Construction Virtual Environment Resource Training Project
Project Summary and Product Report

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Main Contact: Julie Evans,
Project Manager,
Construction Wales Innovation Centre,
University of Wales Trinity Saint David,
Swansea
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The Partners

Project Summary

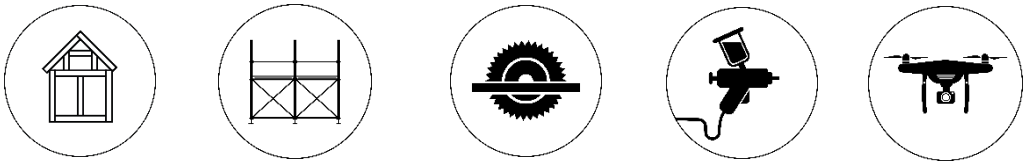
Introduction

This report highlights the success of the UK-wide initiative CONVERT, which aimed to create engaging, safe, and innovative educational resources for educators and training providers in the construction industry.

Led by industry experts, this ambitious project involved the use of virtual and immersive technologies to develop immersive learning resources. The initiative resulted in the creation of three new programmes that offer educators resources that closely replicate real-life construction scenarios.

Additionally, four simulators were collaboratively developed - two for wood machining and two for paint spraying – these were to facilitate hands-on training in a safe and controlled environment.

Despite some challenges encountered by our partners due to the COVID-19 pandemic, we express our gratitude for their collective efforts and contributions towards the success of this project. We hope that this report inspires further innovation in the construction industry and promotes a culture of continuous learning among educators and training providers.



Background to the Strands

The four different training strands developed through the CONVERT initiative are designed to provide learners with a comprehensive understanding of various aspects of the construction industry. These strands are underpinned by awareness related to Building Technology, Working at Height, Health and Safety, and Equipment Use.

These are:

Virtual Built Environment Element Explorer (VBEEE) commissioned by CONVERT via Construction Scotland Innovation Centre and developed by Digitalnauts.

Students from Coleg Cambria using VBEEE to understand how buildings are made.

The Building Technology strand (VBEEE) focuses on building design and modelling, providing learners with the skills and knowledge needed to create detailed digital models of buildings. This strand is particularly useful for architects, engineers, and other professionals involved in building design.

Working at Height/Scaffolding commissioned by CONVERT via Altrad UK and internally developed.

Staff at Bouguyes attend a Safe Start event and trial the Working at Height programme.

CONVERT VR being experienced in Portcullis House, Westminster with our partners from London Borough of Waltham Forest.

The CONVERT initiative supports **Working at Height** by providing learners with immersive learning resources that simulate real-life scenarios involving working at height. By utilizing virtual and augmented reality technology, learners can experience these scenarios in a safe and controlled environment, allowing them to practice their skills and knowledge before applying them in real-life situations.

Wood-Ed (Wood Machining simulator) commissioned by CONVERT via CWIC and developed in collaboration with Mimbus, France.

A trainer the trainer session using the Wood-Ed simulator with college staff.

Simspray commissioned by CONVERT via CWIC and developed in collaboration with Mimbus, France

Industry based use from a joinery business undertaking coating and finishing CPD via Simspray.

The CONVERT initiative supports woodworking machines and paint spraying by providing learners with two hands-on immersive training solutions. The initiative developed four simulators - two for wood machining and two for paint spraying - to facilitate this hands-on training in a safe and controlled environment.

The **Wood-Ed** simulator, developed in collaboration with Mimbus, France, is a wood machining simulator that allows learners to practice their skills on virtual woodworking machines. Similarly, the **Simspray** simulator, also developed in collaboration Mimbus, France, is a paint spraying simulator that allows learners to practice their skills on virtual paint spraying equipment.

By utilizing these simulators, learners can gain valuable experience and confidence in using woodworking machines and paint spraying equipment before applying their skills in real-life scenarios.

Rotorpilot (Drone Surveying for Construction) commissioned by Kier Construction and development by Vmach Media.

CITB Staff visit for a CPD training session at CWIC. Learning about the use of drone piloting for construction use.

The CONVERT initiative supports drone use by providing learners with training in drone surveying for construction through the Rotorpilot module. This module was commissioned by Kier Construction and developed by Vmach Media.

The Rotorpilot module provides learners with an understanding of how drones can be used in construction, including surveying, mapping, and inspection. The module covers topics such as drone safety, regulations, and best practices for drone use in construction.

By utilizing this training resource, learners can gain valuable experience and knowledge in using drones for construction purposes before applying their skills in real-life scenarios.

Project Methodology

Phase 1:

1. Establishment of a Project Team.
2. Established a steering / governance group.
3. Collaborative content creation.
4. Procurement Phase
5. Pilot phase
6. Hub Development Phase

Phase 2:

1. Delivery Phase

Phase 1 Overview

The CONVERT project was conducted in two physical stages. The first stage, which took place between February 2019 and February 2020, involved the establishment of a steering group and the signing of agreements with the Regional Delivery Partners (RDHs).

During this stage, software programs were developed that provided end-users with training in specific areas, such as working at height and scaffolding, drones in construction, and construction technology.

The development of these resources was informed by feedback from education and industry partners, gathered through consultation with the Strand Development Group, which included several education and training experts. In total, 26 modules were

developed in collaboration with industry partners and installed onto laptops and headsets.

After the purchase of the hardware, the software programs were enabled onto the laptops and headsets at CWIC, each were given a unique identification number and recorded on a central CONVERT database.

Partners were provided with an extensive set of equipment, including laptops, Oculus Quests, HP Reverb headsets, drone controllers, and COVID 19 / Lens cleaning wipes. CWIC provided training to staff via the Phase 1 Pilot on how to set up and use the equipment, this was facilitated by core CONVERT staff at all RDH's.

Phase 2 Overview

The second stage of the project focused on the use of these resources to deliver training to students in construction-related subjects at further and higher education levels. The project was also of great interest to secondary school teachers of GCSE and A-Level Construction and the Built Environment qualification, particularly in Wales.

The use of CONVERT resources was also welcomed by industry as a new means of engaging with their stakeholders and was also utilised by companies for training purposes. (See Akzo Noble case study ANNEX 1)

Project Reporting

CWIC held quarterly virtual steering group meetings to discuss project progress, equipment matters, monitoring Key Performance Indicators (KPIs) related to the progress of learners being trained using the resources, and marketing.

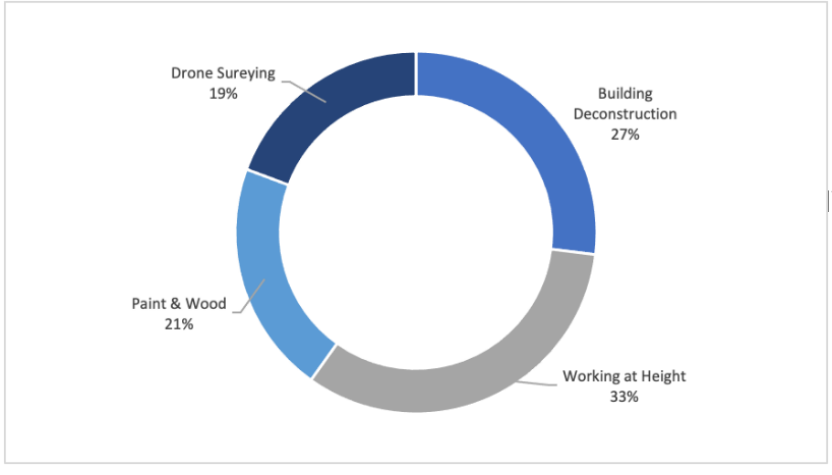
KPIs were collected through a project management platform known as Smartsheets, which also provided an opportunity for feedback from users. Feedback was stored in separate folders for each partner, which allowed the project lead (CWIC) to monitor progress and make improvements as necessary. (See separate Feedback Sheet ANNEX 2).

Feedback was invited from 3 sources; a) Learners, b) Project Partner, c) Industry.

Partners were also asked to record any engagement other than training i.e. careers days, open days, visits to schools etc using an Outputs Sheet so that we could gauge the breadth of activity delivered by the project.

The following charts illustrates how the learning resources have been utilised between the partners and begin with the percentage and number of learners who used the resources.

Learners by Resource %

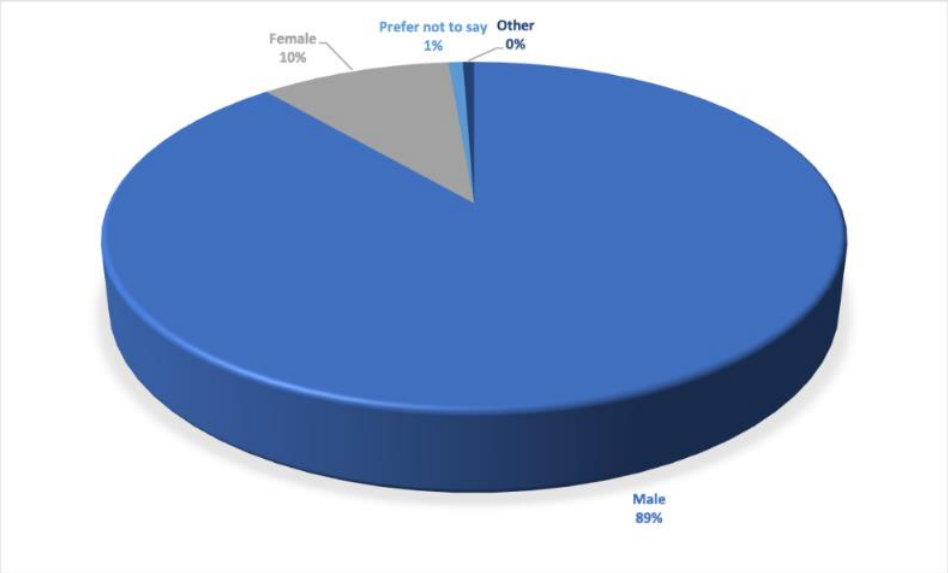


Number of learners per resource trained including industry.

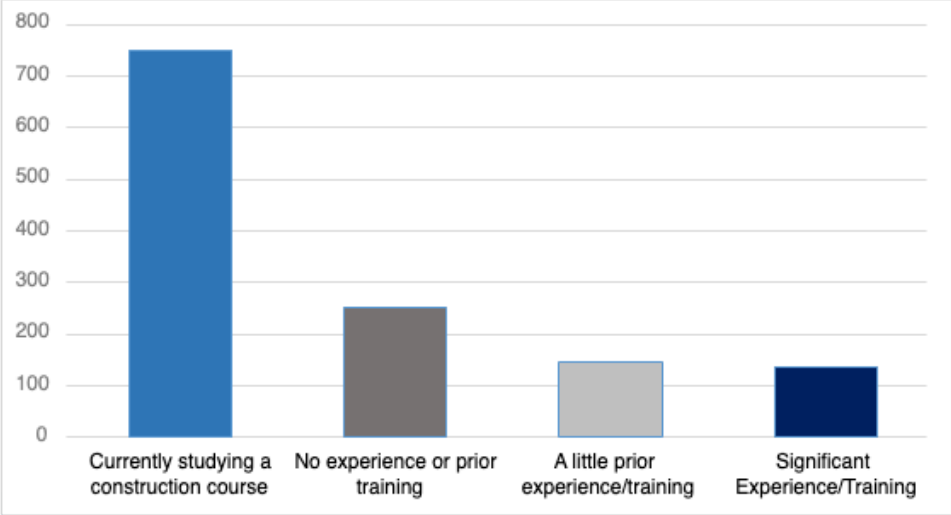
ing Deconstruction	470
Working at Height	574
Paint & Wood	363

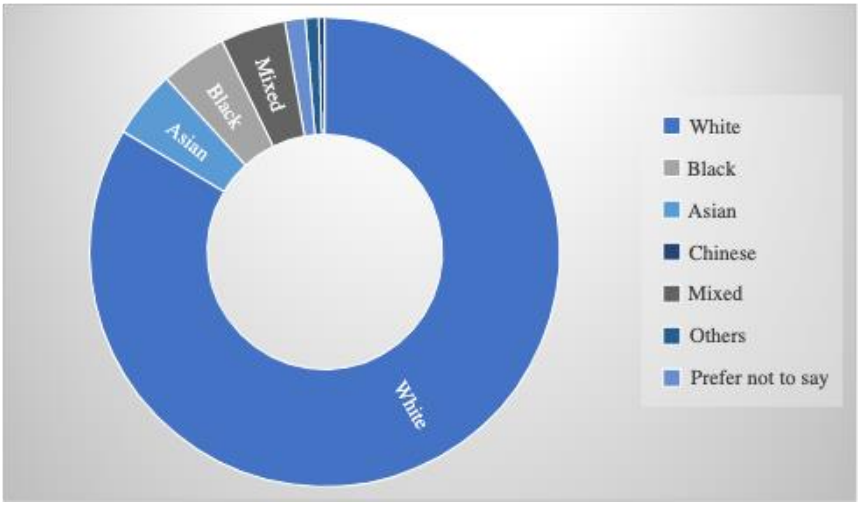
Learners by sex

Drone Surveying	315
Total	**1722**



Learners by experience





[Aims & Objectives]

CONVERT, amongst other pilot CITB projects, was funded to [further] test the efficacy of using immersive technology (VR & AR) to accelerate and enhance learning amongst people joining the construction industry. It followed the publication of CITB's 'A New Reality: Immersive Learning in Construction.'

Its objectives were to;

- Provide new learning opportunities to +2,440 further and higher education students studying construction-related subjects.
- Reduce error, accident, time and costs through the targeted use of immersive learning in education and the workplace.
- Provide employers with cost-effective, scalable training that enhances safety and productivity.
- Provide a more engaging way of learning about construction that's safe.
- Enhance the appeal of the industry to new learners.

Summary of Budget & Funding Sources

Quarter	CITB	Match
Y1Q0	240,600	103,114
Y1Q1	177,708	76,160
Y1Q2	282,865	121,227
Y1Q3	174,409	74,746
Y1Q4	122,161	52,354
Y2Q0	30,985	13,729
Y2Q1	50,519	21,651
Y2Q2	64,167	27,500
Y2Q3	109,770	47,044
Y2Q4	152,881	65,520
Y3Q1	7,950	3,407
	1,414,015	606,452

What worked well?

- CONVERT has been CITB's first truly collaborative, UK-wide project that has enabled industry, educators, training providers and learners to benefit from involvement in a new way of delivering construction education.

- CONVERT has been welcomed across a variety of education institutions, including FE, HE and Private Training Centres.

- CONVERT delivered 206 training sessions and 72 engagement events.

- From these 206 events, CONVERT delivered to 1722 learner beneficiaries and 1,170 engagement beneficiaries.

- CONVERT has enabled the distribution of circa £600,000 worth of Immersive Learning hardware and software to 6 Regional Delivery Hubs.

- We were invited to attend the British Woodworking Federation's Annual conference in 2022 and have been invited to return in June 2023 with our WoodEd and Simspray

simulators. We have also introduced CONVERT to visitors at several skills shows in Birmingham, Edinburgh and Cardiff.

- CONVERT has even entered prison. CONVERT has been introduced into HM Prison Swansea where inmates on parole have been using the Working at Height programme as well as Simspray to improve their employability for work in the construction industry. Staff at the prison established an employability hub where prisoners are being supported in their return to the community.

- The RotorPilot training programme has been used extensively by the surveying lecturers as part of their Technology in Surveying provisions, and by the School of Built and Natural Environment where the use of drone technology in these sectors is growing significantly. The software has proven to be invaluable as part of the pre-training and preparation for staff obtaining their Drone Pilot license qualifications, allowing them to gain a good level of competency in the flight controls of drones in a safe, risk-free environment before attempting to fly a real drone. Subsequently, we have not seen any damage to our physical drone equipment during the typically fraught first few flight hours that we would have expected prior to the introduction of the RotorPilot pre-training.

  8 roofing companies also attended training sessions at CWIC and at the Wales National Roofing Training Centre and found Rotorpilot to be a useful introduction to the concept of using drones for inspection purposes.

- VBEEE has been used enthusiastically by our Architecture lecturers both within their teaching provisions but also as part of their outreach and engagement initiatives.

- The project has been well received by educators and has grabbed the attention of younger learners as it engages them in discussions about pursuing various careers in construction. Wates Construction loaned equipment from our partner in London for a month of engagement and recruitment activities and has reported that they have been overwhelmed by the interest from young people. RotorPilot, especially has brought greater awareness to young learners about some of the lesser-known roles and expertise that are required within the construction industry.

- The resources have proved (and continue to prove) to be of significant interest to staff who work on industry's social value objectives. Equipment has been regularly loaned for use at events such as careers fairs and site open days. This exposure has generated great interest from the wider industry as well as sparked interest in the use of the equipment for CPD.

- The availability of the resources on a free-to-loan basis has served to increase the usefulness of VR to the wider industry for CPD and training far beyond what we would have been able to achieve on our own

What didn't work as well?

Problem: ***Encountered partner changes during initial months of project.***
Implemented factors to mitigate impact:

- Equipment redistribution
- Staff training
- Contract issuance

- Promptly adjusted to developments and proceeded with project implementation.

Problem: **Operational issues with wood machining simulator.**
Implemented factors to mitigate impact:

- Necessitated return to Mimbus in France
- Successfully leveraged other simulators for events and training purposes.

Problem: **Incidental technical concerns with VR headsets and laptops**
Implemented factors to mitigate impact:

- Comprehensive instructional and troubleshooting guide provided by project technician. (see Annex 3)
- Technician remained accessible online for support.

Problem: **Regular discussions on creation of case studies in steering group meetings**
Implemented factors to mitigate impact:

- No submissions received from delivery partners
- Optimistic and open to receiving future contributions

Problem: **Delivery outputs from partners exhibited variance**
Implemented factors to mitigate impact:

- Challenges encountered by some stakeholders in achieving objectives. Impact on Education and Events due to COVID-19.
- Delayed entry of City College Plymouth may have disadvantaged them in output attainment.

Future Recommendations

Qualifications, Education and New Partners

To further enhance the value of CITB's investment in CONVERT, it is recommended that **the immersive resources be aligned with relevant construction qualifications** at all levels, ranging from GCSE to Degrees. This would lend more credibility to the project and its outcomes. During the delivery phase of the project, discussions were held with City & Guilds regarding the use of CONVERT for underpinning "constructional digital technology," but a conclusion has yet to be reached. In addition, CWIC is a member of the British Association for Construction Heads (BACH), which could potentially add value to the VR resources for college staff.

The Regional Delivery Hubs have all recognised the importance of continued use of CONVERT resources in their future business proposals, whether it is for specific units related to construction technology or for health and safety purposes. We would be happy to share these proposals with interested parties.

Efforts are underway to widen the distribution of available resources to enable additional construction training providers, such as the National Construction Colleges in Scotland, Kent, and Norfolk, to offer VR training to students.

	Partner	MSI Laptops	Quest 1	HP Reverb	RotorPilot Controllers
CWIC	Construction Wales Innovation Centre	3	33	13	10
LCB	Leeds College of Building	5	12	5	2
CCP	City College Plymouth	5	12	5	10
CC	Coleg Cambria	5	12	5	2
ESP	Energy Skills Partnership (Scotland)	5	16	5	2
LASC	London Academy of Sustainable Construction	2	5	1	1
B&T	Bridgewater and Taunton College	2	3	2	2
NCC	CITB National Construction College	3	7	4	1
Total		**30**	**100**	**40**	**30**

The expanded list of RDH's is currently:

- ESP in Scotland (sharing equipment with 25 colleges)
- City College Plymouth
- Coleg Cambria
- London Academy of Sustainable Construction
- Leeds College of Building

Expansion to
- Bridgwater & Taunton College
- National Construction College Bircham Newton
- National Construction College Scotland
- National Construction College Kent

Software sharing in progress with

- Neath & Port Talbot College
- Coleg Sir Gar

With plans to contact all FE colleges in Wales.

Industry Engagement and Utilisation

Industry engagement has been less of a focus for Regional Delivery Hubs outside of Wales, with most of their efforts focused on enriching student learning experiences. In Wales, industry partners have utilised the resources significantly for social value engagement, such as open days, careers fairs, and school visits.

While this has been invaluable in creating greater awareness among pupils considering construction as a career pathway, the industry has not yet fully recognised the intrinsic value of the resources for their own training. Therefore, there is an opportunity to develop this at the industry level.

Additional Software

Conversations with partners and industry have revealed that specific organisations have been discussing the need for further software development that can address more current issues, such as retrofitting, renewable technology, modern methods of construction, and decarbonisation.

Although specific new software has not yet been identified, the success of CONVERT lends itself to the creation of additional software that can address the recruitment and training requirements for the industry in areas not already covered by this project.

Conclusion

In conclusion, the CONVERT initiative has been a successful UK-wide project aimed at creating engaging and safe educational programmes for educators and training providers in the construction industry.

The initiative resulted in the creation of 26 modules across four different training strands.

The methodology used to enable this project was innovative, collaborative, immersive, and effective in providing learners, educators and institutions with a comprehensive

understanding of the possibilities of utilising immersive learning within construction education.

We express our gratitude for the collective efforts and contributions of all our funders, partners, and collaborators towards the success of the project. We also acknowledge that delivery outputs from our partners exhibited variance reflecting the challenges encountered by some stakeholders in achieving their objectives.

We hope that this document has provided you with valuable insights into the impact of CONVERT, and we remain committed to further supporting safe working practices within the construction industry through innovative training resources such as those developed through CONVERT.

Annex 1: Akzo Noble Case Study

BACKGROUND

Construction Wales Innovation Centre's (CWIC) CONVERT project was invited to attend the British Woodworking Federation's annual Member's conference in Crewe in 2022 as an exhibitor.

At their request, we demonstrated two of the project's immersive learning resources; Wood-Ed (wood machining) and Simspray (virtual paint spraying) simulators. During the conference breakout sessions, attendees were able to trial the equipment for the first time.

Following the event, we were contacted by AkzoNobel, a Dutch multinational company that creates paints and performance coatings for both industry and consumers worldwide.

They had recently recruited two new technical apprentices for the UK and Ireland who were going through their induction process.

Whilst the company has a paint spraying booth at its Blackburn operation, the availability of Simspray as a cost-effective and free training resource would provide them with the ideal practical opportunity to experience paint spraying without product wastage!

BENEFITS

- Reduced training costs by up to 50%
- Saved on consumables and reduced VOC emissions
- Customized learning paths
- Ability to follow results and skill progression
- Saved on time and product wastage

The equipment is excellent. It speeds up learning in a safe environment and without excessive travel or material costs.

Very impressed at how realistic this was. A very valuable training resource.

Great piece of equipment - especially for people looking to improve their skills at no cost.

The best!

Trainee comments
AzkoNobel, Blackburn, Lancashire

THE TRAINING

Simspray offers learners several paint spraying options using HVLP, Airless & Air-assisted airless guns in a range of virtual environments.

The team at AkzoNobel spent the morning trialing the different functions and spray settings that make up Simspray.

Simspray's flexibility also enabled them to control the air pressure and the paint flow directly from the paint gun. It even replicates the way a spray gun is in real life.

Simspray manage to impress the all by its ability to emulate the real process of spray painting.

Seeing is believing

Making sure the underneath is sprayed!

Apprentice training

Spray painting room with **extraction** arms and painted perfume bottles.

Annex 2. Encouraging comments from Project Beneficiaries.

- A great day. Wish I had booked more time off work to try all immersion walkthroughs.
- VBEEE integrated well with the construction module.
- Fantastic piece of equipment – very easy to use (VBEEE)
- Very realistic – would be interested in borrowing the equipment (paint/wood machining)
- It was fun and I can see how it would be useful for understanding house building much more.
- It was fun and different.
- Brilliant virtual exercise. (WoodEd)
- Everything went well. I really enjoyed the VR experience (WoodEd)
- A good introduction to construction (VBEEE & WoodEd)
- For the drone one I learnt how to use a drone safely. For the house construction if I played around with it longer, I would have had a good understanding of house building!
- Potentially have a VR dedicated room/environment that is bookable and available to all staff. This could save on the logistics as equipment will not need to be transferred and set up from scratch every session this will save time and avoid damage to equipment. This could reduce the chances of accidents occurring as the environment would be fit for purpose.
- More realism needed but great to use for safety critical roles, enables a safe working environment for all (Working at Height)
- I am a lecturer, and I used the working at height module. Once I got the hang of it it was really good. It made a subject that is usually quite dry to deliver interesting and kept me engaged. The software would need to match up with the SQA assessments that we deliver to make it a valuable training experience. The first part when the man fell was quite hard hitting and would get the message across to learners the dangers of working at height early on. I look forward to using this more often in the future.
- Excellent learning experience. The working at height modules were much better than the current Access platform unit and can be completed in a safe environment with a better understanding. VBEE again was a great experience, had a few set up issues to begin with but can see this backing up learning in sustainability and generic units. A similar set up for Health & Safety would be brilliant. This could be developed for so many avenues and will be a great aid to the candidates learning.
- It was very impressive; I think the more you used it you would get better at its functionality and where it could be used best in the curriculum.
- I didn't spend enough time with these headsets, but my thoughts were positive on what i done. I can see these being very useful in the plumbing and heating training course. Can't think of any improvements.
- Good kit with good interactivity, a really good teaching resource. (Working at Height)
- This needs to reflect the type of scaffolding used in the Scottish Qualifications, but very good learning tool. Having the ability to cast multiple headsets on to a computer would be beneficial for lecturers (Working at Height)
- Interactive learning really helps to solidify the information. Being able to experience each element is extremely valuable. Safer and more accessible than a building site. (VBEEE)
- Learning interactively is extremely valuable
- Could this be tailored to my trade in tiling?
- Fantastic and realistic

- I thought this was a good introduction tool but would love to see the plan options adapted to allows for students to push the design a bit further giving them more opportunities to use again and test their knowledge. Doing this over the year should show improvements in knowledge but adding in more brief options would be good to test this knowledge. (VBEEE)
- More of this please!