AR and VR in learning and teaching

Survey findings

October 2019
It gives me great pleasure to share the results of Jisc’s inaugural survey into immersive technologies in teaching and learning. In what we believe is the first survey of its kind in the UK, more than 100 lecturers, researchers and learning technologists at universities and colleges told us about their experiences. The answers also provide valuable insight into their plans and aspirations for the future.

Through our dialogue with Jisc members, it has been clear that virtual and augmented reality will play a vital role in the technology-enhanced future of education – which we call Education 4.0. Immersive technologies such as these will be key in transforming teaching to meet the challenges and opportunities of the fourth industrial revolution.

The results of this survey highlight subject areas where universities and colleges see great potential to enhance teaching, learning and the student experience through immersive technologies. There are also some very helpful pointers for how we can support our members to explore the potential of emerging technology.

We really value the time and energy that the community has put into responding to this survey and we hope that you will find the results insightful.

Dr Paul Feldman
Chief executive, Jisc
Five key takeaways

Implementation of AR/VR is patchy. Most organisations use it in only one or two departments and use AR more than VR.

There is appetite for further use of AR/VR, which is seen as an important and as yet untapped technology for the future. Health, creative arts, education, engineering and architecture are identified as key subjects for HE, and sciences, construction, hair and beauty, agriculture, arts and childcare for FE.

Responses to the technology are positive. Key benefits are the immersive, engaging learning experience and the opportunity for situated/experiential learning that is not otherwise possible. It inspires innovative approaches to teaching and improves learning outcomes.

The relative infancy of the technology means there are issues with implementation, cost being the biggest barrier. It is also difficult to scale when access to equipment is limited. Sector licenses and negotiated deals would be welcomed to help with this.

There needs to be a better understanding of how AR/VR can be used for education and its impact. Organisations need advice and guidance about best practice and are keen to learn from peers and to develop communities of practice in order to embed the technology more widely. Case studies, facilitation of community and advice and guidance would help the sector with these issues.
Background

We are exploring how universities and colleges use immersive technologies (AR/VR) for learning and teaching so we can better understand how members are working with – or would like to work with – these technologies, and how they would like us to support them.
We distributed an online survey in July 2019 and received 101 responses. The majority were from higher education institutions in England. Where relevant in these findings, differences in HE and FE responses are highlighted but the relatively low FE response should always be born in mind.

Q1: What is the name of your institution. (n=84)  
Q2: Which of the following best describes the sector you work in? (n=101)  
Q3: How would you best describe your role within your organisation? (n=100)  
Q4: Please tell us your job title (n=85)
Use and implementation of immersive technology

Rather than being widespread throughout organisations, immersive technology seems to be embedded in pockets, with 54% of responses suggesting that it is mostly used in one or two departments or faculties. Only 12% said that the technology is used in more than five departments or faculties, with slightly more FE responses selecting this option.

Most of those who responded implement a mixed model approach, developing some resources in-house and buying some from external providers. In-house development of content and resources was the second most popular option.
Q5: Please tell us how much your organisation is working with AR/VR? (HE n=74, FE n=14, NB. low response from FE, ‘don’t know’ excluded)
### How AR/VR is implemented within organisations

**Q6: How is AR/VR implemented within your organisation? (n=84 NB. low response from FE)**

<table>
<thead>
<tr>
<th>Method</th>
<th>HE</th>
<th>FE</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed model</td>
<td>35</td>
<td>7</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>Develop our own content and resources in-house</td>
<td>35</td>
<td>4</td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>Collaborate with other organisations to develop content and resources</td>
<td>25</td>
<td>2</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>Buy AR/VR content and resources from an external provider</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Don’t know</td>
<td>7</td>
<td>1</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

*Overall response calculated as a % of those that answered this question (n=84)*
There is a strong interest in immersive technologies in both HE and FE, with 82% selecting 4 or 5 on the scale (where 5 = very interested in making more use of AR/VR). Those who responded from FE expressed a stronger interest, with all 14 organisations selecting 4 or 5. Organisations currently making the greatest use of AR are most interested in further use.

Q9: Looking ahead, how interested would your institution be in making more use of AR/VR? (Overall n=97 (HE n=77, FE n=14) NB. low response from FE, ‘don’t know’ excluded)

Current user’s future interest % 4 or 5
Not used at all 88%
Used in one or two departments/faculties 78%
Used in three-five departments/faculties 83%
Used in more than five departments/faculties 100%
Rationale for level of interest

Sample of comments from those who expressed interest level 1-2 (1=not at all interested) (3 comments, all HE)
Comments at the lower end of the scale refer to staff readiness and institutional priorities, suggesting that investment in technology in its infancy is unlikely to be granted high priority at present.

“It has its place but investment elsewhere is expected to have greater and wider impact in the near term.”
Lecturer, HE

“The tech is not there yet and I think we need to get beyond using Moodle as a dumping ground before doing anything else.”
Practitioner, HE

Sample of comments from those who expressed interest level 3 (11 comments, all HE)
Comments in the middle of the scale express interest in the potential and suggest that evidence from existing implementations has resulted in a growing interest and a desire to build on work to date. However, low understanding, prioritisation and high costs have resulted in a lack of management support for some.

“There is well-embedded use in a few programme areas, such as psychology, graphics/games design etc, and as much as we'd like to see it adopted wider I think the perceived costs and learning curve etc are prohibitive. We're also starting from a low place in terms of staff digital capability and knowledge or understanding of tech such as this.”
Manager, HE
Sample of comments from those who expressed interest level 4-5 (5=very interested)
(75 comments, 13 FE and 57 HE)
At the top end of the scale, comments are positive and express enthusiasm for the ability of this technology to improve the student experience and offer the opportunity for good quality experiential learning. This group see AR/VR as important technology for the future and can see untapped potential within their organisations.

“We see a steady increase in the number of courses now using the AR/VR kits we have developed for curriculum use. As more content becomes available we can increase this to more areas with relevant content.”
Manager, FE

“It’s where all content will be going. We also use mixed reality.”
Manager, FE

“We have identified areas of our online distance learning courses that could utilise technology such as AR/VR to help provide a more engaging and immersive experience for our students. Research shows that the use of such technologies can help increase retention levels.”
Practitioner, HE
The main benefits of using AR/VR

The two biggest benefits were seen as the immersive and engaging learning experience that AR/VR can offer, and the fact that it can give students access to situated/experiential learning that would not be possible in traditional classroom settings. The comments suggest that it inspires innovative approaches to teaching, improves the acquisition and retention of skills and encourages empathetic learning.

Q7: What do you consider to be the main benefits of using AR/VR? (n=79, open question)
What are the benefits?

NB. All comments coded thematically. Numbers represent the number of references to each theme.

- Immersive and engaging learning experience: 32
- Supports situated/experiential learning not possible in traditional classroom settings: 28
- Improves learning outcomes: 8
- Encourages use of new technology: 8
- Encourages new pedagogical models: 6
- Supports empathetic learning: 6
- Engagement/outreach: 3
- Sustainable: 2

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What you said about the benefits

“It is an immersive way of learning. You can get a front row seat in a learning experience (and everyone can have the same experience) and have a completely different viewpoint that you would never have in real life.”
Practitioner, HE

“Giving students those “in someone else’s shoes” experiences that can’t be replicated in other ways.”
Practitioner, HE

“It enables practical application and testing of theories and procedures in a safe and usually a cost effective manner. Depending on the method used you can use it 1:1 or with groups of individuals. It engages users more immersively to give a more realistic learning experience than passive methods alone.”
Lecturer/Teacher, HE

“A adoption and use of emergent technologies enables us to be prepared, and match expectations, as platforms mature into more widely used technologies.”
Senior Manager, HE

“Giving the students the best experience by simulating situations and putting them through scenarios similar to real life to enhance their skills and reactions in some difficult situations.”
Manager, FE

“Ability to do and experience things otherwise unable due to cost, health and safety etc.”
Lecturer/Teacher, FE
“Ability to immerse students in an environment that they might not otherwise have the opportunity to experience, to enhance learning by using immersive technology rather than flat books or computer screens.”
Librarian, FE

“The benefits of AR/VR are that the possibilities are endless. AR/VR can be used for a myriad of purposes from educational and wellbeing to entertainment and real life experiences in places that some users may never get to visit. AR/VR is the next logical step in learning and its implementation and inevitable development cannot come soon enough.”
Practitioner, FE
Issues in implementing AR/VR

Costs are the main challenge highlighted, with the price of hardware, software and implementation all mentioned. The lack of specialist support and skills, and the limited understanding of how AR/VR could be used, are also key issues. Access to equipment is a concern, both in terms of enabling access to headsets and devices for large groups and the ability to purchase appropriate equipment, software and content.

Q8: Have you encountered any issues or challenges when implementing AR/VR? (n=76, open question)
What are the challenges?

NB: All comments coded thematically. Numbers represent the number of references to each theme.

- Costs
- Lack of specialist skills/support
- Limited understanding of the potential for educational use
- Availability of suitable equipment/software/content
- Enabling access to devices and equipment
- Infrastructure/storage
- Long development time
- Limitations and (im)maturity of the technology
- No management buy-in
- Lack of dedicated space
- Motion sickness
- Reticence
- Accessibility

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Challenges in more detail

**Costs**
- The hardware and software associated with AR/VR are often prohibitively expensive, especially for VR. This means that organisations struggle to make equipment and devices available to whole cohorts of students and scalability becomes an issue. In some cases, the inability to purchase VR headsets forces a focus on AR.
- Availability of appropriate, affordable software is also highlighted as a challenge, with organisations struggling to know where to make the best investments.

**Skills and support**
- As AR/VR is not embedded across organisations, knowledge and expertise can be lacking or exist in pockets. There are skills gaps in both technical expertise and understanding the pedagogical applications for AR/VR.
- This can be exacerbated by the limitations of the technology as expectations sometimes don’t equal reality.
- Overall, the expense, skills gaps, lack of evidence of impact and infancy of the technology can lead to a lack of buy-in and investment from senior leadership.

**Infrastructure**
- Access to dedicated space (with support), storage for large files and reliable wifi are all needed for successful implementation of AR/VR, and all are identified as barriers.
What you said about the challenges

“The department I work for creates online distance learning. The use of VR isn’t practical as not all students studying online will have access to a VR headset. Although headsets are becoming more affordable over recent years, they are still not as common in households as other tech such as computers, games consoles, smartphones and tablets. However, most students will likely have a smartphone; because of this we have decided to focus on technology such as AR which can still provide an engaging and immersive experience to students without the need for purchasing extra equipment. But even the use of AR has not been without its challenges. The main obstacle we currently face is the lack of good quality training available for staff.”
Practitioner, HE

“The barriers seem to be a lack of understanding of how AR/VR can be used. Which courses is it most suited for? Are these projects too big / complex / expensive to get off the ground?... To spend time developing AR/VR is likely to take resources away from many of the smaller ‘day to day’ materials we develop that support a wide range of teaching. Are the benefits of AR/VR strong enough to justify this? Would AR/VR elements in our courses make the rest of the teaching material appear dull and dated?”
Learning Technologist, HE

“The availability of equipment for large cohorts is a challenge. Using free software (eg Blippar) to create AR experiences is also limiting in that apps can be reliant on wifi, or cannot be standalone.”
Learning Technologist, HE
“Admin access issues – equipment has to go through IT which means they then add admin rights to it and therefore whenever we want to download anything or update the software we need to wait for an IT member of staff to come down and do it for us, which can take from a few days to weeks before anything gets done. Equipment access – access to a VR capable computer – has been challenging. When I took the post here, the college had previously purchased HTC Vive equipment which is obviously high spec but it requires specific computers to be fully utilised. It also requires a room to set up the base stations and with a college already tight for room allocation this isn’t a great option. Some other departments are using Oculus Go which, although inferior to the HTC Vive’s capabilities, is far superior in terms of accessibility, freedom and usability.”
Manager, FE

“Some of the high-end hardware can be expensive and we can’t afford to give it to classes of ten+. They will have to be divided into groups.”
Manager, FE
Subject areas: summary

For both HE and FE, more organisations are working with VR than AR.

Within HE, **STEM subjects have the highest levels of AR/VR use**, with computer sciences, health, engineering, medicine and dentistry, and physical sciences being the most selected options. This could be related to skill sets being higher within STEM areas, higher interest in technology or demand and it would be interesting to explore this further.

However, **arts and humanities are emerging as subject areas most likely to benefit from AR/VR**, with health (41), creative arts (38), education (38), engineering (34) and architecture (33) as the most selected options.

With fewer responses, **the data related to FE subjects are less informative**. However, a number of subject areas are highlighted as being likely to benefit from AR/VR, with sciences, construction, and hair and beauty receiving the most responses. Again, responses suggest that more subjects are working with VR than AR. Computer sciences (7) and engineering (6) are among the most selected subjects.
## Subjects (HE)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Currently using AR</th>
<th>Currently using VR</th>
<th>Would benefit from AR/VR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and subjects related to medicine</td>
<td>16</td>
<td>26</td>
<td>41</td>
</tr>
<tr>
<td>Creative arts and design</td>
<td>5</td>
<td>10</td>
<td>38</td>
</tr>
<tr>
<td>Education</td>
<td>4</td>
<td>5</td>
<td>38</td>
</tr>
<tr>
<td>Engineering and technology</td>
<td>14</td>
<td>21</td>
<td>34</td>
</tr>
<tr>
<td>Architecture, building and planning</td>
<td>9</td>
<td>12</td>
<td>33</td>
</tr>
<tr>
<td>Physical sciences</td>
<td>10</td>
<td>13</td>
<td>32</td>
</tr>
<tr>
<td>Medicine and dentistry</td>
<td>11</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>Historical and philosophical studies</td>
<td>4</td>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>Business and administrative studies</td>
<td>6</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Veterinary science</td>
<td>3</td>
<td>3</td>
<td>24</td>
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<tr>
<td>Languages and literature</td>
<td>1</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>Law</td>
<td>0</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>Computer sciences</td>
<td>17</td>
<td>28</td>
<td>22</td>
</tr>
<tr>
<td>Mass communications and documentation</td>
<td>2</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Social studies</td>
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<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Mathematical sciences</td>
<td>0</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>Agriculture and related subjects</td>
<td>0</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Combined and general studies</td>
<td>0</td>
<td>0</td>
<td>11</td>
</tr>
</tbody>
</table>
## Subjects (FE)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Currently using AR</th>
<th>Currently using VR</th>
<th>Would benefit from AR/VR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sciences</td>
<td>1</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Construction and built environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hair and beauty</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Agriculture, horticulture and animal care</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Arts</td>
<td>1</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Childcare and education</td>
<td>0</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Computer science and IT</td>
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<tr>
<td>Engineering</td>
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<td></td>
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<tr>
<td>Health and social care</td>
<td>1</td>
<td>3</td>
<td>8</td>
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<tr>
<td>Social sciences</td>
<td>1</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Sport and nutrition</td>
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<tr>
<td>Media studies</td>
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<td></td>
<td></td>
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<tr>
<td>Public services</td>
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<td></td>
<td></td>
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<tr>
<td>Catering, hospitality and tourism</td>
<td>1</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Mathematics</td>
<td>0</td>
<td>1</td>
<td>7</td>
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<tr>
<td>Politics, economics and law</td>
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<td>Humanities</td>
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<td>2</td>
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<tr>
<td>Languages and literature</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Business, management and office studies</td>
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</tbody>
</table>
Turning to what members would find most useful from Jisc, sharing good practice, advice and access to sector deals are high priority for members that responded. Case studies are rated useful by 96%, and advice and guidance by 94% of responders, indicating that members would like direction and information. Community of practice is preferred with formal consultancy rated the least useful of the options.

While the creation of bespoke apps and content by Jisc was seen as useful by only 68%, access to sector licenses for software was the third highest-rated option (92% useful), and deals for apps and content was rated useful by 82%. This suggests that in-house development and access to good quality content would be of interest.

Q14: How useful would the following be for you? (NB. Non-mandatory question, base sizes for each option range from 90-96)
## Working with Jisc by sector (HE)

<table>
<thead>
<tr>
<th>Service</th>
<th>Very useful</th>
<th>Somewhat useful</th>
<th>Not too useful</th>
<th>Not at all useful</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case studies</td>
<td>74%</td>
<td>22%</td>
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<td></td>
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<tr>
<td>Advice and guidance</td>
<td>56%</td>
<td>36%</td>
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</tr>
<tr>
<td>Sector licences for AR/VR software</td>
<td>66%</td>
<td>25%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sector deals for hardware procurement</td>
<td>63%</td>
<td>26%</td>
<td></td>
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</tr>
<tr>
<td>Online community of practice</td>
<td>40%</td>
<td>47%</td>
<td></td>
<td></td>
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<tr>
<td>Sector deals for apps and content</td>
<td>51%</td>
<td>28%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Face-to-face community of practice</td>
<td>21%</td>
<td>57%</td>
<td></td>
<td></td>
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<tr>
<td>Face-to-face training</td>
<td>32%</td>
<td>42%</td>
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<td></td>
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<tr>
<td>Online training</td>
<td>34%</td>
<td>36%</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Bespoke apps and content</td>
<td>33%</td>
<td>33%</td>
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<td></td>
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<tr>
<td>Consultancy</td>
<td>16%</td>
<td>40%</td>
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</tbody>
</table>

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<table>
<thead>
<tr>
<th>Service</th>
<th>Very useful</th>
<th>Somewhat useful</th>
<th>Not too useful</th>
<th>Not at all useful</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advice and guidance</td>
<td>85%</td>
<td>15%</td>
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<tr>
<td>Sector licences for AR/VR software</td>
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<tr>
<td>Sector deals for hardware procurement</td>
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<td>Sector deals for apps and content</td>
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<td>Case studies</td>
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<tr>
<td>Online community of practice</td>
<td>85%</td>
<td>8%</td>
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<tr>
<td>Bespoke apps and content</td>
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<td>Online training</td>
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<tr>
<td>Face-to-face community of practice</td>
<td>62%</td>
<td>23%</td>
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<tr>
<td>Consultancy</td>
<td>54%</td>
<td>23%</td>
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</tbody>
</table>
The most important thing that Jisc can do is...

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

Q15: What is the single most important thing we could do to support your institution? (n=74)

Showcase best practice, case studies (18 refs)
Comments suggest a need to demonstrate impact, to make people aware of the potential for AR/VR and to provide evidence that will help advocate for investment from senior management. Three comments also ask for case studies to be based in reality as the technology can be seen as unattainable by some.

Help with costs and affordability (15 refs)
Comments reference a desire for the negotiation of deals and help with procurement of cheaper headsets and software. The pace of change and obsolescence also cause problems here, as respondents are unsure what to buy to ensure longevity and struggle to keep up with the pace of change.

Provide advice and guidance (13 refs)
Responses suggest a need for advice around how to implement the technology, how to use it effectively for learning and teaching, the benefits of use and guidance around the pros/cons of available equipment and software. A further four comments request help and support with setting up AR/VR and with content creation.
Facilitate communities of practice and connection with peers (12 refs)

Those who responded in this category would like the opportunity to network, connect with peers and discuss best practice around issues such as learning and teaching, implementation and platforms.

Training (7 refs)

Responses suggest a mixture of preference for online and face-to-face training to help people create their own content and decide when/where it might be appropriate to use AR/VR.

Content development and authoring tools (5 refs)

References to access to tools or content that would make it easier to create or implement AR/VR.

Funding (5 refs)

References to access to funding to develop/replace resources and content.
What you would like from Jisc

“Demonstration and procurement of software that would be useful. It changes too fast to keep track of such a diverse subject base.”
Lecturer/Teacher, FE

“Case studies that we can use to lead on adoption of these technologies in other areas.”
Manager, FE

“Awareness of benefits and implementing into curriculum.”
Manager, FE

“Getting it established as a serious educational/wellbeing tool contender. Provide support with academic writing/reports based around findings from trials.”
Practitioner, FE

“I think creating face-to-face training of AR/VR for people to ask questions and to show people how it works so that different disciplines can decide how and when it is suitable to use this technology.”
Lecturer/Teacher, HE

“The development of AR/VR tech and content will be entirely dominated by the entertainment industry. Work is being done to counter this (see especially Limina). I think we need to collectively settle on a platform, develop communities of practice around all of the (complex) aspects that go into making AR/VR happen, and work together to create a genuinely capable and distinct immersive tech in education ecosystem.”
Practitioner, HE
“Networking. AR/VR is in its infancy and we’re all just pressing buttons until it works, really. The more people pressing buttons together, the faster we can bring the technology and usage along. Leadership, Medical Education.”
Practitioner, HE

“Negotiate with vendors to reduce costs for bulk purchases - as per Educase licenses for HEIs.”
Learning Technologist, HE

“Making this affordable. The hardware is costly and needs to be replaced often to remain current and capable. Any cost savings that can be made would surely benefit us most greatly. We have a lot of expertise so the advice and support etc... is not such a concern.”
Senior Manager, HE
Conclusions and next steps

We're grateful to everyone who took the time to respond to this survey, and to our friends at the Universities and Colleges Information Services Association (UCISA), the Association for Learning Technology (ALT) and the Heads of e-Learning Forum (HeLF) for supporting this work. I'd also like to extend my personal thanks to Lisa Charnock from the Jisc insights team, who has led on this project and corresponded with many of the respondents.

We have been working with Jisc members for several years now in helping university and college staff launch VR and AR projects at their institutions. It is clear from the results of this survey that there is an appetite for much more in the way of advice and practical assistance from Jisc.

We have already begun to put this in place, introducing new training opportunities, developing case studies with institutions at the leading edge of practice and creating opportunities for interested parties to meet in person.

Looking ahead, I am keen to see how we at Jisc can help our members embed immersive technologies in teaching and learning practice. Our AR/VR project will pilot a range of potential new Jisc services such as 3D scanning, providing access to equipment and expertise.

To find out more and get involved, please visit ji.sc/ar-vr-project or get in touch at innovation@jisc.ac.uk

Many thanks to Myerscough College, Grimsby Institute of Further and Higher Education and the University of Sheffield Robotics Lab, whose work is featured in the photos in this booklet

Martin Hamilton, Futurist, Jisc