resource design and reviewing content / draft versions.
* What is your budget and what are your deadlines? Is there any flexibility?
* Where will you film your resource, what equipment will you need and who will play the various roles? Ensuring that you reflect the diversity of your intended audience within your resource is important and optimises learning from and engagement with your resource.
* If opting to procure a VR developer you will need to stick to procurement guidelines, and with larger sums of money a tendering process may be required. Clarify formally in advance the skills and expected level of involvement. Can the VR developer assist with any scenario development, procuring actors, evaluation?

**Development phase**

Whilst some projects will be straightforward, for others an iterative approach may be needed. Flexibility and a willingness to adapt the resource content, design and even structure during development can ensure that the final resource meets the objectives that you intend it to and that it’s in line with up-to-date evidence, updated guidelines and changing training needs.

To ensure the highest quality of the final resource we advise frequent review of your content (such as footage and written content) as you create it.

Collaboration can be challenging, but when done well it ensures that a range of perspectives are considered. We suggest involving a wide range of professionals and subject experts to ensure you get the most widely relevant and highest quality resource.

**Evaluation:** Ideally pilot evaluation findings will be taken into consideration as the resource is finalised so that the final resource best meets the needs of learners and that the overall message and learning objectives are correct and as intended.

Evaluation options include paper or online surveys, consultation and feedback with subject matter experts, focus group interviews (e.g. following a pilot workshop) and recording number of learners accessing / completing your resource where possible. The Learning Hub does have the ability for learners to rate individual resources and in future free-text feedback will be possible.

**Post-development phase**

**Sharing of any new resources:** Once you have created new content / resources, we would ask for you to network with HEE’s TEL and Communications teams to enable sharing nationally. Share with e-Learning for Healthcare (e-LfH) and/or Learning Hub.

**Roll-out:** Options include signposting learners to a resource link, holding dedicated workshops (either face to face or virtual) or combining new remote resources with face to face training / simulation courses / events. For the latter, time would be dedicated to introducing learners to the content available for them to complete in allocated time after the course. You may wish to add an ongoing evaluation process onto your roll-out method. Clearly set out the learning outcome at the outset. Debrief options include guided self-debrief, debrief videos or a faculty-led debrief.

**Optimising engagement:** Promotion of new resources is vital, as you will need to get the word out to ensure that your resource is as widely accessed as possible. This is about how you can engage with learners via learner rep groups, social media, local Trusts, your local deanery and nationally. Speak to your local Comms team via your local HEE office, who will be able to help with promotion.

## **How to access immersive technology learning resources**

Several resources currently available, featuring interactive 360o video or computer generated images, can be accessed fully using standard equipment without a VR viewer. Therefore trainees can be signposted to these resources freely and many will access using a desktop / laptop.

There are a number of different VR headsets available to buy that will enable meeting different training needs. Please see our list of suggested viewers below, based on our experience using these including in pilot evaluations, and with advice from the TEL team. If a team / Trust / School wished to purchase viewers which are not listed here, we would encourage them to consider why that headset would be particularly useful.

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| --- | --- | --- |
| **VR Viewer Type** | **Recommended brands / headsets** | **Recommended uses** |
| Standard laptop / desktop / smart phone |  | As above any immersive technology resources can be accessed using standard equipment |
| Cardboard VR viewers i.e. Google Cardboard | Panoramix VR: Wide field of view compared to other available cardboard viewers | Postable, low-cost, most scalable. Converts a smart phone into a VR viewer.  Could be used at home or in workshop setting. |
| VR Viewer | PICO neo 3  PICO G24K  Meta-Quest (Oculus)  Quest 2  RiVR link  HTC VIVE | Access 360o interactive video as well as CGI interactive resources using either gaze or hand-held controls to direct selections or tasks. All these listed viewers allow 6-degrees of freedom. Ability to pre-load content is important to consider due to unreliable Wi-Fi in most hospital sites. Depending on the software / platform that the resource is accessed from, all these viewers can potentially be pre-loaded.  Generally these viewers would be used within workshop setting. VR equipment is highly variable and can range from fixed tactile work stations to stand-alone combined viewer / computer models. |
| AR | Google Glass  Sony | Receive or has embedded digital image view via lens that projects the image in front into the real world. Can communicate; send and receive audio and video. |
| MR - Glass | Hololens2 | It is about creating a digital image in the real world.  Developing a virtual image on the real patient / environment.  Real-time streaming/communication of simulations/operations/procedures from instructor to learners / between experts/people. |

Some examples are provided above, and the TEL team’s assistance can be sought if one needs to discuss the suitability of the equipment for a specific project. The advanced users may wish to innovate and use newer and more complex tools and software in which case any proposals would be helped by more details of the project and explaining how and what benefits will be assessed and quality assured.

Please note that some individuals will find any VR viewer uncomfortable / causing nausea and dizziness. If an individual encountered issues like this, they can often be directed to use standard equipment. There are various options and guidance to overcome some of these difficulties by simple methods; the TEL team can provide some assistance.

## **Existing Learning Resources, generally available Nationally**

**e-Learning for Healthcare (e-LfH) and the Learning Hub (LH)**

All individuals with a GMC number or Athens password or access through their healthcare organisations can apply to register for an e-LfH and/or a LH account. The Learning Hub is a new online system, still being developed and improved, which eventually will supersede the e-LfH system.

You may have access to specific VR / immersive technology content. However we would also signpost you to consider the available resources on the learning hub e.g. <https://learninghub.nhs.uk/Catalogue/SuppoRTTimmersiveresources>.

Cataloguing and adding existing national resources is ongoing and HEE’s TEL team are currently developing a much larger LH catalogue to include several existing resources that will be freely available to those with an LH account (will be made available when ready in due course). The proposed TEL catalogue structure will have resources listed by specialty, learning need and resource type.

## **References**

**The Growing Value of XR in Healthcare in the United Kingdom**, Health Education England.

<https://www.xrhealthuk.org/the-growing-value-of-xr-in-healthcare>

**HEE National Strategic Vision for simulation and immersive technologies in health and care**. Nov 2020. Health Education England. <https://www.hee.nhs.uk/sites/default/files/documents/National%20Strategic%20Vision%20of%20Sim%20in%20Health%20and%20Care.pdf>

**Simulation and immersive technologies**. Health Education England

[The HEE National Strategic Vision for simulation and immersive technologies in health and care](https://www.hee.nhs.uk/sites/default/files/documents/National%20Strategic%20Vision%20of%20Sim%20in%20Health%20and%20Care.pdf) - explores how high-quality simulation-based programmes can be applied to help address system-wide challenges being faced within the health and care sector.

<https://www.hee.nhs.uk/our-work/technology-enhanced-learning/simulation-immersive-technologies>.

**‘HoloLens Demonstration’** by Richard Price accessible on the Learning Hub (can access via your e-LfH if no Learning Hub access).

<https://learninghub.nhs.uk/Resource/5284/Item>

**XR, AR, VR, MR: What’s the Difference in Reality?** Website blog.

<https://www.arm.com/blogs/blueprint/xr-ar-vr-mr-difference>

**Case Studies**

1. **Alder Hey Children’s NHS Foundation Trust – Congenital Cardiac Surgery**

<https://www.uk.insight.com/content-and-resources/2020/case-studies/alder-hey-childrens-hospital-pioneers-remote-clinical-care>

1. **Teamworking: An Immersive Technology Resource**

Promotional video demonstrating three 360o interactive simulation resources covering ‘Teamworking’: <https://www.youtube.com/watch?v=5BpzJg8wqVo>.

Supported Return to Training (SuppoRTT) Immersive Technology resources. Catalogue page. Learning Hub, e-Learning for Healthcare. Various resources available including those on Teamworking.

<https://learninghub.nhs.uk/Catalogue/SuppoRTTimmersiveresources>

**Development Timeline:**

Pre-development

* Teamworking theme decided by National SuppoRTT team
* Proposal chosen from those submitted from SuppoRTT network
* Scoping work between HEE Fellows and TEL exploring options for development
* Commissioned external developer following tendering process
* Decision to include guided self-debrief workbook and plan developed

Development

* Script development between proposal author, HEE fellows, sim lead, VR developer
* Collaboration with specialist trainees: involved in scenario development and filming
* Planning filming, booking venues, sourcing equipment, confirming roles inc. actors
* 360o filming process, with ongoing content review involving sim lead and trainees
* Ongoing development / edits to VR resource content
* Ongoing development / edits to filmed debrief sections / expert speaker videos / workbook
* Pilot groups recruited: online surveys and pilot workshops arranged using VR viewers
* Cardboard VR viewers purchased and sent to pilot trainees accessing remotely
* High tech VR viewers loaned from TEL / VR developer for use in F2F pilot workshops
* Use of pilot feedback to make further edits to resources before final sign-off

Post-Development

* Promotional video created by VR developer, see link above
* National roll-out including HEE comms launch
* Resources listed on learning hub as above
* Plans for ongoing local and regional promotion of resources via SuppoRTT network

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