Jisc

Extended reality in learning and teaching

Report 2023/24

Contents

Foreword

Professor Faisal Mushtaq, director, Centre for Immersive Technologies, University of Leeds

Reflecting on the five years since the last report, it is impossible to ignore the impact that the pandemic has had on the higher education (HE) sector. As I type this, exactly four years on from the first national lockdown, I am reminded of how quickly digital transformation went from being a strategic choice to a necessity for every university across the UK. With it has come a greater willingness to explore new digital solutions. It is in this milieu that extended reality (XR) has started to find its feet.

In this report, you will read case studies of how innovative institutions have embraced XR for health, art, humanities, social sciences and STEM subjects. These examples both inspire – serving as examples for what is possible right now – and excite, scratching the surface of further possibilities.

How might we start realising this potential over the **next** five years? We can start by heeding the comments of the educators surveyed in this report. Institutions will need to invest in technical infrastructure and be proactive in supporting staff to develop the skills they need to deliver rich educational experiences that are tailored for their learning communities. A concerted effort must be made to curate the sense of social belonging that is critical to the learning experience, but so easily lost in virtual environments.

There are also outstanding questions on accessibility and inclusivity, and it's necessary to address these if the technologies are to scale effectively. More broadly, we need to develop the evidence base on what works, where and for whom. In these early days, we need to start generating the frameworks and guidelines that will inform future pedagogical practices. The outlook is optimistic because the UK's HE sector, with its research firepower, is well placed to tackle these issues.

This report marks an important step on the journey towards realising the transformative potential of XR in education. I am sure you will see more than a glimpse of a future where XR goes beyond being an innovative method of educational delivery to a foundational aspect of how students engage and learn.

Paul McKean, director of further education (FE), skills and training at Jisc

As we navigate the rapidly evolving landscape of education and training in the 21st century, it is clear extended reality (XR) technologies are set to play an important role in shaping the future of further education and skills. XR is an umbrella term to include augmented reality (AR), virtual reality (VR) and mixed reality (MR).

In 2019 our **augmented and virtual reality in learning and teaching survey** revealed that the implementation of these technologies in education was inconsistent, with AR being used more frequently than VR. During the pandemic, there was a realisation that a readily available tool to provide high quality off-campus experiential learning did not exist. However, advances in immersive technologies have since opened up new possibilities for learning, teaching and practical skill application.

Compared with our initial 2019 report, I am delighted to see our 2023/24 survey shows high levels of engagement with XR from the FE and skills sector. Many providers are exploring XR technologies through small pilots, although some colleges are moving towards moderate to extensive use. We have witnessed fantastic pockets of practice across the sector, particularly within vocational subjects, where colleges are partnering with local communities and industries to develop immersive content that builds learners' skills in their local area.

In health and social care, immersive technologies are being used to build empathy and raise awareness of social or medical issues affecting specific demographics. In the construction, engineering and automotive industries these technologies are preparing learners for a net zero future by developing green skills. Additionally, XR technologies help learners develop literacy and numeracy skills by providing an immersive way to visualise concepts. By engaging with these technologies, learners build digital confidence and prepare for the future digital world of work.

However, 20% of respondents in the latest survey highlighted that accessibility remains a challenge, and we must urgently consider how to develop digitally accessible XR content or provide equal, alternative learning experiences for those unable to engage with (or access) immersive technologies.

Cost is also a significant issue for the FE sector, with limited funding available to purchase content and a lack of time and resources for content development.

With this report we aim to shine a light on these common issues and call the FE and skills sector to action. We encourage our XR communities of practice to foster a culture of collaboration, working together on content development, sharing knowledge and expertise and finding solutions to the challenges of accessibility and cost.

With a concerted, collaborative effort we can harness the potential of immersive technologies to provide engaging learning experiences and equip learners with the skills they need for the future.

Key takeaways

1 **Investment in extended reality (XR) technologies within learning and teaching sectors is advancing**. Most organisations with these technologies in place are beyond trialling and are now making applied use of them in one or more subject areas. More extensive use is seen within HE.

2 **There is strong appetite for further implementation and use of XR, with many seeing the potential for the technology to improve not only the experiences of learners, but also accessibility and future job readiness for individuals across multiple fields**. Health, sciences and trades are identified as key subject areas for implementation within FE, and health, the arts, humanities and social sciences, sciences and education for HE.

3 **There is significant belief and positivity towards the technology. Described benefits are the opportunities it provides students to situated and experiential learning beyond, or in addition to, that available within the classroom**. These experiences prepare students for employment, support educators with new pedagogical models and institutions in managing and scaling resources.

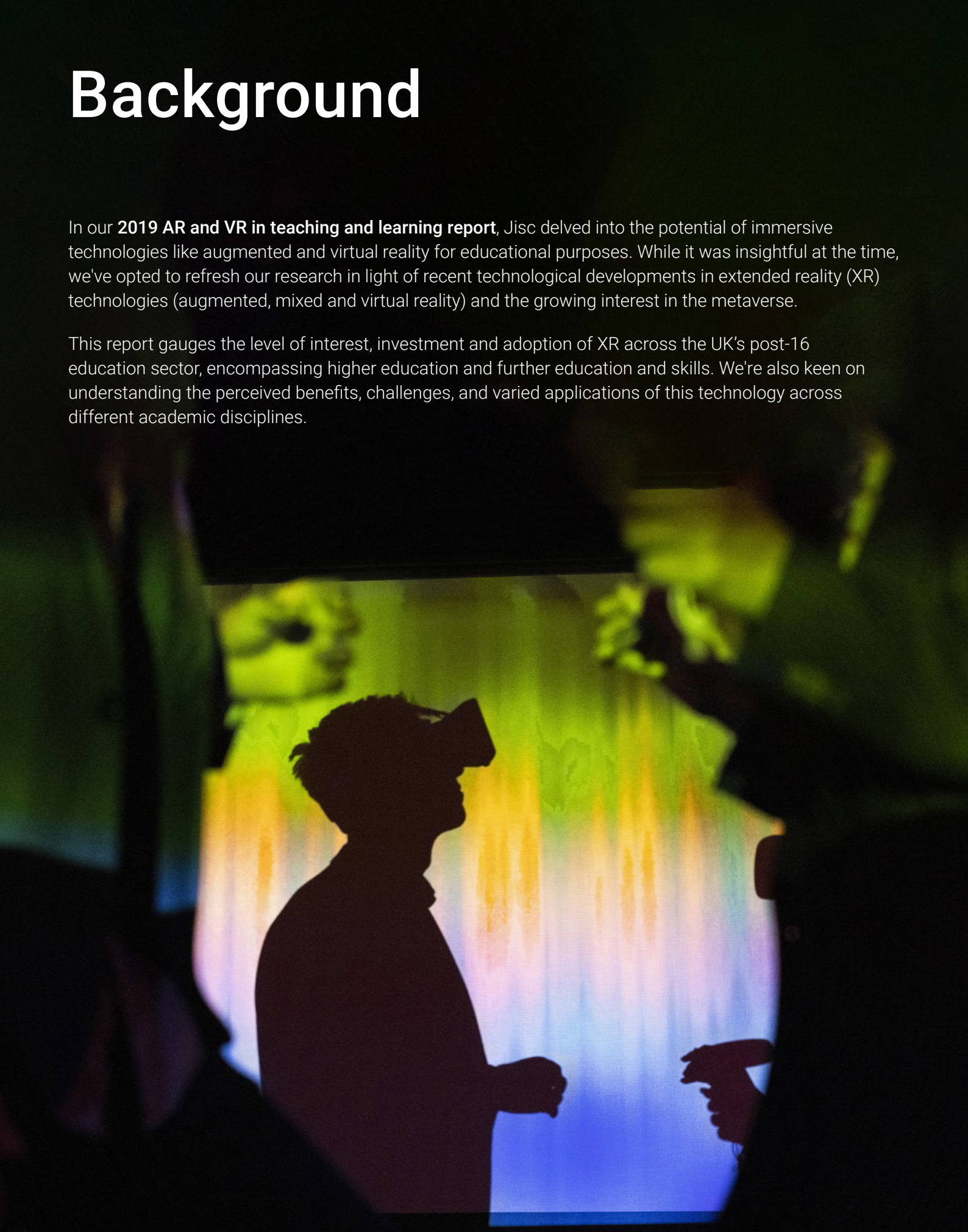
4 **Resourcing for the technology (whether it be financial or allocation of people and time) continues to be a barrier to greater implementation, and so funding sources and negotiated deals would be welcomed**. An additional challenge to the scaled use of the technology is the inherent need to train staff and support IT teams to ensure the technology is used to its full potential.

5 **There is a need for better understanding and more evidence of how XR can be used within education and its impact**. FE organisations in particular want more involved advice, guidance and training, while HE institutions appear to want more DIY resources and sector insight, potentially a result of more established infrastructure and funding.

Background

In our **2019 AR and VR in teaching and learning report**, Jisc delved into the potential of immersive technologies like augmented and virtual reality for educational purposes. While it was insightful at the time, we've opted to refresh our research in light of recent technological developments in extended reality (XR) technologies (augmented, mixed and virtual reality) and the growing interest in the metaverse.

This report gauges the level of interest, investment and adoption of XR across the UK's post-16 education sector, encompassing higher education and further education and skills. We're also keen on understanding the perceived benefits, challenges, and varied applications of this technology across different academic disciplines.



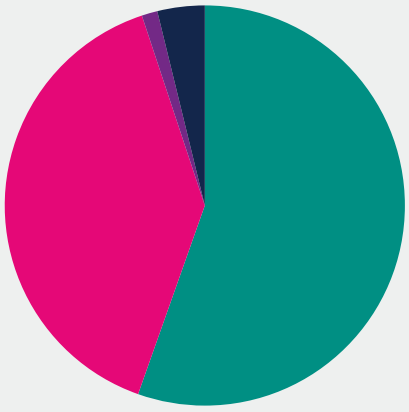
Method and overall sample

157 responses from 110 identified organisations

We distributed an online survey through October and November 2023 and received 157 responses. The majority were from further education institutions and based within England.

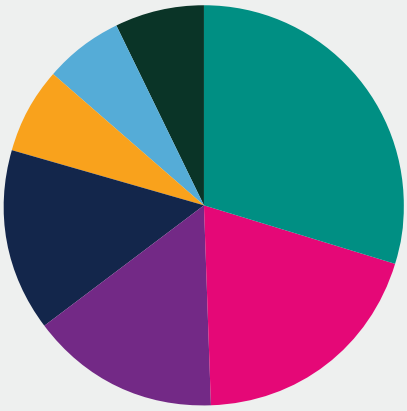
We also asked participants their role within the organisation.

Organisation type



- Further education (87) **55%**
- Higher education (62) **39%**
- Research organisation (2) **1%**
- Skills provider (6) **4%**

Role within the organisation



- Learning technology (47) **30%**
- IT (31) **20%**
- Academic (24) **15%**
- Learning administrator (23) **15%**
- Library (11) **7%**
- Administrator (10) **6%**
- Other (11) **7%**

In addition to their job role and organisation, we also asked participants how aware they were of the use of XR technologies across their department/ area and the whole organisation, as well as their influence over the acquisition of new learning technologies. This was to help us understand how informed and knowledgeable respondents could be expected to be with regards to their institution's use of XR technologies.

Over half of respondents (**55%**) indicated full awareness of their departmental use of XR technologies while only **32%** indicated the same level of awareness across the whole institution.

Approximately **10%** of respondents held budget and sole decision-making responsibility for acquiring new learning technologies within their institution.

Together, the sampling method and survey sample suggest that results should be seen as a generalised view of what the sector is doing and not a census of activity.

We also interviewed 21 staff members within various roles such as heads of e-learning, e-developers and teaching practitioners, from ten colleges and six universities. The purpose of these interviews was to gather some qualitative examples of how these technologies are being used within the sector.

The results of these findings are included as anonymous vignettes throughout the report.

Results

Use and implementation of XR

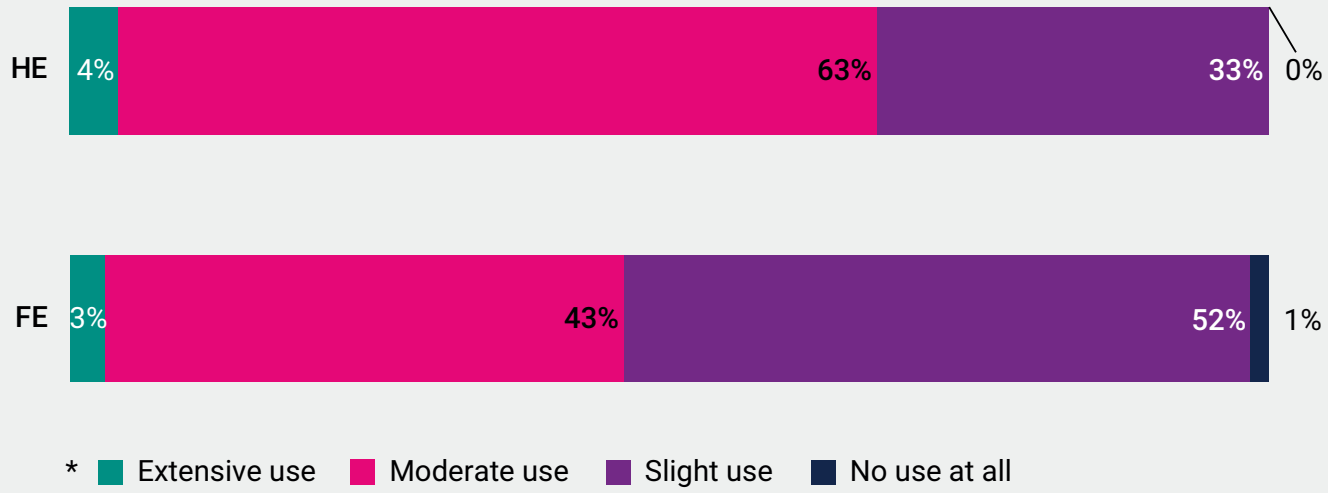
In our 2019 survey, 54% of respondents said virtual and augmented reality were used in one or two departments and only 12% said they were used in five or more departments. Our current research suggests use has increased as 78% of respondents indicated that their institution had made an investment in XR technologies.

The data shows a notable increase in the adoption of XR technologies across institutions since 2019, possibly spurred on by a move to blended/ online learning post-pandemic. This increase in investment and usage indicates a growing recognition of the potential benefits of these technologies in education.

Indeed, of those who had made an investment, just over half (55%) report moderate to extensive use of the equipment. Almost a third (31%) of the respondents (who had made an investment) from HE institutions reported purchasing large quantities of headsets (100+) for their organisation. The findings suggest a positive correlation between the number of headsets an organisation has and the extent of their use; implying institutions with a larger investment in XR technologies can be more likely to integrate them into their learning and teaching practices.

Nonetheless, while the data shows promising trends, it's important to acknowledge that the adoption of XR technologies is not without its challenges (as discussed later in the report).

Organisational reported use of XR technologies



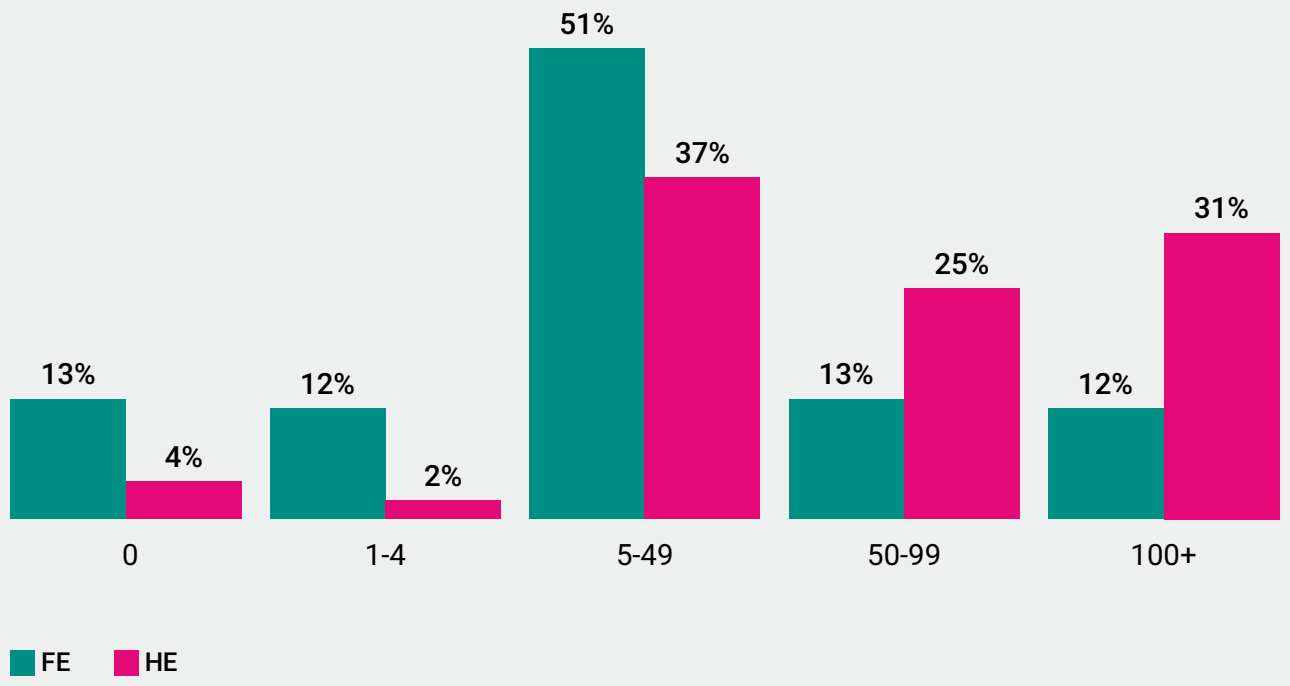
*Label definitions: Extensive use (active integration into education across disciplines)
Moderate use (some application to teaching across one of more disciplines)
Slight use (some trials, no formal use across the organisation)

Investment and engagement with XR

- The level of investment does appear to differ between sectors with over half of respondents within HE indicating their organisation had 50 or more headsets, while in FE the same level of investment was reported by only 25% of respondents.
- For those who indicated that their organisation had invested in at least one headset, a further question looked to understand the level of use that the headset/s were getting:
  - Only 1% of respondents indicated that their organisation was not using the technology at all
  - 55% indicated that their organisation was getting extensive to moderate use* out of the technology. This proportion was higher for those within HE (67%) in comparison to those in FE (46%)
  - Organisations with a greater number of headsets also report more extensive use:

Number of headsets	1-4	5-49	50-99	100+
% reporting moderate or extensive use	21%	46%	68%	80%

Number of headsets that respondents' organisation had invested in

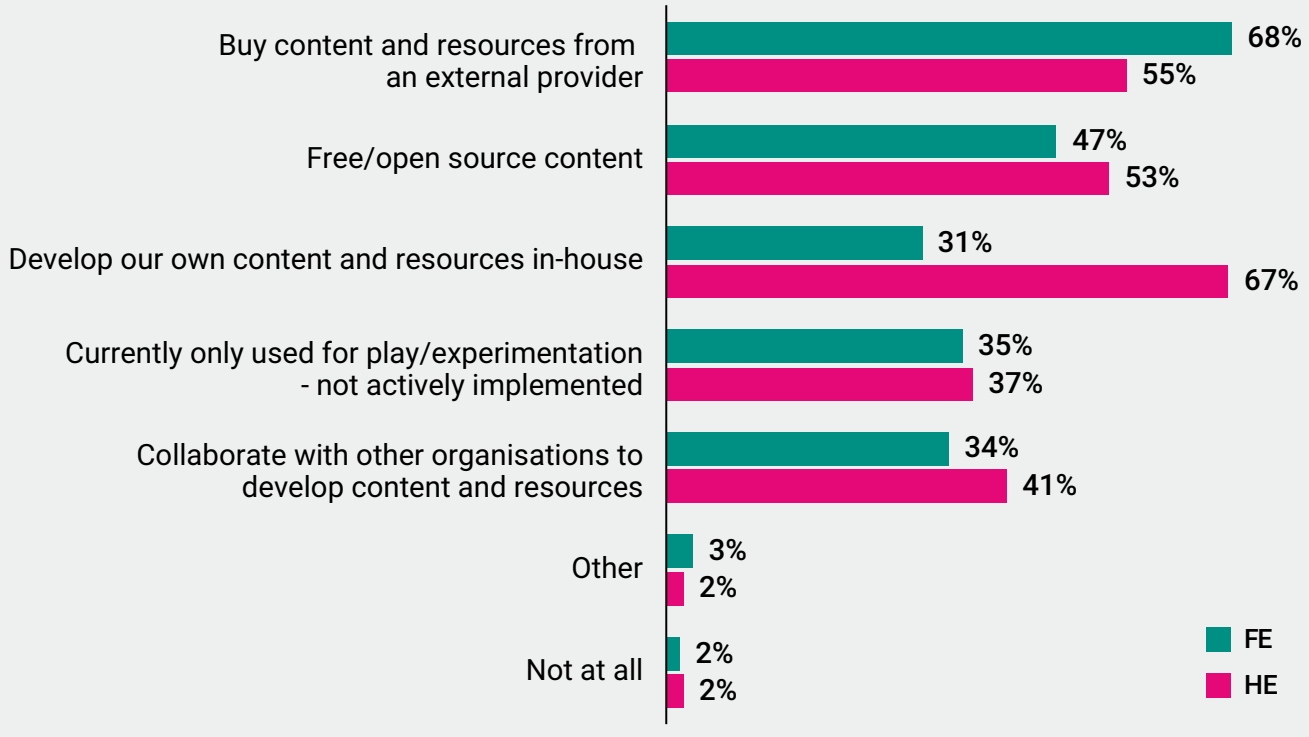


Most organisations are using a mixed model approach to content sourcing

How XR is implemented within organisations

- Of those respondents who indicated that their institution had actively implemented XR, 68% stated that their institution sourced content via a mixed method approach, developing some resources in-house or getting them from open source and external providers.
- In-house development of content and resources was the third most popular option (45%) although this varied substantially by sector:
  - The large majority from FE indicated that they predominantly implemented XR by buying content and resources from external providers (68%) while developing content was the fourth most selected item for content sourcing (31%)
  - Within HE, most respondents indicated that their institution was developing its own content and resources in-house (67%) although there was still significant sourcing of content from both external providers (55%) and free sources (53%)
- Approximately a third of overall respondents indicated that their institution was collaborating with other organisations to develop content and resources, suggesting more can be done in this area to work with local institutions and industry partners.

Method of XR implementation within organisations



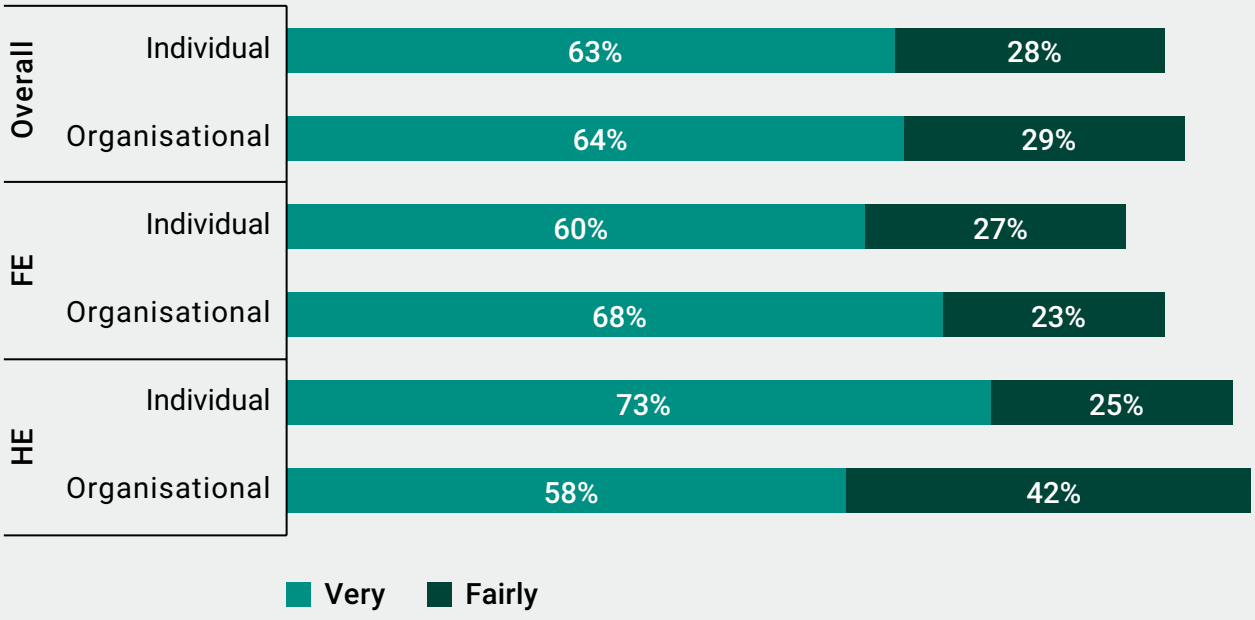
There is strong interest in the future use of XR at both the individual and organisational level

Future interest in XR

- Dependent on whether a respondent was classed as a leader or practitioner, they were asked whether their organisation or they personally, respectively, would be interested in making more use of XR technologies.
- There is little difference in the overall level of interest in the future use of XR between leaders and practitioners, both showing interest at over 90%.
- Individual interest for practitioners in FE (87%) was lower than within HE (98%). Interestingly, overall interest in the future use of XR was higher for leaders in HE (100%) compared to FE (91%). However, the proportion of those stating 'very interested' was 10% higher for FE.
- Organisations currently with the greatest investment in XR also have the strongest interest in future use although it is worth mentioning that most institutions currently without any investment in technologies do also appear very interested in future use.

Note: it can be assumed that those participating in the survey will have some previous interest in the topic of XR technologies given it was highlighted in recruitment, therefore these proportions will likely be over generous in terms of overall sector interest with regards to future use.

Level of interest in future use of XR



Number of headsets	0	1-4	5-49	50-99	100+
Very interested	56%	25%	59%	78%	95%
Fairly interested	22%	63%	41%	11%	6%

Rationale for level of interest

Sample of comments from those who expressed they were ‘very’ interested in the future use of XR (29 comments, 15 FE and 14 HE)

Those with the most interest comment positively and express enthusiasm about the potential for XR technology to improve learner experiences, accessibility and future job readiness across multiple fields. They see XR as an important step in advancing pedagogy and an opportunity for employers to directly impact the future workforce's skills. However, it's important to note the limits of current evidence and approach these claims with a degree of caution. The lack of extensive research on the effective use of XR in education and the uncertainty surrounding its scalability and wider applicability suggest that a measured perspective is necessary to temper techno-optimism.

“XR can transport users into digital worlds, enhancing engagement. Immersive simulations boost learning and skills development. Remote collaboration becomes more intuitive with virtual presence. Complex datasets take shape through detailed 3D visualisations. Workflows improve as augmented guides assist difficult procedures. The creative possibilities stretch as far as the imagination with virtual rapid prototyping. XR brings ideas to life by merging real and digital environments. The potential applications across training, design, collaboration and more are vast. XR promises to revolutionise how we learn, work and create together as virtual worlds feel increasingly real.”

Practitioner, FE

“The development of low-cost, realistic simulation within learning will transform education. Furthermore, if we can convincingly simulate social presence (already part way there) that will have a huge impact on distance learning and the way that this converges with in-person experiences.”

Practitioner, HE

Sample of comments from those who expressed they were ‘fairly’ interested or ‘neutral’ towards the future use of XR (11 comments, five FE and six HE)

Those comments from within the middle of the scale express interest and can see the potential of the technologies with a desire to build on the work to date. However, they appear conscious of challenges associated with cost and development of content, as well as the need to upskill staff, which can take time.

“We are keen, but limited time and budgets mean it's difficult to get anywhere with a lot of this! We also don't have any free in-house developers to build related content, so it would need to be open source, bought in, or student-created materials that are put in use.”

Practitioner, HE

“The main barrier for us is cost but also staff know-how. Effectively integrating new tools requires staff training and that can be difficult due to time constraints and lack of buy-in from the organisation management.”

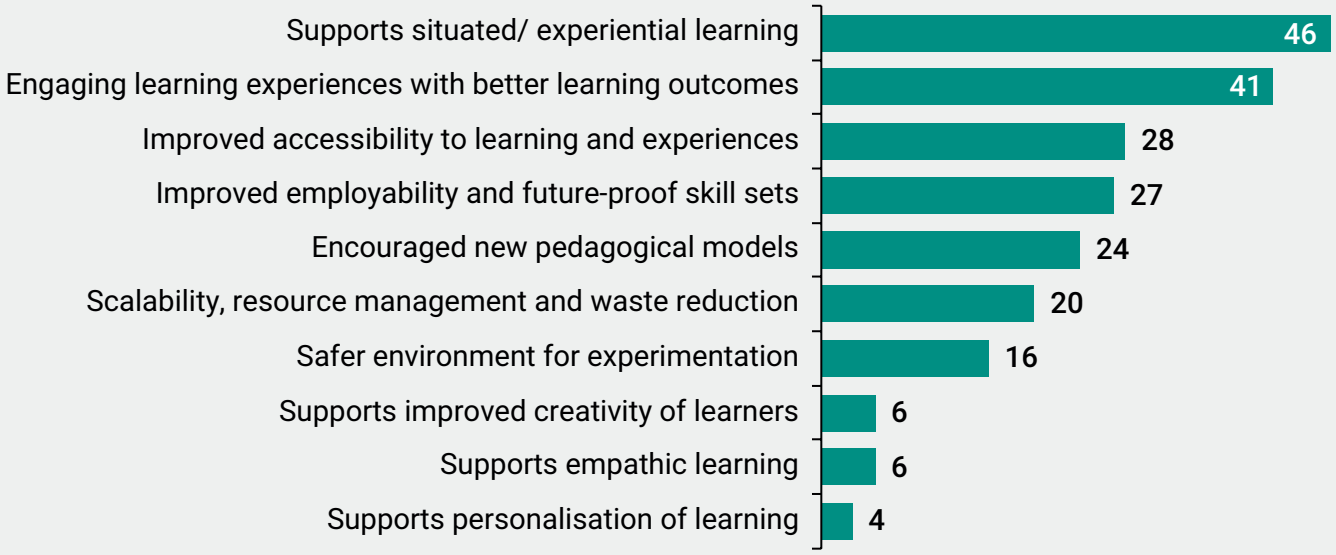
Practitioner, FE

Situated and engaging experiences are key benefits of using XR

Perceived benefits of using XR for teaching and learning

- 105 open responses were submitted when participants were asked about the main benefits of using XR. The two most frequent comments were that participants believed XR can offer students access to situated and experiential learning, beyond or in addition to that available within the classroom, and that it can offer engaging learning experiences with improved learning outcomes compared to traditional teaching methods. What is not established in the survey is how improved learning outcomes were measured, which would be something to follow up on in a future survey.
- The comments also suggest that XR can be used to help develop learners' employability skills, by giving them an opportunity to practice before they enter the workplace.
- Many of the comments also referred to immersive technologies being able to facilitate new methods of teaching and learning (pedagogical models). Another interesting benefit was the mention of being able to manage resources and scale the use of XR. This is particularly relevant where XR experiences can simulate real-life experiences which are Dangerous, Impossible, Counterproductive or Expensive – as per the DICE framework (Bailenson, 2018[1]). Indeed, there were numerous references to how XR is also safer for students' learning in terms of both physical and emotional development.

Number of references to key themes describing the benefits of XR



1 Source: Bailenson, J., (2018). Experience on demand: what virtual reality is, how it works, and what it can do. W. W. Norton & Company: New York.

Comments in reference to the perceived benefits of XR

“1. Delivering 'real life' training and experiences 2. Developing current and innovative skills leading to employment. 3. Keep up to date with latest industry innovations.”

Leader, FE

“To provide immersive, interactive and engaging learning experiences to learners to improve their learning experience. To enable them to practice and improve certain skills in a safe environment. To introduce them to innovative ways of learning and working.”

Leader, FE

“Better utilisation of existing spaces; future ready employees, allow experiential learners to succeed.”

Leader, HE

“Unique and impossible experiences/ways of learning, rehearsing tasks and experiments, manipulating and interacting with objects and phenomena at scale (e.g. the very large, and the very small). Art, experiencing cultures and locations.”

Practitioner, HE

“Experience that would not normally be available within college, ability to practice and replay experiments without cost of equipment reuse, reduction in supervision in certain exercises, external partners contribute to creation of projects to support knowledge within sector, access to tech which will become the norm in the future, enhanced learning and experience.”

Practitioner, FE

“Supplementary learning, access to experiences unaffordable or inaccessible to many, augmenting current teaching, students producing content.”

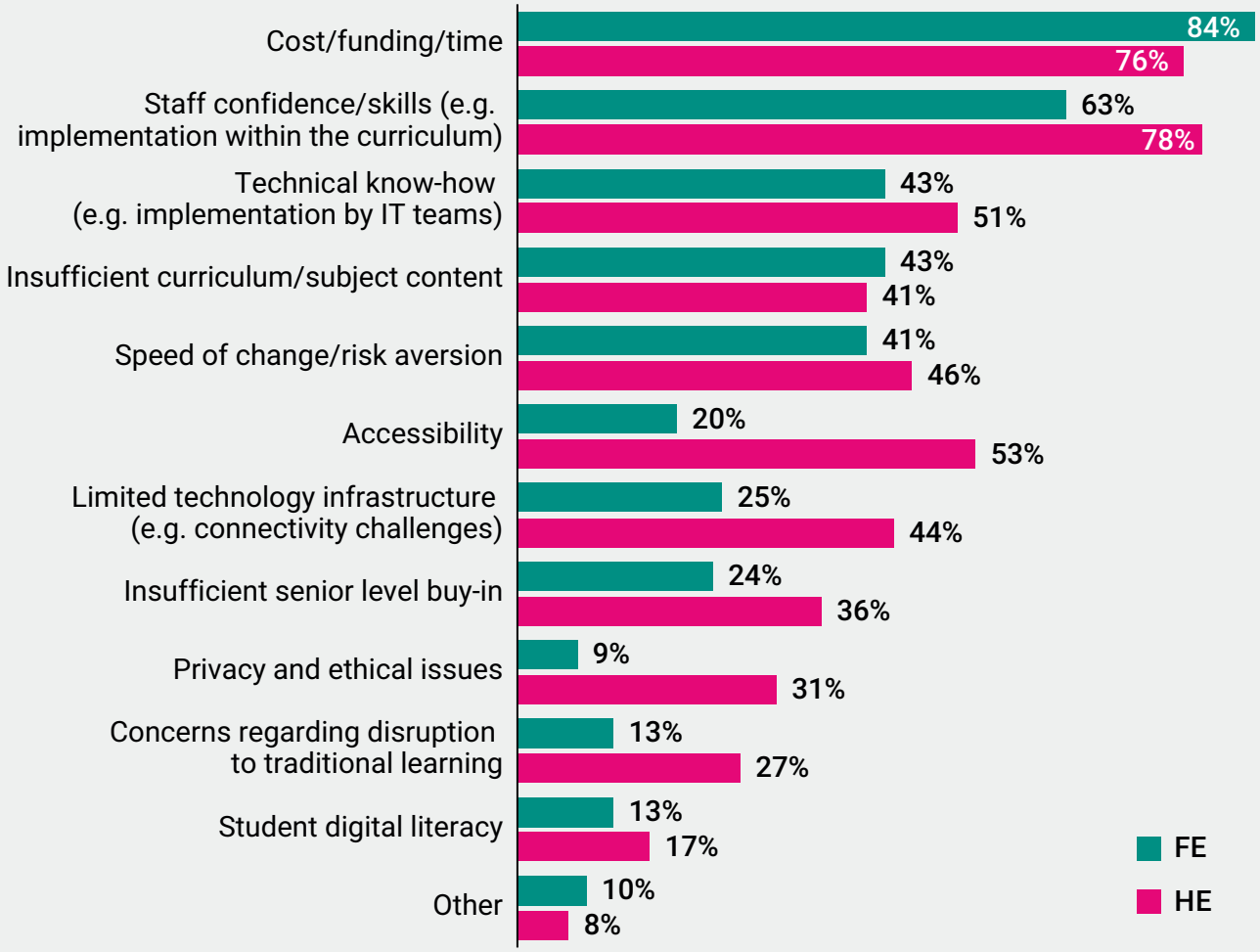
Leader, HE

Perceived barriers of implementing XR for learning and teaching

Resourcing and staff skillsets are perceived as the greatest barriers to XR implementation

- Resourcing, in terms of costs, funding and time, is the main challenge to implementation of XR within organisations. Cost is a particular issue within the FE and skills sector as there are often limitations on funding which only allow for the purchase of physical assets and not software.
- The lack of specialist skill sets, both in terms of implementation by staff into the curriculum, and technical implementation and maintenance by support teams, is also a key issue impeding greater use.
- The order or perceived scale of challenges did vary by sector:
    - In FE, two challenges appeared to be key to more than half of respondents, namely resourcing (84%) and staff competency in using the technologies (63%). It is somewhat surprising that only 20% of FE respondents highlighted accessibility as a barrier, given the ongoing challenges in ensuring digital accessibility in XR development. Addressing accessibility is crucial not only for meeting legal obligations but also for providing equal learning opportunities for learners
    - In HE, staff competency was selected as an equally challenging issue to implementation as resourcing (76% and 74% respectively). Accessibility of the technology and specialist technical know-how were also selected as challenges by more than half of respondents within the sector (53% and 51% respectively)
- Interestingly, leaders were more likely to select speed of change of the technology and risk aversion (52%) than their practitioner counterparts (38%). The rapid pace of technological development poses a significant issue in terms of sustainability, as the high turnover rate of XR devices may lead leaders to be more hesitant to invest substantial amounts of money in the technology without a clear long-term plan. Incidentally, as cost has been highlighted as a key barrier, justifying high costs becomes increasingly difficult when the hardware may need to be upgraded in five years' time, or when XR software the institution has developed or purchased may no longer be compatible with updated hardware.

Perceived barriers to implementation of XR



Comments in reference to the perceived challenges of implementing XR

"Our institutional IT is not configured for non-user owned devices. This has made things extremely difficult when looking for connectivity for devices, but also for usernames / generic accounts etc... Aside from this, the main issue is staff time but the ability to work with our digital learning teams to make best use of academic / education / technical time has been helpful here."

Practitioner, HE

"Are staff willing to invest time in learning new technology, off-the-shelf content only gets you so far, custom content is key but takes time in development, not all people like or experience VR in the same way/react differently, so will need traditional methods as a failsafe, finding a new teaching methodology, one that doesn't bring tech into a traditional setting, but one that creates a new setting looking to the future."

Practitioner, HE

"Firewalls and access to internet. Constant need to update headsets is very, very time consuming. Need to develop advanced learning modules, but off-the-shelf is nowhere near where we want to be (using [Microsoft] HoloLens in engineering), future gazing and using latest tech is costly in staff time (time more costly than hardware)."

Practitioner, FE

"Funding for resources and off-the-shelf content is too expensive. Staff not having the time locally to use equipment like Insta 360 to create content."

Leader, FE

"Trial software, e.g. Bodyswaps generated excitement and ideas for including in curriculum. Severe budget limitations have meant software cannot be purchased reducing value of few headsets we own."

Practitioner, FE

"Yes, with regard to safeguarding and privacy policies. We had to ensure that the technology had an adequate device management system. Also cost, budget for tech is controlled by faculty leaders rather than the digital team."

Practitioner, FE

"Managing headsets at scale. All the options we have trialled have been disappointing. Especially in terms of syncing headset experiences across a class. Purchasing content for use on multiple headsets - e.g. having to use gift vouchers. Charging and hygiene issues. The options for bulk storage and charging are very expensive."

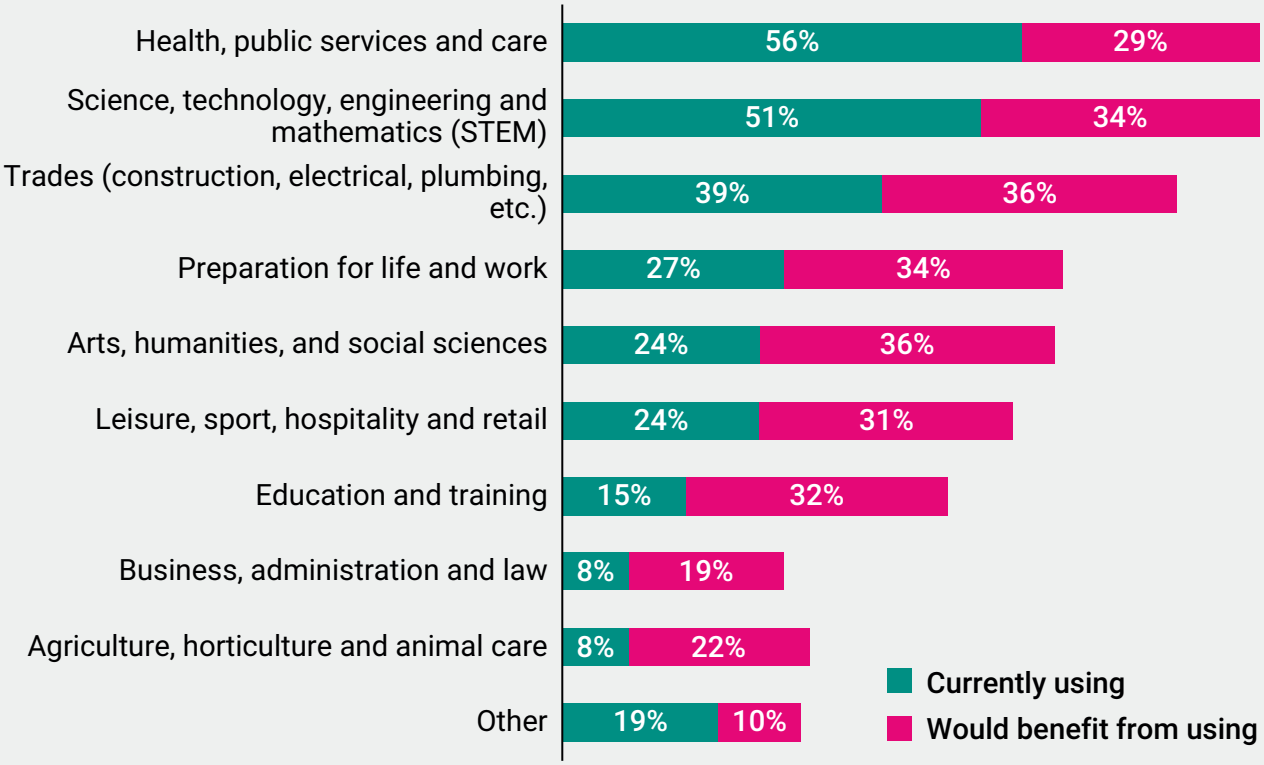
Practitioner, HE

Health and STEM subjects have the highest levels of XR use within FE

Subject use of XR within FE

- Two subject areas were making use of XR in more than half of FE respondents' institutions – health, public services and care (56%) and STEM (51%) subjects.
- Due to the low general usage of XR outside of health and STEM subjects, many subject areas were identified as having potential to benefit from XR. In particular, trades, preparation for life and work, arts, humanities and social sciences and leisure, sport, hospitality and retail were considered to be subject areas with great potential to use XR technologies.
- In addition to overall use, we asked about the hardware and software institutions were using within each subject area and how they used it. In health, public services and care, XR was noted to be useful for teaching anatomy and physiology concepts using **Organon** and other apps from the **Meta Quest Store** or **VIVEPORT**. Mathematics courses made use of the augmented reality mobile phone application **Photomath** for solving equations. Engineering/trades courses used virtual welding kits and virtual paint spraying simulations.

Subject usage and where respondents feel benefit could be had from usage within FE



Use of XR in health and social care (FE)

Stories from the XR community

An FE college we interviewed shared how they are using immersive technology, particularly VR, in subject areas such as health and social care to experience the realities of a hospital ward. They also used 360 content simulating a shopping scenario to explain the concept of needs and wants to their learners with additional learning needs. They have purchased Quest 2 headsets and are also using VR applications like **Bodyswaps** for soft skills development and **Metaverse Learning** to simulate experiences specific to their health and social care courses. The college has set up a dedicated VR zone in the library where students can access the immersive technology.

Lecturers bring their classes to use the equipment, with the help of an e-learning facilitator to manage the technical aspects and ensure a smooth experience for all students, including those with accessibility needs. For example, students with epilepsy can access the virtual environments on computers instead of headsets, allowing them to experience the content in a safer way, while still developing their skills. The college aims to expand its VR offerings in the future. They will explore rolling out the VR content to the entire college, providing a booking system for students to use the technology independently, and potentially creating their own VR assets tailored to their courses.

Another FE college shared their experience of collaborating in a research project with a local university, to investigate the effectiveness of immersive technologies within assessment practices for health and social care. Students at the college had the opportunity to use professional-grade simulation equipment at the university's facilities, exposing them to the same technology used to train doctors, nurses and surgeons. Additionally, the college has created its own VR content, focusing on three 10-minute scenarios that align with key elements of the curriculum and industry requirements. They used **iRIS software** to create scenarios that map to **Association for Simulated Practice in Healthcare (ASPiH) standards**, something that is crucial to ensure standardisation and student safety.

The college emphasises the importance of industry requirements. As well as knowledge about medical conditions, students need to know how to behave within certain situations, something that immersive technologies can facilitate: "we can teach them the knowledge, but you can't teach the behaviours and if they're not ready for work, they don't act appropriately (…) Getting [learners] to reflect on that, is a game changer."

Despite challenges such as limited funding, staff expertise and the rigid structure of further education, the college remains committed to expanding the use of immersive technology. By providing students from disadvantaged backgrounds with access to immersive technologies, the college aims to promote social mobility and prepare learners when they begin their roles in hospital. As the interviewee stated: "for me that's all about social mobility because it's linking back to looking at who your learner is, where your learner comes from, and giving them the best opportunities that we can possibly provide for them, to help them move on in life and progress in their careers".

Aircraft engineering (FE)

Stories from the XR community

One FE college shared how they have been integrating VR into their aircraft engineering courses. The main reason for this was the limited capacity of their aircraft simulator, which could only accommodate two learners and an instructor at a time. To provide more students with hands-on experience, they started exploring VR applications like **Microsoft Flight Simulator**. This college noted how the move to VR is timely as this is the same route many of the industry partners are using to train their staff (British Aerospace and Royal Air Force).

As they received positive feedback from students, the college secured more funding to invest in advanced hardware and software. They chose products based on technical specifications, compatibility and portability. The college uses a combination of high spec PCs and Quest 2 headsets, along with software like **Airport Ground Handling Simulator** and Pennant Engineering's **Virtual Aircraft Training System (VATS)**. The college aims to provide students with experiences as close to real life as possible while keeping them safe and preparing them for their future careers. They are looking to further develop their XR journey through industry partnerships, staff training and continued investment in hardware and software.

Animal care and land-based courses (FE)

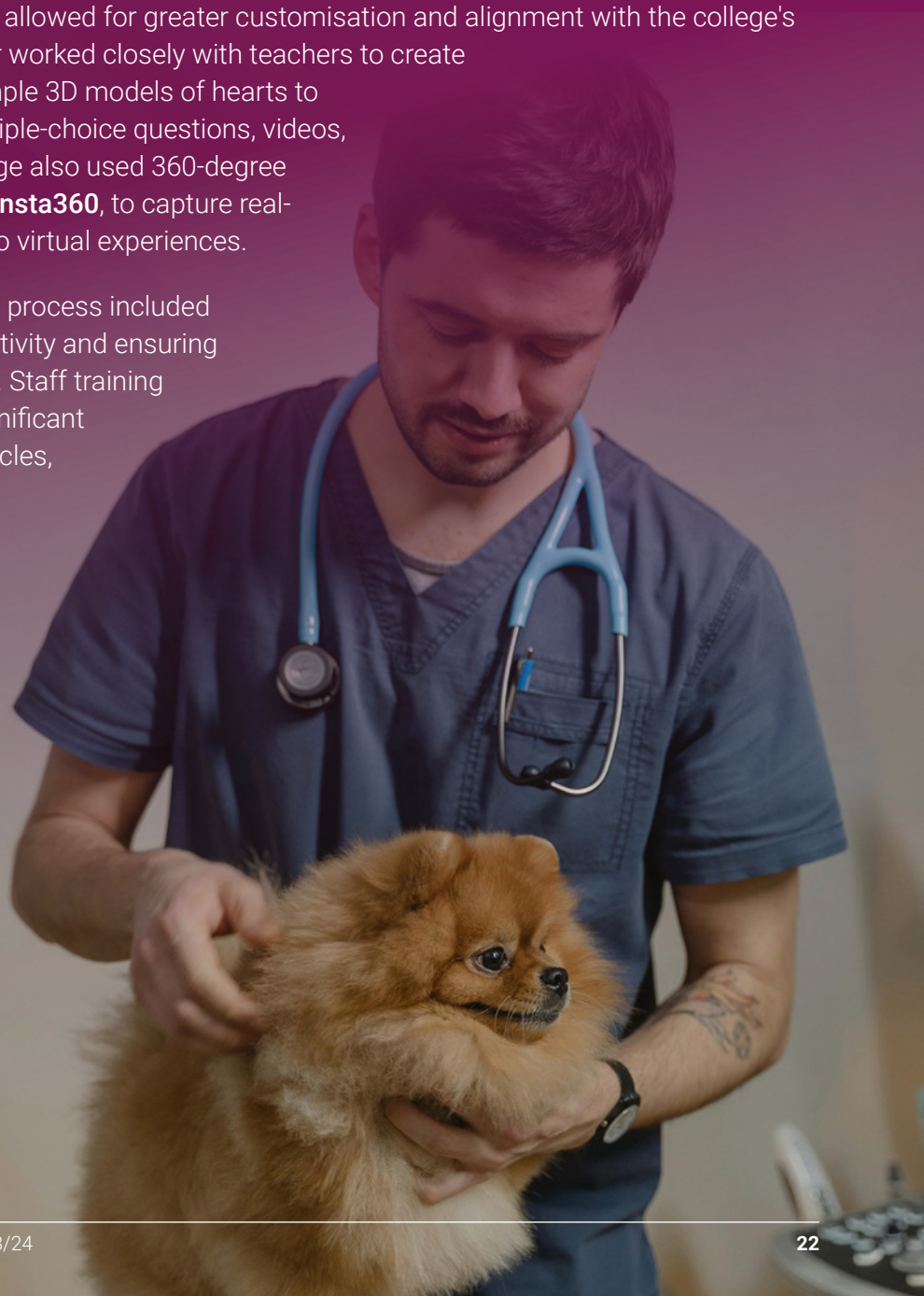
Stories from the XR community

A technical college specialising in land-based courses, offering subjects such as animal management, veterinary nursing, and golf greenkeeping apprenticeships, embarked on a journey to integrate immersive technologies into their teaching and learning practices. Driven by the principal's vision, the college secured funding to build a centre for immersive learning. The college now uses a combination of AR, Quest 2 and Quest Pro headsets with their learners.

The college found that both VR and AR had their merits, with VR being particularly effective for simulating environments like kennels or catteries, which animal management students couldn't easily access in real life.

The college made a key decision to create their own immersive content using **Stage software, provided by VISR**, a local VR/AR company. This allowed for greater customisation and alignment with the college's curriculum. The e-learning coordinator worked closely with teachers to create tailored experiences, ranging from simple 3D models of hearts to complex scenarios incorporating multiple-choice questions, videos, text and learning objectives. The college also used 360-degree cameras, including some donated by **Insta360**, to capture real-world environments for integration into virtual experiences.

Challenges during the implementation process included technical issues related to wifi connectivity and ensuring student safety in virtual environments. Staff training and content creation also required significant time and resources. Despite the obstacles, the college has seen high levels of student engagement with the VR and AR experiences, finding them both educational and enjoyable. Looking ahead, the college plans to continue expanding its use of VR and AR while exploring other emerging technologies such as artificial intelligence.



XR journeys (FE)

Stories from the XR community

Starting with just 20 headsets, one FE college now has over 170 HTC Vive Pro devices. Their head of technology enhanced learning told us they have been conducting teacher training sessions with staff from various schools, including creative industries, engineering, and childcare, to familiarise them with these technologies. Instead of relying on traditional teaching materials like PowerPoint presentations, the college is using XR apps to teach concepts that cross over many curriculum areas, such as anatomy and physiology, in an interactive and retainable way.

The goal is to make immersive technology a seamless and meaningful part of the learner experience, especially as these technologies will become increasingly prevalent in the future workplace. The college also utilises **Bodyswaps** to help learners to develop their soft skills and educate them about anti-racism in the workplace. The college recognises that education sometimes lags behind Industry 4.0 and is determined to bridge this gap by integrating immersive technology into day-to-day practice. The college's strategy focuses on ensuring that students are well prepared for the technological demands of their future careers.

Another FE college we spoke to is at the beginning of its XR journey. They have invested in a small number of VR headsets (15) to enhance teaching and learning. They are exploring how to integrate immersive technology into a range of subject areas such as: performing and visual arts, engineering, maths, health and social care, fashion, graphics, psychology, law, criminology, sports and e-sports. In addition to subject-specific applications, the college also uses **Bodyswaps**, allowing learners to practice and develop essential soft skills such as interview techniques, communication, collaboration and leadership. To ensure the effective implementation of the immersive technology, the college recognises the importance of working with curriculum staff from the beginning, and providing teachers with dedicated time to explore, trial and reflect on the available VR products.

XR journeys (FE)

Stories from the XR community

One FE college has focused on upskilling staff in using VR so that they are able to confidently use it with learners safely. The college purchased 50 HTC Vive Pro and 35 Meta Quest 2 headsets which are available for staff to book out from the campus libraries. The training took place as a 'VR driver's licence' to teach the basics of using VR for teaching. As well as safety aspects, it included looking at the pedagogical value to enhance learning. Teaching staff were encouraged to consider use as part of a station rotation style lesson. Once staff have their 'VR driver's licence', they are then empowered to use VR independently.

The college has primarily been using **Bodyswaps** for developing soft skills and **Organon** to teach learners about anatomy and physiology. Students' feedback is gathered after each use, which is used as evidence for future purchasing and licence renewal. The VR experience has proved to be so popular with students that the college hosts VR after school clubs, where learners have the opportunity to use it for revision sessions outside of their lessons.

Another FE college discussed the importance of having a clear plan on embedding technology into lesson planning, curriculum design, and assessment, while providing onboarding support to both students and staff. The college recognised the importance of being able to justify the cost and time of implementing these technologies and discussed metrics to do this such as the number of hours booked out by staff/ learners using the equipment/ the number of hours on each VR software, and learner satisfaction surveys. They stressed that it is key to engage in a two-way conversation with curriculum staff to choose relevant content to meet the learners' needs. On some occasions they even worked with the games development learners to co-design content for specific subject areas: "we're very keen to remind staff that we can absolutely search the market and we can find all these things, but we might not necessarily know exactly what you need".

They shared a few examples of what this integration looks like in practice. For their leisure and tourism learners, the cabin crew health and safety VR content **Avietra** is now built into their formative assessment practices. VR proves advantageous in this context as it helps learners better visualise the reality of the job without the difficulty and cost of accessing real-life training spaces. The college also uses applications such as the **National Geographic Explorer VR** to help support their IELTS students with language learning, and their English literature A-level students with their creative writing, by providing structured prompts to guide their reflections on the experience. Similarly, the college explained how many of their learners are from deprived areas with low levels of numeracy and literacy, and how VR can help them engage with learning and build their confidence, compared to more academic or traditional methods.

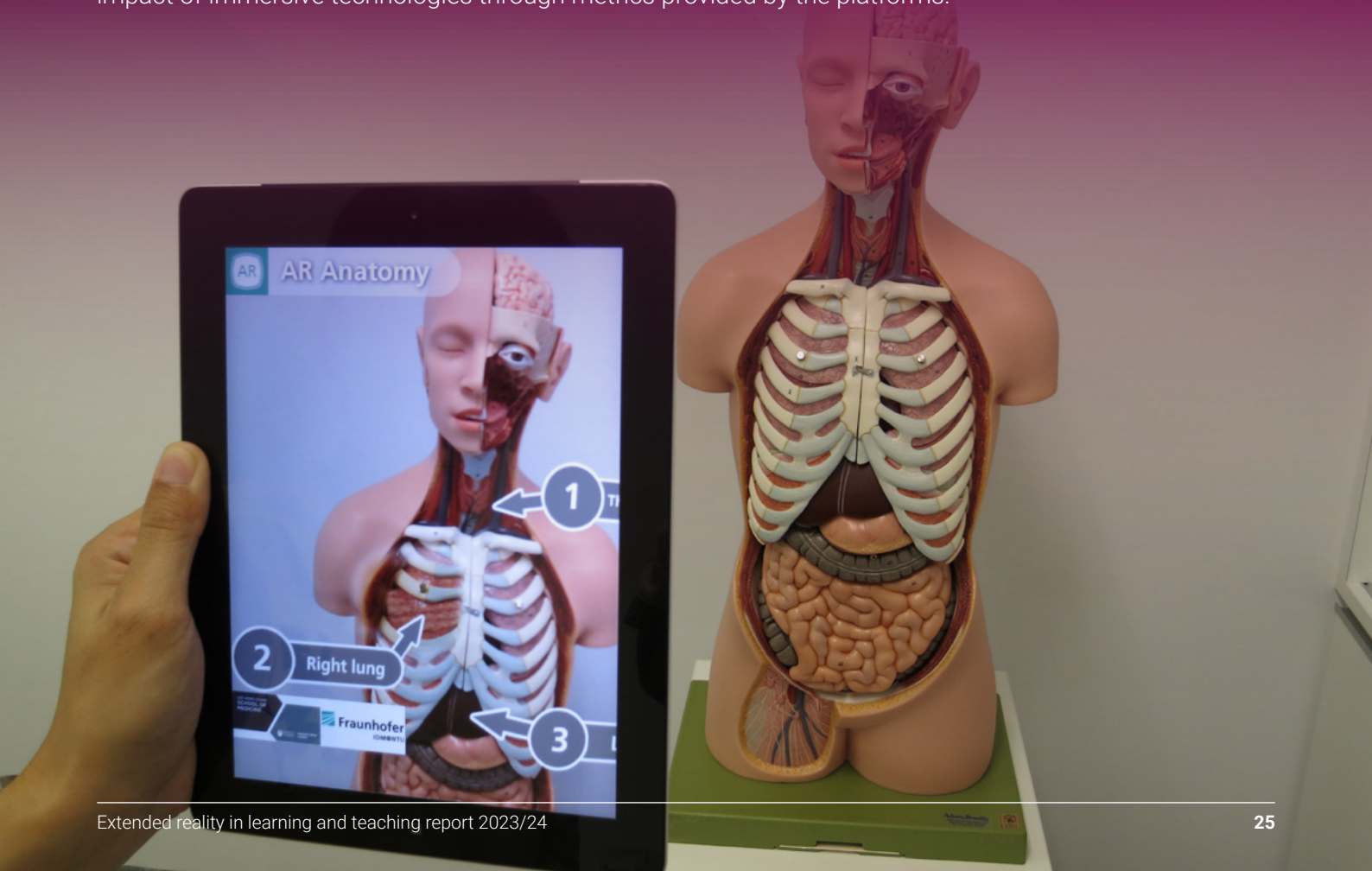
In the future, the college hopes to explore the potential of mixed reality technologies to seamlessly blend virtual content within physical spaces: "simulated environments to match some of the industries we've got locally, which you would lay out in a large space with physical objects, representing bulky bits of industry equipment, and then you'd lay a virtual layer on top of that."

XR journeys (FE)

Stories from the XR community

A head of digital learning at an FE college shared with us their experience of integrating immersive technologies, such as VR and AR, into their teaching and learning practices for the past eight or nine years. Initially, they recognised the potential of AR as a marketing tool and later saw its benefits in sharing educational resources with learners. They identified learners' mental health as an area of concern, and worked with **Rethink Mental Illness**, creating AR posters to provide easy access to a wide range of supportive content. The college has since expanded its use of AR, contextualising it to various curricula, to reduce costs and enhance learning experiences. For example, in bricklaying courses, AR allows students to review demonstrations through videos and complete quizzes, even if they miss a class. The college primarily uses **Zappar** for AR content creation due to its ability to embed PowerPoint presentations, its educational discounts and its cloud-based hosting.

In terms of VR, the college has focused on curating existing content, such as 360-degree videos on YouTube, to provide immersive experiences for students. They have found success in using VR for creative writing in English courses, where students write travel blogs based on virtual experiences like coral reefs and rainforests. The college has also collaborated with companies like **Focus XR** to develop subject-specific content, particularly in emerging industries like electric motor vehicles, where no content existed at the time. The college shared some of their challenges such as compiling assets, ensuring device compatibility and addressing health and safety concerns. However, they have worked to overcome these issues by creating standardised templates, investing in device management systems like **Arbor XR**, and offering browser-based access for students who may not be able to use headsets. The college actively involves staff, students, governors and business partners in their digital strategy, and it measures the impact of immersive technologies through metrics provided by the platforms.



XR journeys (FE)

Stories from the XR community

One further education college in the UK has been integrating immersive technologies into its learning and teaching for the past five years. The journey began with the creation of an immersive room designed for collaborative learning across two campuses. The college then expanded its focus to include XR production facilities, such as motion capture, photogrammetry and volumetrics.

Initially, the college aimed to work with third-party companies on commercial projects while integrating students into these projects. However, they have since shifted towards in-house research, development and production of immersive products in partnership with other FE providers. The college has gradually increased the number of VR headsets available and integrated VR experiences into subjects such as: health and social care, classical civilisations, art and design, media and games design.

They primarily use Meta devices like the Quest 2 and Quest Pro for their ease of use and developer-friendly documentation. They have developed their own VR campus software, which can be customised to meet specific course requirements. The college also uses third-party applications like **Bodyswaps** for soft skills training.

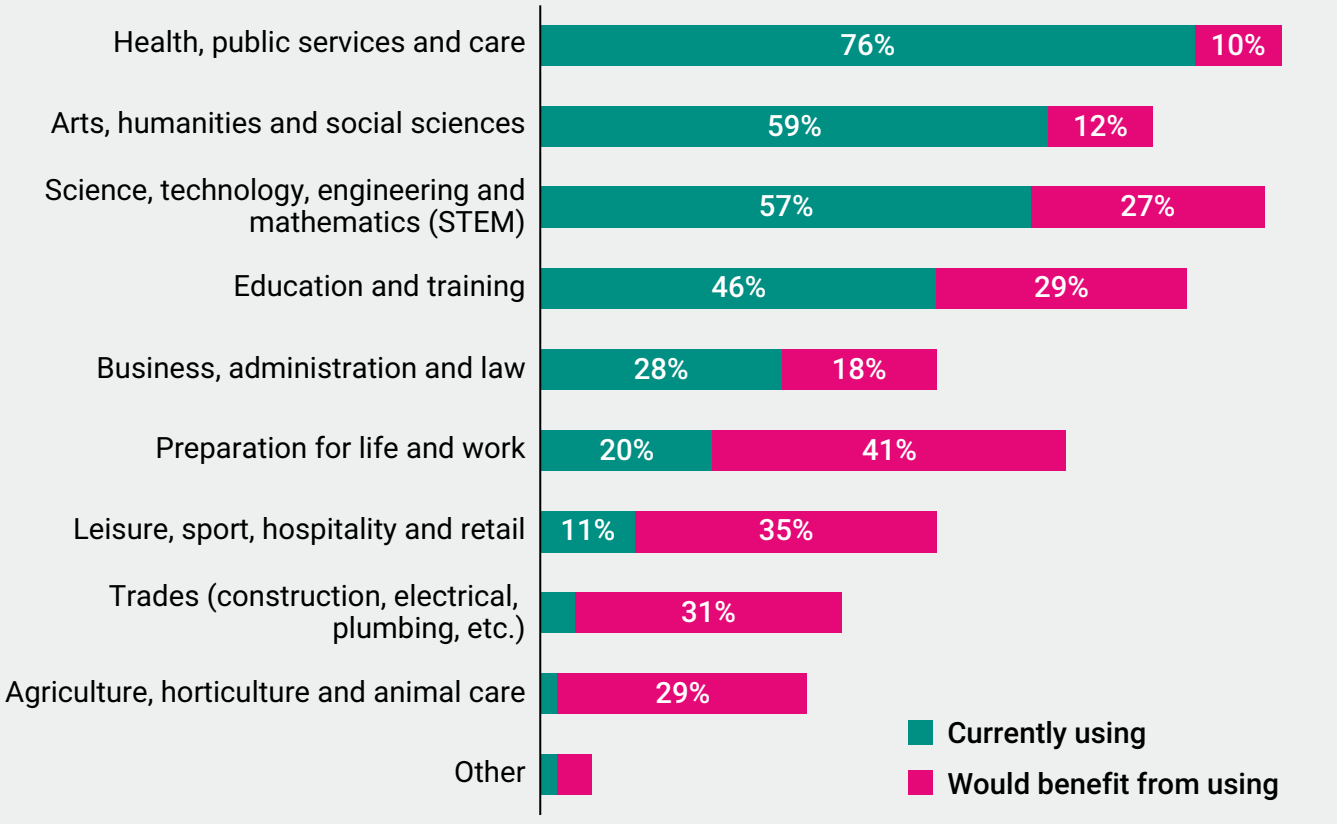
Challenges include the high cost and limited educational value of many existing VR experiences, which tend to be more entertainment in nature and don't meet specific learning outcomes or assessment criteria. This was one of the driving factors for the college to develop their own content. They are currently conducting action research to explore creative arts learners' experience of using their VR campus application with an exploration of different art styles through a virtual museum. They're also interested in facilitating a teacher-led approach to integrating immersive technology into lessons, by providing teaching staff with a five-step plan and induction session to prepare.

Health, public services and care subjects have the highest levels of XR use within HE

Subject use of XR within HE

- Within HE, three subject areas were making use of XR in more than half of respondents' institutions, most notably health, public services and care (76%) followed by arts, humanities and social sciences (59% – notably higher than within FE) and STEM subjects (57%).
- When asked which subjects in their institution would benefit from greater use of XR, votes were made for STEM subjects (27%), education and training (29%), and preparation for life and work (41%).
- We also asked which hardware and software institutions were using and how they were using it. For the training of nurses and doctors in health, public services and care, universities were using virtual reality apps such as **Oxford Medical Simulation** and **Sharecare**, as well as exploring developing their own content through **Unity** or **Unreal Engine**, and incorporating the use of virtual avatars as patients. Encouraging students to create their own creative works using **Gravity Sketch** or **Open Brush** was discussed within the discipline of arts and humanities in HE, as well as building virtual galleries using **Matterport** scans or through **Wonda VR**.

Subject usage and where respondents feel benefit could be had from usage within HE



Use of XR in health and sciences (HE)

Stories from the XR community

One university we interviewed is using XR technologies to enhance the training of their third-year healthcare students, specifically in the area of patient management skills. The immersive learning scenarios focus on decision-making, teaching students when and how to escalate care in various situations. This practical experience complements and reinforces the theoretical knowledge gained through lectures, providing students with valuable hands-on learning opportunities.

The university shared how they used immersive technologies to simulate the care of patients with sepsis. Many students had no prior practical experience in managing this critical condition, but the immersive simulations allowed them to practice the necessary steps and protocols. By running through these scenarios in a safe, controlled environment, students gained confidence in their ability to handle real-life cases of sepsis, knowing that they had at least a foundational understanding of the proper procedures.

A significant advantage of XR technology in healthcare education is the ability to repeat scenarios consistently, ensuring that all students receive the same high-quality learning experience. As our interviewee stated: “The thing that XR tech allows you to do is you can run it time and time again and the students get the same experience - If you tried to do that on campus with staff demos and mannequins, you couldn’t do it, even with the best will in the world.”

A university shared their struggle in sourcing educational pharmacology or physiology content, particularly for advanced level students and researchers. This led to the university choosing to make their own from scratch, creating models using 3D scanning, high resolution images, MRI scans and AI generation where there were gaps. However, they noted that a substantial amount of work goes into creating VR content and keeping it up to date.

Nonetheless, they emphasised the new learning opportunities immersive technology can offer: “the students can climb inside a protein and see where the drug binds and determine which acids are essential for the drug to bind. They can visualise how they could change that drug to make it bind better. Or even make a new drug."

Simulated lab experiences (HE)

Stories from the XR community

A university shared how they have been exploring the potential of simulated science labs for over a decade to enhance practical classes and address the challenges posed by large class sizes. The shift to remote learning during the pandemic accelerated their plans to develop virtual labs and training tools that simulate practical skills development in a 3D environment.

After evaluating existing content on the market, the university decided to create its own content, focusing on photorealism and AI-driven simulations that replicate real lab environments. Their virtual labs allow students to choose techniques, conduct experiments and learn from mistakes without the dangers of a physical lab. It is available in both virtual reality headsets and desktop PCs.

The university has collaborated with other institutions to further develop their simulations and has launched a non-profit startup to expand their offerings. With 200-300 VR headsets available, they plan to roll out the technology asynchronously for students to take home the headset to use in their own time, followed by synchronous sessions with tutors. The university aims to continue refining the pedagogy behind their simulations and expand into other subjects such as geography, biological sciences and engineering in the near future.

Veterinary science (HE)

Stories from the XR community

A school of veterinary science found that sourcing XR content was a challenge due to their niche focus. Therefore, they used 360-degree video scenarios on the **Wonda VR platform** to allow students to engage with realistic situations before interacting with live animals, such as cows. In one example, a dairy milking parlour scenario was created by filming the morning and evening processes over a week and a half. This immersive content captured authentic details, including unexpected events like a cow kicking and pink milk appearing, prompting students to consider their response. The school also has an equine programme and found it more effective to create their own VR resources, as some existing digital content is outdated or varies from regional practices.

Use of XR in the arts (HE)

Stories from the XR community

One university spoke to us about their use of immersive technology in their arts courses, aiming to enhance student learning experiences and foster digital literacy. Through the use of VR sketching applications like **Gravity Sketch**, students engage with philosophical concepts, theatre practices and digital performance in new ways. They are also exploring building a digital twin of the university's theatre space with **Victory XR**.

The university has invested in VR headsets and established dedicated XR innovation spaces, which are accessible to students and staff across various disciplines. This encourages interdisciplinary collaboration and experimentation. By exposing students to immersive technologies the university seeks to prepare them for an increasingly digital world. However, challenges remain, such as the need for ongoing funding to maintain and update equipment and software licences. Educators at the institution are also exploring the potential of VR for virtual global creative collaboration to encourage sustainable theatre practices.

Another university shared with us how they had participated in a research project that brought together six European partner institutions to explore the impact of the move to blended and online learning after the pandemic and whether immersive technologies could provide an accessible learning modality.

The university hosted workshops and training sessions to familiarise staff and students with VR tools and platforms, such as Quest 2 headsets and **Gravity Sketch** software. These hands-on experiences allowed participants to experiment with the technologies and consider their potential integration into the arts curriculum. For the university's Ukrainian partner institution the use of the VR headsets for learning became especially valuable, as it enabled students to continue working collaboratively together during the ongoing conflict.

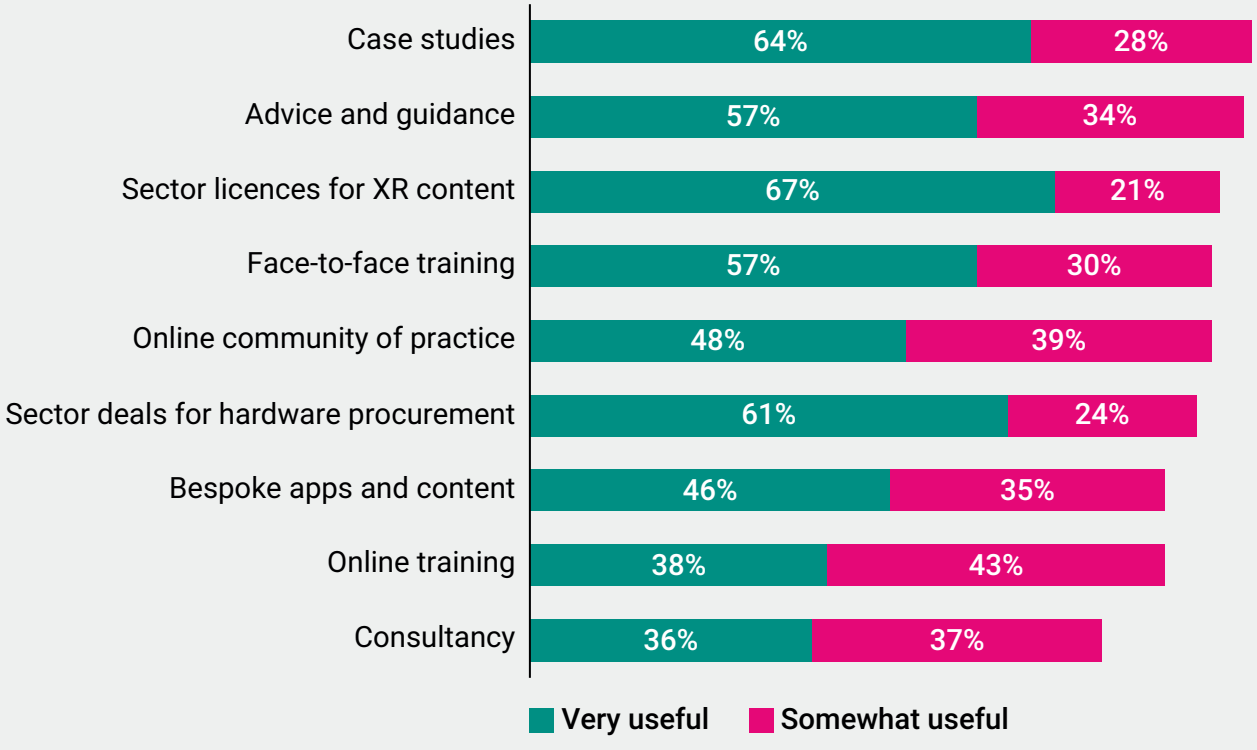
The project also emphasised the importance of collaboration and knowledge-sharing among partner institutions. By working together the universities were able to identify common challenges and opportunities through student feedback and generate resources and case studies of best practices for incorporating VR into arts and design.

What support is most desired to support implementation of XR in learning and teaching?

43% agree that they have sufficient skills within their organisation to be able to use and support XR in learning and teaching.

- Interestingly, those classified as leaders were less likely to agree that they felt they had sufficient skills within their organisation to be able to use and support XR (31%) in comparison to their practitioner counterparts (47%).
- Looking at what respondents would find most useful to support implementing XR within learning and teaching, sharing good practice, advice and access to sector deals for both hardware and software are high priority.

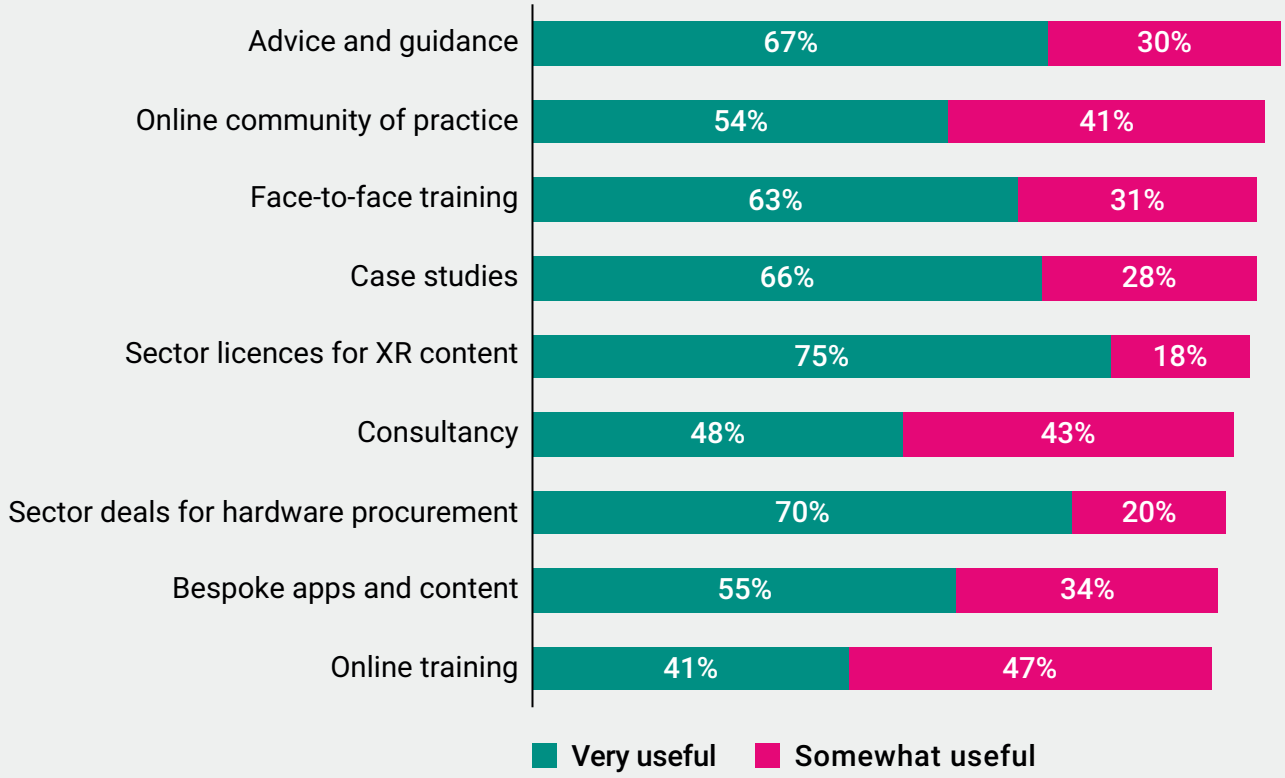
Usefulness of particular services and resources



Generalised advice and guidance on using XR most desired within FE

- Support for sector licences of content (75%) and deals for hardware (70%) were perceived to be **very** useful by the largest proportions of respondents within the FE sector. This is not surprising given cost and resourcing is a primary concern for the FE and skills sector.
- However, the most frequently selected options were things associated with guidance, community, and training. This suggests that there is still a large proportion of the sector in need of greater knowledge and fundamental learning as to how the technology can really be used effectively irrespective of availability of technologies.

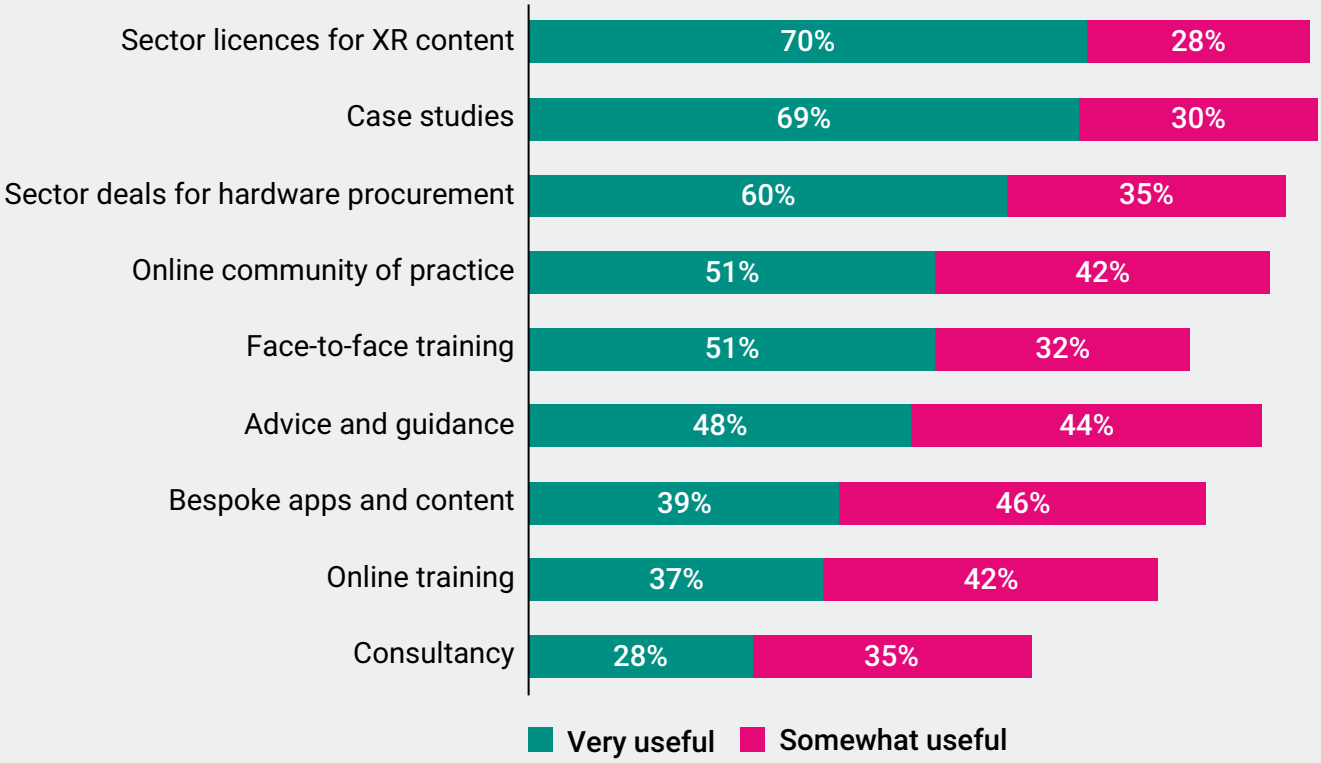
Perceived usefulness of particular services and resources by FE sector



Sector intelligence and procurement deals most useful in supporting HE

- As in FE, large proportions of respondents in HE valued sector content licences (98%) and deals for hardware (95%).
- Interestingly, respondents within HE appear to find less usefulness in personalised and engaged support, with training (79%), bespoke apps (85%) and consultancy (63%) less frequently indicated as useful services in comparison to more DIY resources such as case studies (99%) and online communities of practice (93%). This may suggest that HE organisations have the internal expertise but are interested in refining and improving use.

Perceived usefulness of particular services and resources by HE sector



The single most important thing that Jisc can do is…

133 respondents provided comments around the most important thing Jisc can do to support organisations which further highlighted that advice and guidance, reducing costs and sharing of best practice are the main priorities.

Help with costs and affordability
(36 references)

Comments are consistent with previously expressed concerns over costs, particularly with content, and a desire for Jisc to support with negotiating sector-wide deals. In line with the above, there were multiple statements indicating a need for new funding streams to develop or replace equipment and content as XR technologies advance. Also, sector-wide deals would be useful to mitigate restrictions placed on institutions by their funding providers. An additional consideration is the range of content used with one comment indicating a desire for a Jisc 'content-store' for a mix and match approach to content under one licence.

The learning, teaching and assessment portfolio within Jisc licensing, working with our strategic oversight **learning content expert group**, is focused around licence agreements to enable digital transformation, and aligning with key sector priorities, such as experiential learning and simulation.

Since 2020, working with an array of vendors, Jisc licensing has negotiated licences for a number of XR resources, including **Bodyswaps**, **Labster**, **Medical Realities**, **VirtualSpeech**, **Metaverse Learning** and **Mindscape Commons**.

All licensed solutions are set against due diligence standards and procurement requirements, including digital accessibility, technical compatibility, data protection and cyber security practices; ensuring content, delivery and pricing models are highly relevant and support sector aims.

Research and showcase best practice, case studies
(33 references)

Comments suggest that there is a need to demonstrate the value and impact that XR can have on teaching outcomes, to encourage uptake amongst faculty as well as help advocate for investment from senior management. Many comments ask for further development of sector-led scalable case studies, with a few suggestions indicating that they would like to see research done by Jisc to provide supportive evidence of the impact of XR on learning and teaching.

Since our 2019 survey, Jisc has recently published a number of **member stories** around the use of XR within forensics, healthcare and student inductions.

Provide advice and guidance
(25 references)

Responses indicate a need for advice from end-to-end showing a pathway from entry level activity (eg engaging and demonstrating senior leaders and faculty the benefits of use), through building capabilities (eg what are the best/ appropriate tools for requirements, identify courses where early adoption would be beneficial), and finally to refinement and improvement of provision (eg advice on how to scale, how to develop own content, where content can be openly sourced etc).

Currently, there is a working group within Jisc developing a toolkit around XR maturity, covering advice and guidance on strategy, accessibility and inclusion, infrastructure, pedagogy and digital capabilities and skills.

Training
(17 references)

Responses suggest a preference for face-to-face training (although a desire for online training was mentioned due to cost sensitivities) to be provided to teaching staff to help them identify where, when and how XR can best be used. There was one reference that indicated that they would like this training to be accredited.

Infrastructure and policy
(12 references)

Comments suggest that a foundation of advocacy at governmental level, investment in infrastructure (whether that be in Jisc-owned tech or funding for mass provision) and production of policies and frameworks (e.g. an XR suitability frameworks to support faculty in understanding appropriateness of implementation) across the sector would be beneficial to help standardise practice.

Facilitate communities of practice and connection with peers
(6 references)

Those who responded to this category would like opportunities to network with other institutions to discuss ideas in implementation and best practice, including potentially with industry to leverage advances made outside the sector. There was also interest in being able to collectively design and develop apps, resources and processes. One comment also referenced finding a partner or mentor institution to grow experiences.

Since March 2023, Jisc has partnered with the Association for Learning Technology (ALT) on an **XR community of practice**, which is open to tertiary education providers across the UK and hosts free termly meet-ups to share best practice.

Comments describing how Jisc can help

"Case studies focused on high (educational) quality, flexible solutions (authoring / software) that can be implemented easily, quickly, and at scale – making sure that the wider context is captured too (eg this also took 5 facilitators for every 10 students). There is so much great work going on, but a huge amount of it is not replicable in a realistic way."

Practitioner, HE

"Publications and case studies that support what practitioners already know about student engagement and positive outcomes when using XR technologies with students."

Practitioner, HE

"Networking opportunities to share ideas in advanced XR, including how industries are using XR/VR now (NHS, motor industries). How to replicate and get that into FE."

Practitioner, FE

"Licence costs. The Wales Digital 2030 purchases allow for hardware, however we become very stuck when it comes to purchasing licences and this results in a lack of effective use of the equipment."

Practitioner, FE

"Demystify, explain the difference between VR/AR/XR to the community, show a pathway from entry level activity on to more sophisticated use/uptake."

Leader, FE

"If Jisc could have a content store that we could subscribe to that contained really good content linked to the curriculum then that would be a game changer."

Leader, FE

"The production of an XR suitability checklist/framework/tool for academics to use when assessing when it's appropriate and worthwhile to use XR. Something like the Open University's '**VR Suitability Toolkit**'"

Practitioner, HE

"Grant funding – funding projects to research the impact of technologies."

Practitioner, HE

"Face to face training – staff engage with focus in face-to-face discussion thus more likely to consider and be open to new ideas, implementing tech."

Practitioner, HE

Recommendations and conclusion

Recommendation: evidence of impact

Based on the findings of this report, we recommend the following. First, to evidence the impact of using XR technologies. Although this survey finds that high levels of investment correlate with extensive use, high investment in XR technologies alone does not guarantee successful integration or improved outcomes. As cost and resourcing is a key barrier identified in this survey, alongside leaders' inclination to being more risk-averse, it is essential to ensure that when we are using this technology, we are doing so in an impactful way, and we need to think about how we are gathering evidence to demonstrate this. It's crucial to consider how we can effectively measure and demonstrate the impact of these technologies on learning and teaching.

The increased investment in, and the adoption of, XR technologies is encouraging. But institutions must also focus on developing clear strategies for integration and evaluating their effectiveness. This involves setting specific goals and objectives for the use of XR technologies, aligning them with the curriculum, and establishing metrics to assess their impact on student learning, engagement and outcomes. Institutions can do this by:

1. Conducting research: where immersive technology is used, conduct research measuring student satisfaction, confidence and comprehension of learning outcomes
2. Gathering feedback and acting upon it: regularly gather feedback from students and teaching practitioners who use XR technologies in their courses or observe lessons where the technology is used. This information can offer insights into the perceived benefits, challenges and areas for improvement
3. Monitoring use: to justify the investment made in immersive technology, it is useful to track the usage. This can be done through a number of methods such as: the number of hours XR content has been accessed, number of learners who have used the XR technologies, number of courses/ lessons where the technology has been implemented (at what scale?) and number of hours staff have booked out the equipment for
4. Sharing best practices: encourage staff to share their experiences, successes and lessons learned. This knowledge sharing can help refine best practices and guide future implementation efforts. It can also save possible duplication of efforts

Focusing on evidencing the impact of XR integration can help institutions ensure that their investments are yielding meaningful results and that these technologies are enhancing the learning experience.

Recommendation: foster collaboration

Secondly, while it is encouraging that approximately one-third of the respondents said their institution collaborates with other organisations to develop XR content and resources, there is significant potential for increased cooperation in this area. We recommend that institutions actively seek opportunities to collaborate with students, other local institutions, communities and industries to develop content. There are several reasons why this is beneficial:

1. Pooling expertise: by working together, institutions can leverage the diverse knowledge and skills of their faculty, staff and students to create high-quality, innovative XR content. It can also save duplication of similar work across multiple organisations. Collaboration can extend beyond content development to include sharing valuable insights and experiences related to evaluating XR vendors and content available on the market, helping institutions make informed decisions and navigate the rapidly evolving XR landscape
2. Sharing costs: collaborating on XR resource development or building a local consortium for content development can sometimes help distribute the financial burden associated with creating and maintaining these materials, making it more feasible for institutions with limited budgets
3. Enhancing student engagement: where possible, involving students in the creation of XR resources can provide them with valuable hands-on work experience, build their digital literacy skills and foster a sense of ownership in their learning journey
4. Addressing industry needs: working in partnership with local industries can ensure that XR resources align with real-world requirements and equip students with the skills needed for future employment

To facilitate and encourage collaboration, we recommend joining the ALT/Jisc UK XR community as a starting point for networking and building partnerships with other institutions and industry professionals interested in advancing XR in education.

Conclusion

We would like to thank all participants who took the time to complete this survey. Your insights and experiences are invaluable in shaping our understanding of the current state and future potential of XR in education.

It is encouraging to note that interest in and use of XR technologies have increased since our 2019 survey. The benefits of XR for experiential learning and developing employability and digital skills are apparent, but we must also consider the sustainability of both the high turnover of devices, especially given the cost concerns, and the preservation of XR content. Furthermore, it is crucial that we prioritise the development of accessible and inclusive content for all learners while providing alternative provisions for those who may not wish to use headsets due to motion sickness (or other reasons).

As we integrate XR technologies into education, it is essential that we adopt a student-centred approach. XR should be carefully planned and implemented to ensure that it genuinely enhances the learning experience and is not merely a gimmick or an unused resource.

Another key aspect to consider is the need for rigorous research and evaluation of XR in education. Conducting studies and gathering empirical evidence can help us to better understand the impact of XR on learning outcomes, student engagement and retention. This evidence-based approach will help inform future decisions and investments in XR technologies.

As we move forward, let's collaborate and share best practices to ensure that the integration of XR in education is not only innovative, but also equitable and sustainable.

Jisc
4 Portwall Lane
Bristol BS1 6NB
0203 697 5860

help@jisc.ac.uk
jisc.ac.uk

Extended reality in learning
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