LEADING THE FUTURE

How Universities and Colleges are Fostering Innovation-Driven Regional Economic Development Initiatives

ENGINEERING | McMaster University

OHIO UNIVERSITY
RUSS COLLEGE OF ENGINEERING AND TECHNOLOGY

EUSKO JAURLARITZA GOBIERNO VASCO
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DEPARTAMENTO DE EDUCACIÓN

UCF | Institute for Simulation and Training — IST®

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Foreward by Thomas C. Merrick
University of Miami

As industries accelerate toward digital transformation, universities are evolving from traditional centers of education into engines of innovation, collaboration, and regional economic growth. Today's most pressing challenges, whether in manufacturing, health, climate, education, etc., require rapid prototyping, interdisciplinary thinking, and immersive problem-solving environments. The convergence of extended reality (XR), artificial intelligence (AI), and digital engineering provides unprecedented tools to meet these challenges.

This white paper explores **how shared XR and digital engineering infrastructure, supported by technology providers like Virtualware and HTC VIVE**, is enabling colleges and universities to play a leading role in workforce development, product innovation, and public-private collaboration. By transforming existing physical spaces into connected immersive labs, institutions are not only preparing the workforce for tomorrow, but they are also helping solve real-world problems today.

At the University of Miami, we've seen firsthand how immersive technologies can support student learning, faculty research, and strategic industry partnerships. Through my work as Associate Director of VR/AR Initiatives and Chair of the North America Colleges and Universities Committee for the VR/AR Association, I have the privilege of engaging with dozens of universities working to break traditional boundaries and build collaborative ecosystems. Together, we are laying the groundwork for a new educational and economic paradigm, one where immersive tools help visualize the invisible, prototype the complex, and unite diverse minds across distance and discipline.

Thomas C. Merrick
Associate Director of VR/AR Initiatives
Adjunct Professor
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SUMMARY

Executive Summary

As universities and colleges seek new ways to amplify their societal impact, this white paper presents a compelling framework for transforming higher education institutions into engines of economic development by providing infrastructure and resources that can be shared to accelerate innovation and collaboration. Anchored in partnerships between Virtualware, HTC VIVE, and academic stakeholders, this initiative leverages Extended Reality (XR), digital engineering and advanced simulation technologies to establish scalable, shared infrastructure that unites research, education, workforce development, and industry collaboration.

At the heart of this model is the VIROO enterprise XR platform—an open, standards-based development, deployment and management software platform that enables students, faculty, researchers, and industry partners to collaboratively design, prototype, and validate solutions in real time, both physically and virtually. Complemented by HTC VIVE's Business+ suite and enterprise grade head mounted virtual and mixed reality displays, these XR labs turn traditional classrooms into dynamic centers for experiential learning, research, and industrial innovation.

The paper highlights exemplary case studies—Ohio University's Digital Enterprise Collaboratory, UCF's DEEPspace, McMaster University's IMRSV@MAC and the Basque Government's Vocational Education Training network—demonstrating how institutions in three different countries can rapidly deploy these systems in days, not months, and produce measurable gains in skill development, research throughput, and regional workforce readiness.

For the academic community, the implications are profound: the democratization of immersive technology, seamless integration of digital tools into curricula, and the ability to contribute directly to local and global innovation ecosystems. The model repositions institutions not just as educators, but as co-creators in the digital economy—offering a replicable blueprint for universities worldwide seeking to align education with 21st-century industry needs.

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INTRODUCTION

Virtualware and HTC VIVE

Virtualware and HTC VIVE are partnering to equip universities and colleges with technology infrastructure to enable these institutions to be catalysts for collaboration in the areas of digital engineering, product development and workforce development to accelerate regional economic development initiatives.

Manufacturers globally are facing a common challenge: how to design, develop, and produce new products more quickly and cost-effectively while also attracting and training new workers. New products and a skilled workforce are essential for economic development in any market. Emerging technologies, such as extended reality (XR) and artificial intelligence (AI), offer manufacturers capabilities that were only imagined a few years ago. However, the implementation of these technologies comes with risks, uncertainties, and often substantial investments.

So, how can manufacturers effectively leverage these modern technologies and develop the workforce they require? One pathway is to harness the resources of local and regional universities and vocational college ecosystems commonly referred to as post-secondary colleges. Colleges often serve as collaboration hubs for government and industry to research, develop, and test new concepts or products. However, they face challenges in keeping their technology infrastructure and resources current to remain valuable to industry needs.

Colleges can play a crucial role in supporting manufacturers and supporting regional economic development initiatives by providing infrastructure for digital engineering, collaboration and workforce development that can be shared across local industries and government agencies

The use of digital technologies is rapidly transforming university and vocational training programs, particularly in the field of digital engineering. Colleges are increasingly integrating advanced tools such as computer-aided design (CAD), simulation software, digital twins, and data analytics into their curricula to prepare students for the demands of modern engineering workplaces.

These technologies enable learners to engage with real-world scenarios in virtual environments, enhancing their problem-solving skills and technical proficiency. In vocational training, hands-on experience with automation systems, industrial IoT, and smart manufacturing platforms is becoming standard, bridging the gap between education and industry.

This shift not only modernizes curricula but also aligns workforce preparation with the evolving needs of digitally driven engineering sectors.

Integrating industry leading hardware and software technologies from HTC VIVE and Virtualware.

HTC VIVE and Virtualware have partnered to create an integrated off-the-shelf solution that can transform existing physical spaces into hubs for digital engineering and workforce development initiatives within a few days.

By utilizing HTC VIVE's commercial virtual and mixed reality hardware and enterprise software technology, along with optional private 5G networking infrastructure, and Virtualware's VIROO Enterprise XR platform, universities can rapidly and cost-effectively deploy scalable and versatile physical and digital spaces.

These labs can be utilized by researchers, students, government agencies, and companies to develop new products and solutions quickly.

Today, nearly all new products are developed using digital technologies that are used throughout their lifecycle. From design and prototyping to production, training, installation, and support, 3D models and simulations form the foundation that drives digital assets through the product lifecycle.

One of the goals of this solution is to enhance human collaboration using virtual spaces and immersive technologies. A product designer or researcher can create a model of their ideas using commercial software such as SolidWorks, Inventor, Creo or other design tools, or even by leveraging generative AI tools. These models can then be uploaded to the VIROO platform and shared with others in 3D...

Users can collaborate in real-time or at their convenience from their desktops, VR devices, or in immersive labs, where multiple people can collaborate in person using room-scale XR.

Once the design is developed it can be uploaded to the VIROO platform for collaboration among project teams or external stakeholders. In addition to working with static models, engineering teams can also create simulations and digital twins to evaluate how their products perform individually or as part of larger systems. The strength of VIROO lies in its ability to facilitate collaboration, whether in a physical space or virtually, from anywhere in the world.

During the production process manufacturers can create digital twins of individual products or complete integrated systems including manufacturing processes. They can model and create simulations of workflows again using their current tools and processes and use VIROO to collaborate within the enterprise and with external stakeholders.

Virtualware's Simumatik software emulation tools can enable colleges and manufacturers to create and virtually commission digital twins of manufacturing equipment and complete manufacturing lines with the easy-to-use engineering and emulation platform.

The digital assets can then be used during the sales and marketing process to create immersive experiences to be used with buyers and partners.

Manufacturers can also use the VIROO platform and studio applications to develop, deploy and manage immersive training content for XR devices or desktop/laptop computers leveraging the digital content developed during the product development process.

One Enterprise XR platform to Support the Product Lifecycle

The VIROO Enterprise XR Platform enables organizations to ingrate physical and virtual workplaces across the enterprise to support lifecycle management.

DESIGN

Enhance real-time collaboration and ideation. Virtual design and engineering make manufacturing processes more efficient from conceptualization to final products.

DEVELOPMENT

Leverage digital assets in virtual environments to make significant product leaps more efficiently, sustainably, and at a lower cost

TRAINING

Develop real-world simulations to train your workforce in specific operations to attain new knowledge and skills in safe, controlled and data-driven scenarios.

VIROO

CREATE ONCE

Use VIROO Studio to create rich interactive content in Unity without the need for code.

IMPROVE EFFIENCY BY STANDARIZING XR COMPANY-WIDE

PROTOTYPE

Overcomes inherent limitations associated with the elevated cost of building physical replicas.

MANUFACTURE

Create 1:1 digital twins of assembly lines to virtually plan, review workflows and optimize workspaces.

PROMOTION

Elevate your business with cutting-edge XR content that transforms the way you engage with clients, and present your yet to be built custom products, virtually in real-time 3D

DEPLOY EVERYWHERE

All-in-one interoperable and device-agnostic ecosystem that evolves to integrate current and future XR advancements

VIROO

The OpenXR Enterprise Platform

At the core of the solution is Virtualware's VIROO enterprise XR platform. **VIROO is based on an open standards-based architecture that enables the development, deployment and management of immersive experiences across the enterprise.**

Organizations can use their existing tools and processes to create content, upload engineering models, create simulations, develop digital twins and develop full-scale solutions for training or sales and marketing promotions.

The VIROO platform can be deployed on public or private cloud platforms such as AWS and Azure or installed on premises for airtight security. This provides educational institutions and manufacturers with multiple deployment options to meet their requirements.

Enabling multi-user immersive spaces with HTC VIVE Business+

One of the unique features of VIROO is that it is pre-integrated with HTC VIVE's Business+ software suite that includes the VIVE Location-Based Software Suite (LBSS) to enable room scale XR spaces where multiple users can collaborate within a single physical location with complete spatial awareness of other participants.VIROO can also enable multiple physical spaces to connect and allow remote users from desktop, XR devices or even other rooms to join with users in the physical spaces.

Students learning healthcare practices

Campus-wide wireless connectivity with HTC VIVE's private 5G mobile networking solution – REIGN CORE

Both enterprise and academic Wi-Fi infrastructure are under constant pressure to support the ever-growing demand for new services and devices. One way to provide seamless, high-performance connectivity for XR headsets and other devices is through HTC VIVE's private mobile 5G solution called REIGN CORE.

REIGN CORE is a 5G mobile base station that offers a reliable, secure connection for devices with a 5G antenna. It can connect via ethernet to a college network, or to a separate commercial internet service, to eliminate loads on campus networks.

REIGN CORE is unique in that it can cover large indoor and outdoor spaces with a scaled private 5G network, offering connectivity to XR headsets, smartphones, IoT devices, and more. One REIGN CORE box can provide up to 100,000 square feet of 5G coverage. In many cases this is sufficient for an entire building or small campus area. But if more coverage is needed, an organization can simply add more REIGN CORE boxes. For use cases where privacy is paramount – like product design or defense training – REIGN CORE uses Zscaler's renowned Zero Trust solution. Furthermore, REIGN CORE can also backhaul Starlink satellites for large, private 5G bubbles in far-flung locations.

HTC VIVE is currently the only XR device manufacturer that offers a private **5G infrastructure** product that works natively with their devices and supports other manufacturers' XR and mobile devices that meet 5G standards.

Note: The programs outlined in this paper currently use Wi-Fi infrastructure for their services; however, as the demand for more users and bandwidth evolve requiring additional infrastructure, all of these programs can easily migrate to REIGN CORE to support their programs.

Reign Core Base Station

CASE STUDIES

University and College Case Studies

While each institution has created a unique platform tailored to the needs of its community, they all share a common foundation: an enterprise XR platform that can scale with the needs of the institution securely and cost-effectively.

This shared technology not only supports internal scalability but also facilitates collaboration with government and industry partners on both regional and global levels.

1. The Digital Engineering Collaboratory (DEC), Ohio University
2. DEEPSpace at The Institute for Simulation and Training at University of Central Florida
3. IMRSV@MAC at McMaster University, Ontario Canada
4. The Basque Government Vocational Education and Training (VET) Network, Basque Autonomous Region Spain

OHIO UNIVERSITY

RUSS COLLEGE OF ENGINEERING AND TECHNOLOGY

CASE STUDY #1

The Ohio University Russ College of Engineering and Technology - Enabling digital engineering programs and training the Advanced Manufacturing Workforce.

Ohio University, established in 1804 in Athens, Ohio, is the state's oldest public institution and holds an R1 classification for very high research activity. The university's total enrollment is nearly 30,000 students, encompassing its main Athens campus, 5 regional campuses, and online programs. The university comprises 12 degree-granting colleges and receives about $65 million per year in research funding, reflecting its commitment to advancing knowledge across various disciplines.

Ohio University offers a comprehensive suite of industrial automation and certification programs designed to meet the growing demand for skilled technicians in Ohio's advanced manufacturing and semiconductor sectors. Besides undergraduate industrial automation degrees, students can pursue one-year, stackable financial-aid eligible certificates in Automation Technician, Mechatronics Technician, and Semiconductor Manufacturing Technician Fundamentals. These programs provide hands-on training with industry-standard equipment, including programmable logic controllers (PLCs), robotic cells, and vacuum systems, preparing graduates for immediate entry into high-tech fields.

The State of Ohio is one of the nation's largest advanced manufacturing states and over the past few years many advanced technology manufacturers such as Intel, Honda-LG, Anduril and Joby Aviation have announced new manufacturing facilities that will require new workers with skills in factory automation systems. These manufacturers along with the State of Ohio have turned to Ohio University to provide educational programs along with technologies to enable workforce development programs to support the expected demand for 20,000 advanced manufacturing workers over the next 5 years.

One of those programs is called the Digital Enterprise Collaboratory (DEC). Started in 2024, the DEC provides researchers, students and even other universities with robust technology infrastructure to accelerate the use of model-based systems engineering through digital thread/digital twins of products which can be rapidly produced using advanced manufacturing methods including immersive technologies.

Virtual and Augmented Reality and Artificial Intelligence are enabling collaboration between OHIO's different campuses across the state, manufacturers, other academic institutions and the US Air Force Material Command which is headquartered at Wright-Patterson Air Force base near Dayton.

> *"This program represents a bold step forward in immersive digital engineering. By integrating XR technology into our educational and research programs, we are preparing the next generation of engineers to think spatially, act collaboratively, and solve real-world problems. Manufacturing is Ohio's largest industry sector that contributes 17.5 percent of the state's GDP, and we need to prepare our local workforce for new jobs in advanced manufacturing."*
>
> Scott Miller, Associate Dean for Industry Partnerships at Ohio University's Russ College of Engineering and Technology.

The Digital Enterprise Collaboratory (DEC)

The Digital Enterprise Collaboratory (DEC) is designed to create innovative physical and virtual environments that accelerate the development of digital engineering and training programs. By providing advanced infrastructure and tools, the DEC enables seamless collaboration among internal and external stakeholders—whether they are working together in person or remotely. Through the integration of cutting-edge immersive technologies and compatibility with existing systems, Ohio University (OU) has built a powerful platform that connects students, researchers, manufacturers, end users, and government agencies.

A prime example of this integration is how OU has connected its existing industrial automation labs to the DEC platform. This connection allows for virtual design, programming, and remote testing of factory automation equipment and robotics.

OU's engineering staff maintains digital twins of various robotic systems and Programmable Logic Controllers (PLCs) through the Simumatik platform. This enables students and researchers to develop, integrate, and test new code virtually—and even deploy it to physical equipment, either on campus or at manufacturing facilities. However, a key limitation has been that access to these simulations required users to be physically present in OU's engineering labs, working from 2D desktop computers.

The DEC addresses this challenge by migrating these models and simulations to the VIROO cloud platform, making them accessible remotely in immersive 3D virtual reality. Now, users can collaborate from anywhere in the world. With OU's immersive DEC laboratories, models can be projected at full 1:1 scale in shared virtual environments, allowing multiple users to work together in real time on virtual systems.

Thanks to the DEC, OU estimates a 3 to 10 times increase in the speed of developing new engineering modules and designs, along with enhanced capabilities such as multi-location virtual testing and commissioning.

Imagine a manufacturer testing new designs virtually—without the need to build physical prototypes or travel for every design iteration. With the DEC, they can access the platform remotely, upload their models and digital twins, and collaborate with suppliers and staff in real time. They can also visit immersive lab locations in Dayton or Athens to experience and interact with full-scale virtual systems in person—while still enabling remote participants to join via desktop or VR devices.

Ohio University Digital Enterprise Collaboratory (DEC) Platform Components

The DEC From Concept to Reality – Dual Lab Implementation in only 1 week

A key strength of the Digital Enterprise Collaboratory (DEC) is its foundation on pre-integrated software and hardware components. This strategic approach allows for rapid and straightforward deployment of both the virtual and physical infrastructure, significantly reducing setup time and complexity.

At the core of the DEC is VIROO's Enterprise XR platform, hosted by Amazon Web Services (AWS) public cloud infrastructure. VIROO offers a robust ecosystem of applications through its marketplace, enabling collaborative design reviews, training simulations, and digital twin integration. Users can upload CAD models, digital twins, and training content directly from their desktop systems and create collaborative "sessions." These sessions can be accessed via the VIROO Single Player application, available for desktop and VR systems—making real-time collaboration possible from virtually anywhere, with or without access to the DEC Immersive Labs.

The Immersive Labs themselves are equipped with both digital and physical infrastructure. Each lab is managed by a VIROO Room Manager running on a local desktop, giving lab administrators full control over user configurations, device management, content uploads, session creation, and remote user access—all through an intuitive interface.

These labs utilize HTC VIVE Focus Vision mixed reality headsets, which allow users to move freely and untethered throughout the space. Integrated HTC VIVE Business+ services provide Lab Managers with real-time oversight, including user session assignments, system monitoring, and spatial tracking of users within the lab. Multiple labs—and remote desktop users—can be seamlessly connected in a single collaborative session.

Ohio University converted two existing computer lab spaces into DEC Immersive Labs: one at the main campus in Athens and another at the Digital Transformation Center at the University of Dayton Research Institute (UDRI). Notably, these conversions required no physical structural modifications. VIROO's Room Manager and spectator tools allow for accurate user tracking within the virtual environment, ensuring users are properly aligned with their real-world surroundings.

This precision is achieved through HTC VIVE's Location-Based Services, which use headset-mounted cameras and strategically placed markers on walls and floors to align users correctly in the virtual space.

Once the room layouts were finalized, each lab was installed in just two days with a single technician from Virtualware and support from one or two Ohio University staff members handling IT and logistics.

> *“When Virtualware told us we could install 2 locations in less than a week, I was admittedly skeptical. It was truly amazing how quickly we were able to implement the DEC and get our faculty and customers up and running on real projects. Thanks to the DEC, we already have other colleges, manufacturers and government agencies reaching out to get involved, and we’re beginning to develop training curriculum for new industry partners.”*
>
> — Scott Miller, Associate Dean, Industry Partnerships and Outreach, Russ College of Engineering and Technology, Ohio University

CASE STUDY #2

The University of Central Florida Institute for Simulation and Training accelerates programs with the Digital Engineering and Experiential Prototyping Space – DEEPSpace.

The University of Central Florida (UCF) is a public research university located in Orlando, Florida and is one of the largest universities in the United States by enrollment with over 70,000 students. Established in 1963, UCF was originally founded as Florida Technological University to support the growing U.S. space program before expanding its academic scope. Today, UCF offers more than 225 different degree programs across various disciplines and is classified as an R1 research institution. UCF is known for its commitment to innovation, community partnerships, and cutting-edge research. Its main campus is situated near one of the top research parks in the nation, and it also has specialized campuses for medicine, hospitality, and entertainment studies.

UCF also hosts The Institute for Simulation and Training (IST) which is an internationally recognized research institute dedicated to advancing modeling, simulation, and training technologies. With over four decades of experience, IST develops innovative solutions to address complex challenges in various fields, including defense, healthcare, and education. The institute fosters collaboration between academia, industry, and government, driving research that enhances simulation-based learning and decision-making.

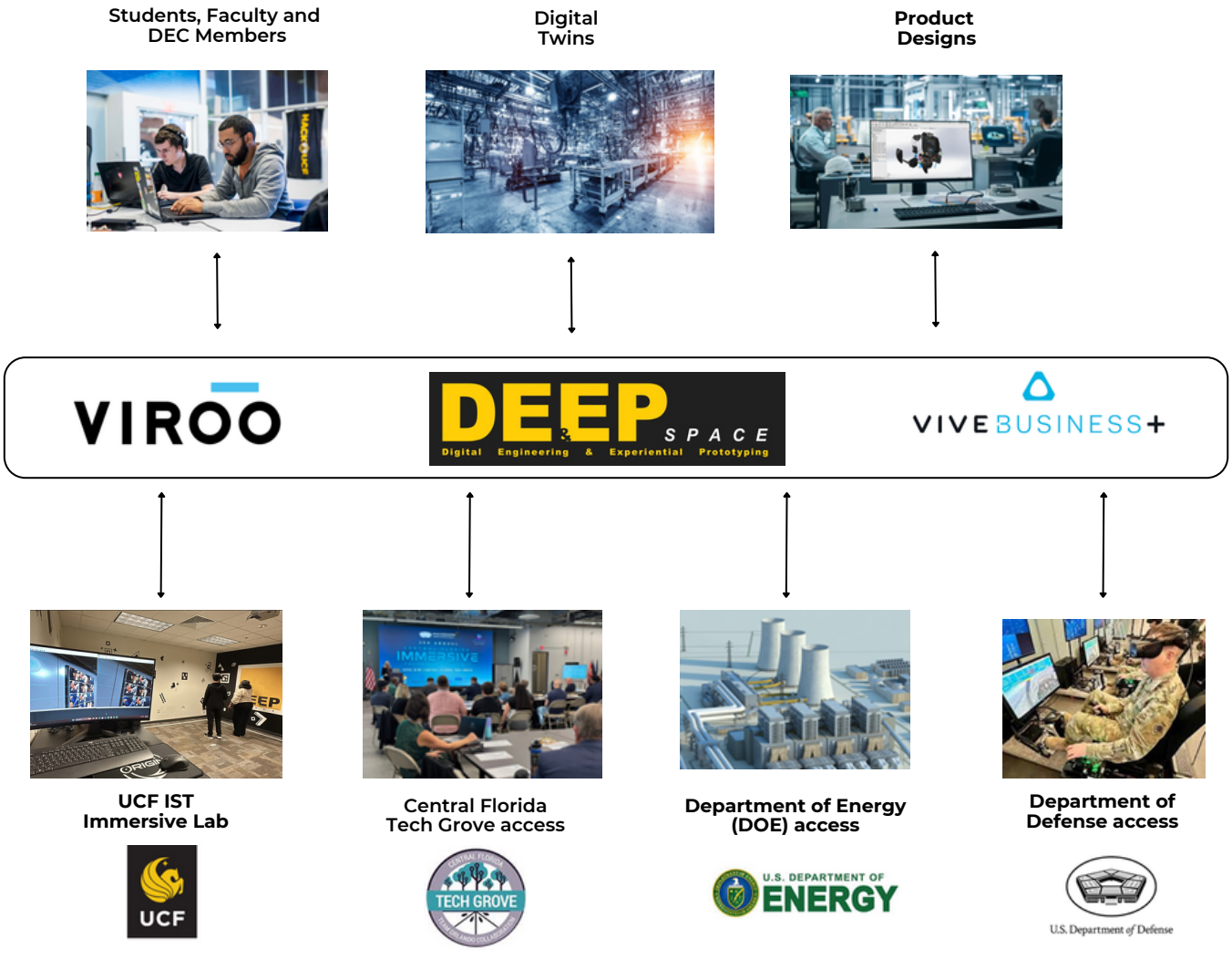
> *"Digital Engineering and Immersive technology is becoming a critical component of much of our research and products we are developing for our clients. We knew that we needed a robust collaboration platform and a physical space that would enable researchers and students to collaborate with end users and partners both in the physical space as well as virtually from other locations anywhere in the world in real-time and in 3D. The vision for DEEPSpace was to provide that capability that can be a shared resource that uses standard off-the-shelf tools and technologies that can be expanded and upgraded easily as technologies change."*
>
> Dr. David Metcalf, Director of the Mixed Emerging Technology Integration Lab (METIL)

One of the areas of focus for IST is digital engineering and finding ways to use digital tools to accelerate the process of developing concepts, products and full systems such as digital twins and training programs. Immersive technologies are being incorporated into most of the areas that IST supports.

Accelerating Innovation and Collaboration with DEEPSpace

The goal of DEEPSpace is to significantly reduce the time required to conceptualize, prototype, and iterate on ideas. The platform enables researchers, faculty, and students to upload their content directly from their own computers and collaborate with others virtually, whether in desktop mode or fully immersive virtual reality using a headset.

In addition to remote collaboration, users can also access the DEEPSpace physical lab, where they can engage in shared virtual or mixed reality experiences at a true 1:1 scale. This seamless integration of virtual and physical environments supports faster innovation, deeper engagement, and expanded opportunities for interdisciplinary collaboration across the university.



Reimagining Immersive Learning and Collaboration with DEEPSpace

Imagine having a digital model—or digital twin—of a spacecraft or a power plant. With the DEEPSpace platform, faculty and students can upload these complex models and then enter the DEEPSpace Lab, where they can don a VR headset and physically walk through the design with collaborators. This can be done both in-person and remotely, enabling participation from desktop users around the world.

Later that same day, a different team might upload a healthcare training module to the platform, schedule a session, and use the lab to review and refine their content collaboratively.

UCF faculty, staff, and students can develop content to support academic programs or research projects using Unity Studio tools integrated into the VIROO platform. These immersive experiences can then be shared across a range of devices—from personal computers and VR headsets to in-lab collaboration spaces.

DEEPspace is a shared infrastructure resource, available at no cost to university departments or external stakeholders. Its flexibility supports a wide range of applications, accelerating research, enhancing curriculum, and fostering interdisciplinary innovation.

ENGINEERING | McMaster University

CASE STUDY #3

McMaster University Faculty of Engineering's IMRSV@MAC platform accelerates applied research for regional development.

McMaster University is a public research university located in Hamilton, Ontario, Canada and is renowned for its innovative approach to education and research. Founded in 1887, McMaster has established itself as one of Canada's leading research-intensive universities with approximately 36,000 students. The university is home to more than 70 research centers and institutes and is recognized globally for its medical school, engineering program, and commitment to problem-based learning. McMaster consistently ranks among the top 100 universities worldwide and is classified as a research-intensive institution with a strong focus on interdisciplinary collaboration and innovation.

The Faculty of Engineering at McMaster University is particularly distinguished for its excellence in research and education across various disciplines including mechanical, electrical, civil, chemical, and biomedical engineering. With over 4,500 undergraduate students and 1,000 graduate students, the Faculty of Engineering has built a reputation for developing innovative solutions to complex engineering challenges through collaboration with industry partners and government agencies.

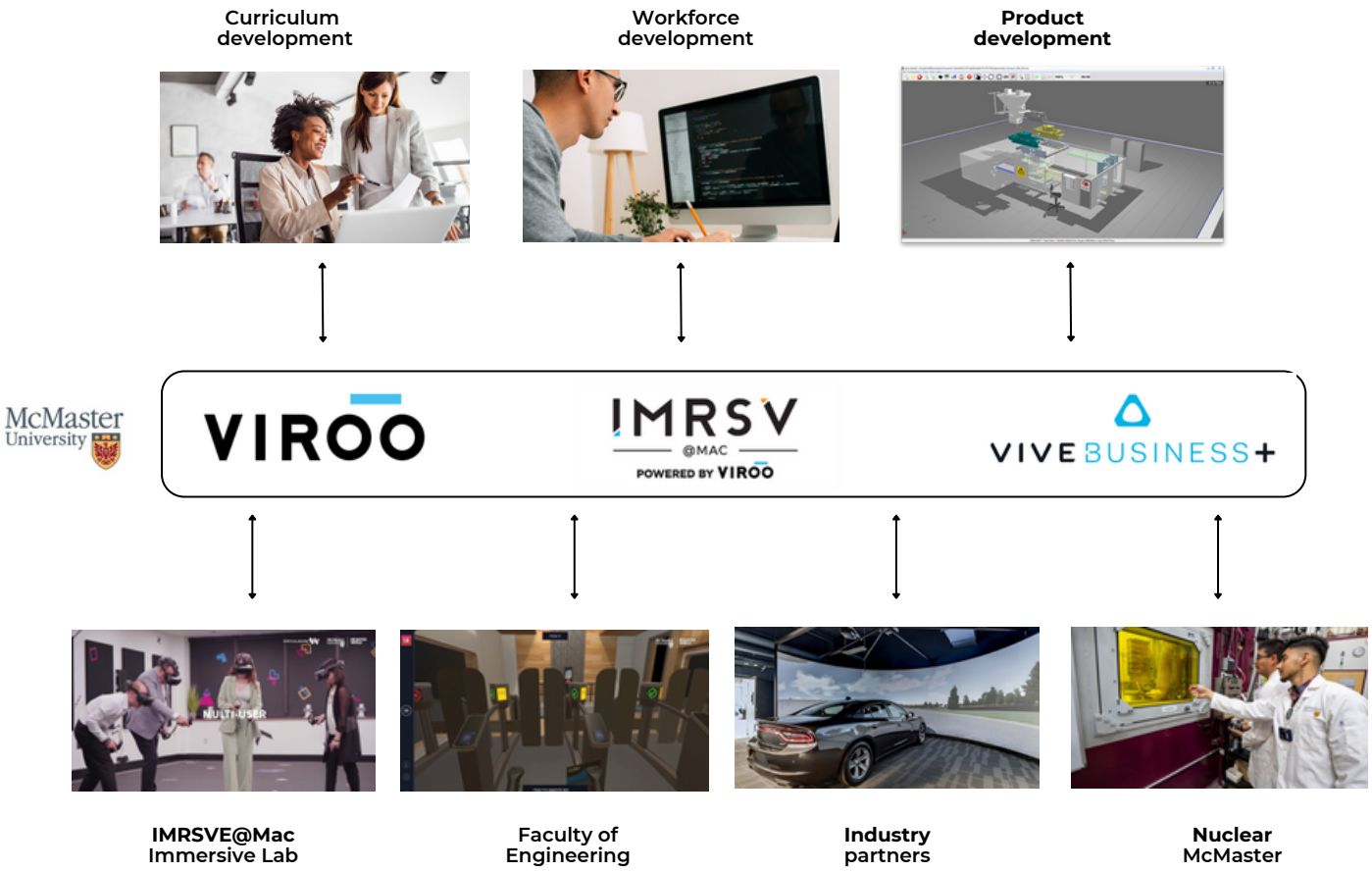
One of the strategic priorities for the Faculty of Engineering is advancing digital engineering methodologies and applying extended reality (XR) technologies to enhance both research capabilities and educational outcomes. To meet this growing need, **McMaster Engineering has implemented IMRSV@MAC powered by VIROO, a state-of-the-art collaborative space designed to accelerate innovation and learning through immersive technologies**.

> *"The unveiling of the custom-built immersive room will provide access to students, faculty, and businesses to push boundaries and explore the use of VR tools and technologies in the region,"*
>
> Ali Emadi, engineering professor and Canada Research Chair in Transportation Electrification and Smart Mobility, McMaster Engineering.

Engineering disciplines are increasingly relying on digital tools and immersive technologies to visualize, prototype, and validate complex designs before physical production. The Faculty of Engineering recognized the need for a collaborative environment that would allow researchers, students, and industry partners to work together in virtual spaces using 3D models and simulations regardless of their physical location. The VIROO Room was conceived as a versatile platform that could support multiple engineering disciplines while providing an intuitive, seamless experience for users with varying levels of technical expertise.

With IMRSV@MAC, McMaster has dramatically reduced the time from concept to validation for many research projects. Faculty members can upload their 3D models or simulations to the VIROO platform directly from their workstations, then schedule collaborative sessions where participants can join either physically in the VIROO Room or virtually from remote locations. This flexibility has been invaluable for maintaining research momentum and fostering collaboration, especially with international research partners.

"This is an exciting partnership that will not only lead to new technologies to solve the world's biggest challenges but will also attract new strategic partners in Canada and internationally," John Preston, Associate Dean, Research, Innovation and External Relations, McMaster Engineering.



Students have also embraced the program enthusiastically. Engineering classes now incorporate virtual reality enabled sessions where students can access realistic simulations of industrial equipment that would be too expensive or hazardous to interact with physically. They can create their own engineering models using standard tools and then upload them to the IMRSV@MAC cloud platform for presentation and critique by classmates and instructors, whether they're physically present in the lab or joining remotely via desktop or VR device.

IMRSV@MAC serves as a shared infrastructure resource accessible to all departments within the Faculty of Engineering, as well as collaborators from other faculties, external industry partners, and government agencies. The university has established a straightforward reservation system that democratizes access to this powerful technology without creating additional barriers for researchers, educators, or companies looking to leverage the unique utility of such an advanced amenity on a fractional level.

> *"The collaboration will help companies start their VR journey, giving them the opportunity to incorporate the VR platform in their daily operations, so they can be more competitive and improve their processes,"*
>
> Ali Emadi, engineering professor and Canada Research Chair in Transportation Electrification and Smart Mobility, McMaster Engineering.

The versatility of the IMRSV@MAC has allowed McMaster Engineering to reimagine how they approach complex engineering challenges and has created new opportunities for interdisciplinary collaboration. It's not just enhancing existing workflows – it's enabling entirely new approaches to engineering design, education, and research validation that weren't possible before.

IMRSV@MAC has positioned McMaster Engineering at the forefront of digital engineering education and research, providing a flexible platform that adapts to the diverse needs of modern engineering disciplines while preparing students for careers in increasingly digitized industries.

CASE STUDY #4

The Basque government accelerates economic development through the Vocational Education and Training (VET) Network.

The Basque region in northern Spain, home to about 2.2 million people, is one of the country's most industrialized and economically advanced areas. Once focused on heavy industry and shipbuilding, it has shifted toward high-tech sectors like aerospace, automotive, renewable energy, and precision manufacturing. Strong research institutions and innovative cooperatives have helped drive this transformation.

To support this shift, the Basque Department of Education faces the challenge of preparing a skilled workforce for modern, human-centered, and sustainable manufacturing. One way the government supports workforce development is through a network of 184 vocational colleges that comprise the Basque Vocational Education and Training (VET) Network. To ensure strong coordination and foster innovation across this network, the government established Tknika, a center for applied research and innovation—dedicated to positioning Basque vocational training as a European leader.

> *"At Tknika, we explore the possibilities offered by these new forms of communication. We believe that this culture has enormous potential to energize group work and that if the classrooms were adapted to these modes of communication, it would be possible to take advantage of this potential to enhance the educational process,"*
>
> Jorge Arévalo, Former Deputy Councilor of Vocational Training of the Basque Government

Tknika coordinates innovation projects across all 184 public and private vocational training colleges and operates a strategic monitoring service that stays connected with universities, companies, and technology centers to track the latest developments, ideas, and approaches in innovation.

At the international level, Tknika participates in global networks of vocational training colleges, technology centers, and associations such as EFVET (European Forum of Vocational Education and Training), TA3 (Transatlantic Alliance), and WFCP (World Federation of Colleges and Polytechnics).

These memberships enable Tknika to exchange tools, knowledge, and best practices related to innovation in vocational education across different countries.

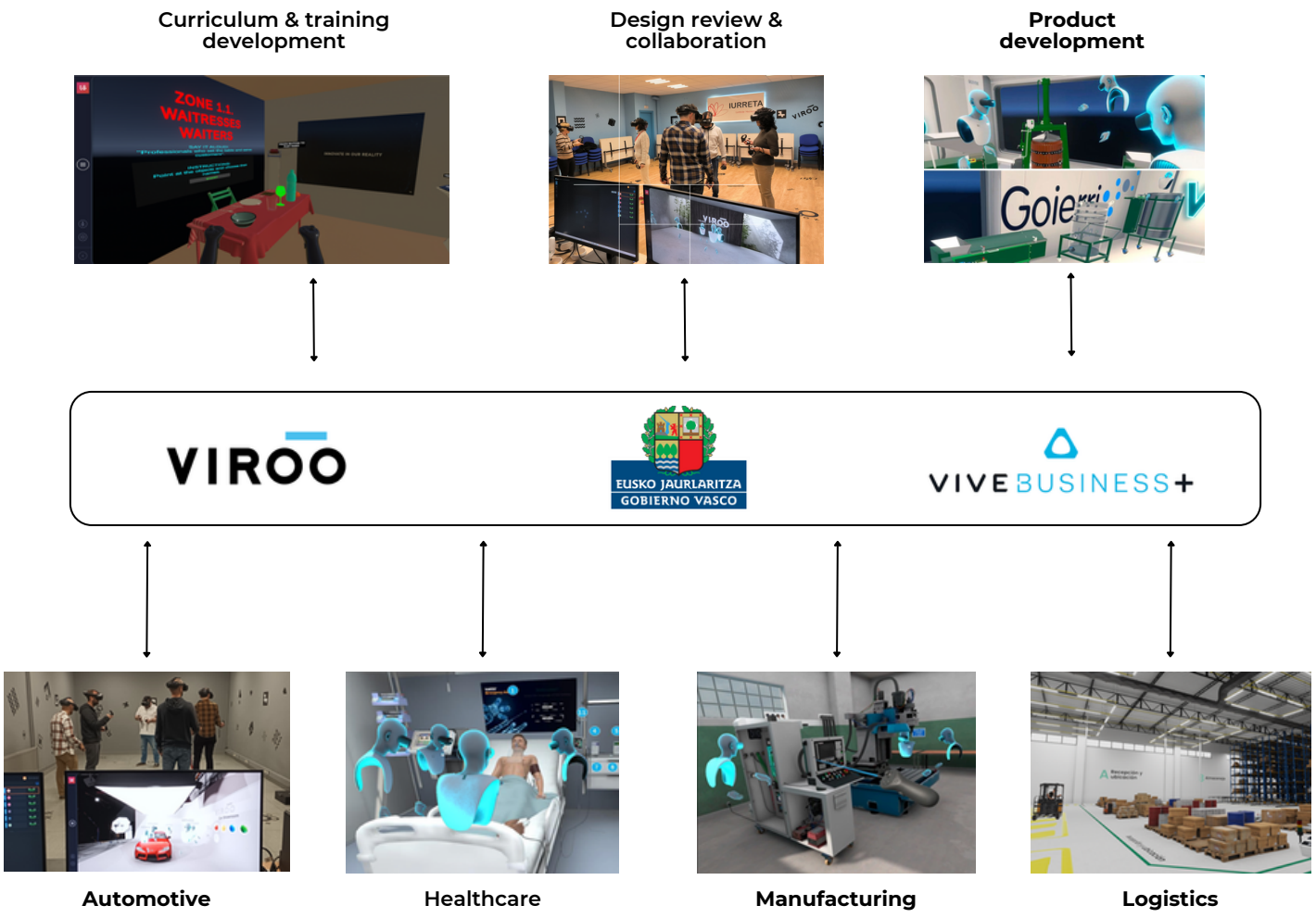
In 2022 Tknika launched a digital transformation program which incorporated the use of virtual and augmented reality technologies and provided infrastructure, tools and training for the region's vocational colleges which is referred to as the Vocational Education and Training (VET) network.

To enable their vision of shared infrastructure and services, Tknika selected Virtualware's cloud-based VIROO platform as the central platform to connect and manage all the training centers. This platform enables students and teachers across the network to access, develop and share content and curriculum seamlessly. The digital infrastructure is complemented by physical labs equipped with VIROO room player software, HTC VIVE virtual reality devices, and HTC VIVE's Location-Based Software Suite, creating an immersive and collaborative learning environment that can be accessed by the entire ecosystem

> Jorge Arévalo, Former Deputy Councilor of Vocational Training of the Basque Government, said *"A key component of the centers being developed in the Basque Country is that they will operate under a collaborative network scheme. We are going to have people physically there (in the training rooms), with other people who are not there physically, who are there virtually. These are the new spaces we are working on in the immersive field."*

These labs provide physical space for teachers and students to prototype their designs, test their applications, and collaborate in person using the latest digital technologies. They can also connect to other physical labs and enable remote users from desktop or VR devices to participate in the sessions.

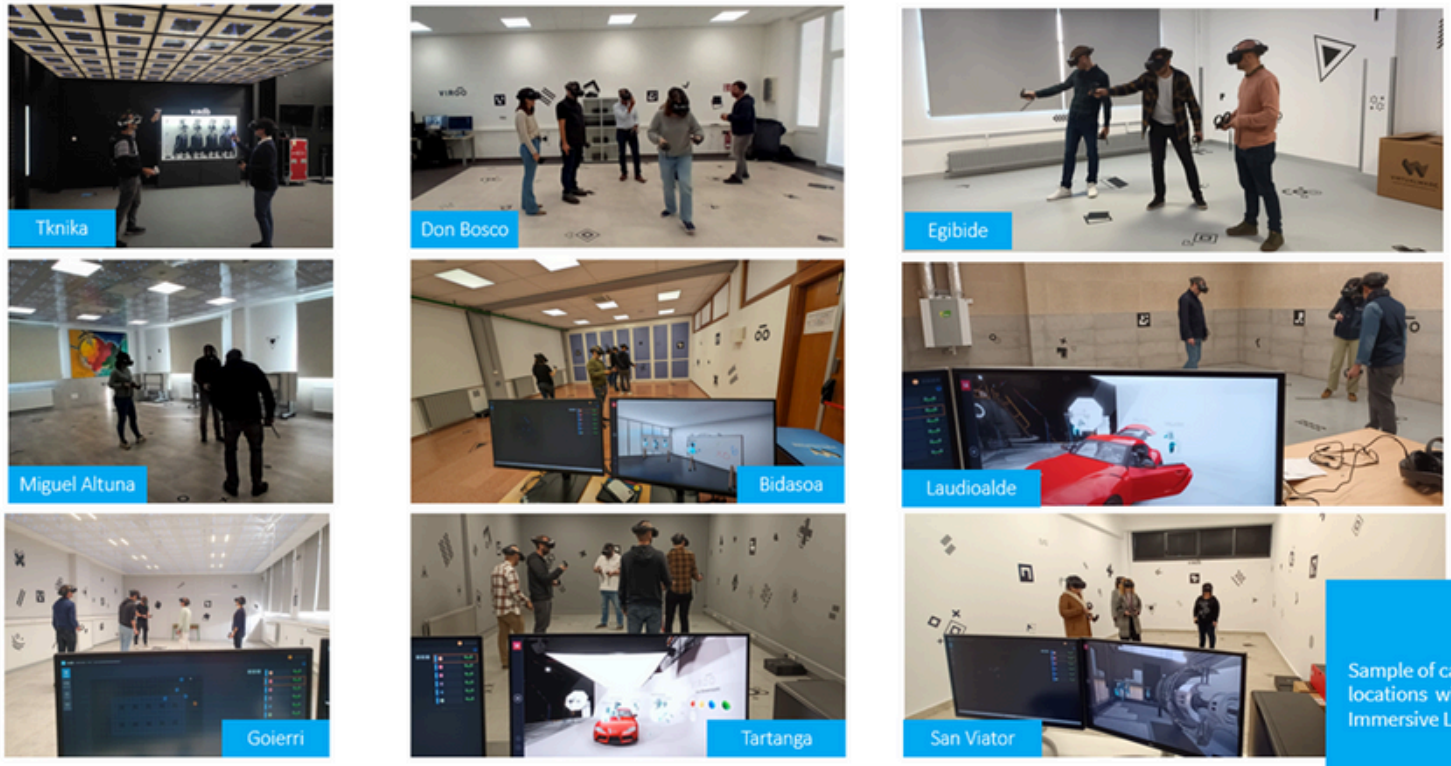
Vocational Education and Training Network XR Platform



The world's first and largest XR enabled vocational education and training network!

When the Basque Government and Tknika first embarked on their plans in 2022, no other college networks in the world had implemented a program of this scale. While the use of XR technology was gaining popularity and traction for academic use around the world, most immersive lab and collaboration implementations were (and continue to be) within one college or university and do not use location-based services for tracking users' physical immersive lab spaces to enable them to collaborate on a 1:1 scale with digital assets and other people.

As of 2025, the Basque government has successfully deployed their platform to 30 different campuses and training centers across the region and has plans to eventually include all the colleges in their network. This makes the program the largest implementation of an integrated network-wide XR platform by any academic institution in the world.



Examples of Immersive Labs at Basque VET colleges

The VIROO platform enables constant technological updates

The first immersive lab was set up at Tknika in 2022. It supported up to five people in the room, with additional users able to join remotely from their desktops or VR headsets. At the time, users had to wear backpack PCs, and a custom tracking system was developed to enable tracking their positions and movements in the lab space. While this setup was valuable for training and teaching content development, it required technical support and setup time prior to each session.

Since 2022 there have been significant improvements in technology both on devices, software, and communications tools. VET's immersive labs today use advanced VR and mixed reality tools that are much easier to manage and need only half the hardware compared to a few years ago. A faculty member or student can now run the lab with minimal training.

"The VIROO platform was built to be modular and based on open standards like OpenXR, so users can benefit from new XR technologies without changing their content or having to change the platform," says Sergio Barrera, CTO of Virtualware. "We host VIROO in the cloud to reduce IT overhead, but institutions can also install it on their own servers if needed. Our team continues to add features and improvements regularly."

One major upgrade was the integration of HTC VIVE's Business+ suite, which includes the VIVE Location-Based Software Suite (LBSS). These tools use built-in headset cameras to track users in the space thus eliminating the need for bulky tracking systems and making setup much simpler.

Now, users only need a VR headset to join a session. The entire lab can be managed from a single console, and installation takes just a few days. The labs can be set up in almost any available room, including standard classrooms, and don't require infrastructure upgrades.

Enabling content developers with VIROO Studio for Unity

Vocational colleges aim to equip students with job-ready skills that meet industry demands. As digital technologies evolve with Industry 4.0, there's a growing need for developers who can create real-time 3D and virtual reality (VR) applications. This demand is especially strong in the Basque region where there is a large and growing advanced manufacturing economy.

Unity is the most widely used tool for building real-time 3D and VR experiences. When Virtualware created the VIROO platform in 2019—based on their previous 15 years of industry experience—they chose Unity as the first supported development environment due to its popularity.

While Unity is powerful and relatively easy to start with, it can be complex to master. To simplify this, Virtualware developed VIROO Studio for Unity—an overlay application that helps users create content more easily, without needing deep Unity knowledge. This allows students and teachers to quickly develop and understand 3D content.

As users become more experienced, they can begin working directly in Unity and upload their projects to VIROO, offering flexibility across the platform.

> *"Companies in our region are increasingly hiring students from the Basque VET network because of their Unity and virtual reality development skills learned through structured curriculum complemented by hands on learning with real industry clients."*
> — Maria Madarieta, Client Success Manager, Virtualware

Content is key - enabling faculty & students to create their own content

There are a few essential components required for any successful educational technology to be successful in academic networks. The tools need to be easy to use, cost effective, reliable, and there must be relevant content available to support educational goals. While Virtual Reality is gaining tremendous popularity in post-secondary education, it is still an emerging industry and there is not a tremendous amount of content available and relevant to meet the VET's needs. Because VET needs to support the entire region, it also needs to support many different industries such as manufacturing, healthcare, automotive, transportation and logistics, hospitality and others.

Therefore, one of the success criteria was going to be the ability to develop relevant content quickly and with existing faculty and student resources.

One of the main benefits of the Basque VET platform is that due to the architecture of the platform and the VIROO Studio for Unity tools the faculty and students can create content to support curriculum development and project development either for academic research purposes. In addition, due to the architecture of the platform, third parties can create content from their own locations for the curriculum and upload it to the Basque VET platform for deployment across the VET network.

The library now spans many different academic courses and is growing every day. Because all of the VET schools use the same platform, it is possible for content to be easily shared across the 30 different VET schools from the common platform. This provides the VET network with tremendous potential to scale to additional schools and extend to industry partners.

Benefits to Regional Industry

The Basque VET network's integration of XR technologies delivers direct value to industry by producing a highly skilled, future-ready workforce trained on the same advanced tools used in modern manufacturing and design. With the VIROO platform and shared immersive labs, students learn to develop & prototype solutions, test applications, and co-develop training content tailored to real-world needs. This can benefit employers with faster new employee onboarding, reduced training costs, and access to talent familiar with cutting-edge tools like Unity and VR development which will enable them to create their own products and solutions more effectively and cost efficiently.

One example is a Basque industrial alliance called Goierri Valley based in the Goierri region of Gipuzkoa, in the Basque Country of northern Spain. Established in 2017, it comprises over 50 companies from the metal-mechanical sector, including industries such as energy, mobility, machine tools, and electric motors. The alliance focuses on fostering collaboration among its members to enhance industrial competitiveness and drive innovation. Goierri Valley promotes digital transformation and supports the adoption of Industry 4.0 technologies among small and medium-sized enterprises (SMEs) in the region.

Goeirri has been working with faculty and students to design and prototype new machine designs and training materials using the studio tools provided by the VET. Students get the opportunity to work on real world projects that are also benefiting the members of the alliance who would not have access and in-house expertise. This collaboration has resulted in many successful projects and resulted in many students being employed by regional manufacturers that are part of Goierri Valley.

Shared infrastructure for the entire ecosystem

The Basque VET network benefited significantly from shared XR infrastructure by creating a connected, collaborative ecosystem across 30 campuses, enabling students, faculty, and industry to co-develop and share immersive content and training tools. By using the VIROO platform and standardized XR labs equipped with HTC VIVE devices, the network streamlined access to cutting-edge technologies, reduced duplication of resources, and accelerated the deployment of digital transformation initiatives. This unified infrastructure allows for rapid curriculum development tailored to real industry needs, hands-on experience with Industry 4.0 tools, and seamless collaboration—both locally and remotely. As a result, regional companies gained access to a highly skilled talent pool and new opportunities to innovate alongside educators and students, supporting economic development and workforce readiness across the Basque region.

Student Developed Content for Regional Manufacturing Alliance