DIGIWIND

D2.4
DigiWind Virtual Campus
USER AND TECHNICAL REQUIREMENTS SPECIFICATION

D2.4 –USER AND TECHNICAL REQUIREMENTS SPECIFICATION FOR THE DIGIWIND VIRTUAL CAMPUS

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Abstract	A report detailing the user requirements and technical specifications of the DigiWind virtual campus, encompassing the learning portal and immersive learning experiences.

DigiWind

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Contents

1 Introduction

1.1 Purpose

This specification document is intended to describe the main functionality and features of the DigiWind virtual campus from both a user and technical perspective.

1.2 Intended audience and pertinent sections

	Stakeholder Group	Section
1	Academic partners	1,2,3,4,8
2	Project Managers	1,2,3,4,5,6,7,8,9
3	Developers	1,2,3,4,6,7,8,9
4	Testers	3,4,6

1.3 Project Scope

The scope of this document is firmly aligned with the DigiWind Project Specific Objective 3 (SO3): Delivering interoperable digital learning solutions, equipment, and infrastructure (WP2, WP5).

This reads as “The consortium will establish a seamless digital interface – the DigiWind virtual campus – to connect to each partner’s respective learning platforms for both existing and new learning experiences where the prospective learner will be able to design their own custom learning journey geared towards their individual needs built upon resilient, secure, and trustworthy infrastructure. The Higher Education Institutes (HEI) partners in DigiWind will upgrade existing High-Performance Computing (HPC) resources and purchase access to cloud HPC to ensure that dedicated HPC facilities are always available for education and training and to eliminate conflicting needs between researchers and educators. The consortium will provide real-time-access for learners to digital twins of wind turbine blades and power systems and install state-of-the-art equipment for hybrid learning experiences (T2.2) to ensure the best possible degree of contact between individuals who participate physically and remotely.”

1.4 Assumptions & Dependencies

Target Audience and Accessibility

- The virtual campus will be accessible to a diverse range of users, including students, educators, professionals, and researchers from different geographical locations.
- Users will have access to a stable internet connection and basic digital devices (e.g., computers, tablets, smartphones) necessary to access the virtual campus.
- The virtual campus will incorporate links to a range of immersive experiences accessible to users with a VR headset.
- The platform will be accessible 24/7, providing flexibility for users in different time zones.

Technological Infrastructure

- The virtual campus will be built using a robust and scalable platform that supports high traffic and multiple simultaneous users.
- It will be compatible with major web browsers (e.g., Chrome, Firefox, Safari) and operating systems (e.g., Windows, macOS, Linux).
- The platform will incorporate necessary security protocols, such as encryption and multi-factor authentication, to ensure data privacy and protect against cyber threats.
- Payment for LLL courses will not be handled by the virtual campus but rather will be directed to the relevant HEI as the course responsible for processing via their existing payment methods.

User Experience and Interface Design

- The virtual campus will offer an intuitive and user-friendly interface that requires minimal training for users to navigate and utilize effectively.

Learning Management System (LMS)

- The virtual campus will incorporate a standalone Learning Management System for hosting of DigiWind Life-Long-Learning course content only.
- The platform will support various content formats (e.g., video, audio, PDFs, interactive simulations) and enable both synchronous and asynchronous learning activities.

Pedagogical Methods and Content Delivery

- The virtual campus will support multiple teaching methods, such as gamification, virtual reality, problem-based learning, and simulations.
- Educators will have access to training and resources for using digital tools and delivering courses online or in hybrid formats.
- Courses and learning modules will be designed to be modular, allowing for flexible, self-paced learning paths.

Collaboration and Communication Tools

- The platform will include integrated tools for communication and collaboration, such as virtual rooms, video conferencing and chat forums.
- Assumptions are made that users will be comfortable using digital communication tools and will have basic digital literacy skills.

Data Management and Analytics

- The virtual campus will have a robust data management system to track user progress, engagement, and performance.
- Assumptions include compliance with data protection regulations (e.g., GDPR, CCPA) and that all data will be stored securely.

Support and Maintenance

- A dedicated support team will be available to assist users with technical issues, provide training, and ensure smooth operation.
- The platform will require regular updates and maintenance to remain compatible with evolving technologies and user needs.

Financial and Resource Considerations

- There is an assumption that any costs associated with access (such as software licenses or internet usage) are manageable for most users.

Scalability and Future Expansion

- The virtual campus will be designed to scale up or down based on demand, with the potential to accommodate future expansions such as additional courses, modules, or features.
- The system architecture will support future integrations with new technologies and platforms.

Stakeholder Collaboration

- Assumptions include active collaboration and communication between all stakeholders (educators, IT staff, administrators, and learners) throughout the development and deployment phases.
- Stakeholders will provide continuous feedback to improve the platform based on real-world use.

Compliance and Standards

- The virtual campus will comply with educational standards and accreditation requirements relevant to the courses offered.
- Content will meet quality assurance criteria and align with institutional and industry standards.

1.5 Definitions, Acronyms and Abbreviations

Acronym/ Abbreviation	Title
AI	Artificial Intelligence
API	Application Programming Interface
CA	Consortium Agreement
CMS	Content Management System
DEP	Digital Europe Programme
DESI	Digital Economy and Society Index
DMP	Data Management Plan
DSAB	Digital Skills Advisory Board
EC	European Commission
EU	European Union
EWEM	European Wind Energy Master (programme)
GA	Grant Agreement
HEI	Higher Education Institution
HPC	High- Performance Computing
ICT	Information and Communications Technology
IP	Intellectual Property
LFM	Logical Framework Matrix
LLL	Lifelong Learning
LMS	Learning Management System
M.Sc.	Master of Science
PCDER	Plan for Communication, Dissemination, and Exploitation of Results
PO	Project Officer
RPL	Recognition of Prior Learning
SEP	Specialised Education Programmes
SIS	Student Information System
STEM	Science, Technology, Engineering and Math
WP	Work Package

2 Overall Description

2.1. Summary

The DigiWind project is committed to transforming education in the wind energy sector by leveraging the latest pedagogical and technological advancements. The project's approach involves integrating virtual reality, metaverses, gamification, digital twins, and simulations into the delivery of courses and lifelong learning (LLL) modules. This innovative approach is designed to engage learners more effectively, making education interactive, immersive and engaging.

Central to this ambition is the DigiWind virtual campus, enabling delivery of state-of-the-art Specialised Education Programmes (SEP's) in the Wind Energy sector to a diverse and globally distributed student body comprising postgraduates and industry professionals seeking to specialise and upskill. Prospective learners will discover the learning experiences available to them via the DigiWind course catalogue, and by proceeding to enrol in their chosen course will gain access to a location agnostic digital learning environment designed with self-paced blended learning and diversity in mind.

Furthermore, the DigiWind virtual campus will provide access to state-of-the-art hybrid classrooms and collaborative virtual spaces to facilitate both in-person and remote participation, along with access to advanced digital twin and simulation tools to support delivery of high-quality, engaging learning experiences.

In tandem, the DigiWind virtual campus aims to empower educators with the tools and techniques necessary to deliver education that is not only effective but also engaging, regardless of the learning environment. This will lead to a new standard of educational excellence where both educators and learners thrive in a digitally enhanced, boundary-free setting.

2.2. Objectives

The objectives of the DigiWind Virtual Campus as a key component of the DigiWind project include:

Education and Skill Development: Provide comprehensive training programs and courses on digital technologies, wind energy systems, and sustainable practices. The Virtual Campus aims to equip students, professionals, and researchers with the skills needed to excel in the evolving wind energy industry.

Access to Digital Tools and Resources: Offer access to cutting-edge digital tools, simulations, and data analytics platforms that allow learners to engage with real-world scenarios. The Virtual Campus provides resources such as digital twins,

predictive maintenance models, and performance optimization algorithms for hands-on learning.

Research and Innovation Support: Support research initiatives by providing a platform for experimenting with new ideas, sharing research findings, and collaborating on projects. The Virtual Campus connects researchers with industry partners to drive innovation in wind energy technology and practices.

Promotion of Best Practices and Sustainability: Advocate for best practices in wind energy management and sustainable development. The Virtual Campus serves as a hub for disseminating knowledge on reducing environmental impact, improving energy efficiency, and advancing the adoption of renewable energy.

Customization and Flexibility in Learning: Offer flexible and customizable learning paths that cater to different levels of expertise, from beginners to seasoned professionals. The Virtual Campus adapts to the needs of its users, allowing them to progress at their own pace and focus on areas most relevant to their career goals.

Certification and Professional Development: Provide recognized certifications for course completions, contributing to professional development in the wind energy sector. The Virtual Campus enhances the credentials of participants, making them more competitive in the job market.

Global Reach and Inclusivity: Ensure that the Virtual Campus is accessible to a diverse, global audience. By offering universal learning content and accommodating different time zones, it aims to be an inclusive platform that supports the global wind energy community.

Focus on Digital Upskilling: The Virtual Campus will be aligned with the Digital Europe Programme and in particular the Digital Skills and Jobs Platform (europa.eu), enabling access to high-quality information, resources and opportunities in digital skills and jobs across all levels for DigiWind course participants.

Overall, the DigiWind Virtual Campus aims to be a leading platform for education, collaboration, and innovation, driving the future of wind energy through digital empowerment and community building.

3 Requirements and Features

3.3 Summary of DigiWind Requirements

The DigiWind Virtual Campus is designed to advertise, manage and deliver courses while integrating various external systems and supporting a range of user types. The diagram below provides an overview of the key systems, external entities, and data flows within the platform.

Virtual Campus: The Virtual Campus serves as the central system, responsible for managing core services such as learning management, content creation, user administration, and student engagement.

Users: External entities like learners, educators, admins, and support staff interact with the platform to perform functions such as enrolling in courses, managing staff, publishing content, and resolving support tickets.

External Services: The system also integrates with external services such as OpenID for authentication, university payment systems for course fee processing, and EBSI for certificate issuance.

Data Flow: Data flows represent the key interactions between the Virtual Campus and these external entities, including the handling of course data, user data, payments, support requests, and more.

Figure 1: Virtual Campus Context Diagram

This section provides an overview of the core components of the Virtual Campus, including the XR Showcase, Learning Management System (LMS), Content Management System (CMS), Support Desk, 3D Meeting Spaces, and the Student Information System (SIS). Together, these systems form the foundation of the Virtual Campus, enabling dynamic, immersive, and efficient online learning experiences.

XR Showcase is a platform designed to present immersive 3D content and interactive experiences to engage users, especially prospective students. It showcases innovative technologies and course-related demonstrations, potentially featuring 3D models, virtual tours, and other extended reality content.

Learning Management System: The LMS is the core of the Virtual Campus, responsible for delivering course content, managing student progress, and handling interactions between students and educators. It includes functionalities such as:

- Enrolment Management: Handling student registration and course enrolment.
- Content Access: Delivering course materials to students.
- Grading: Tracking and reporting student performance and providing continuous feedback on assessments and assignments over the course duration.

Content Management System: The CMS is responsible for managing the creation, storage, and publishing of course materials. Instructors can upload and organize multimedia content, such as videos, documents, quizzes, and simulations, for their courses. It supports:

- Content Creation: Developing new course materials.
- Content Management: Editing, versioning, organizing and previewing content.
- Content Delivery: Publishing content to the LMS for student access.

Support Desk: The Support Desk manages support tickets, helping users resolve technical issues or inquiries about course content and platform functionality. This component integrates with a ticketing system (like JIRA) to track and manage user requests efficiently.

- Ticket Submission and Tracking: Allowing users to submit support requests.
- Ticket Resolution: Managing escalations and resolving user issues.
- Knowledge Base: Providing FAQs and documentation to users for self-service support.

3D Meeting Spaces: The 3D Spaces provide a virtual environment for students and educators to interact. These spaces can host virtual classrooms, study groups, or community events, creating immersive, real-time learning experiences.

- Common Rooms: 24/7 collaborative spaces for course-specific discussions.
- Community Events: Spaces for large-scale events, such as webinars and conferences.
- Immersive Learning: Using 3D environments to enhance learning through interaction.

Student Information System: The SIS performs a key function in managing all critical student and course data within the Virtual Campus. It manages the registration, tracking, and management of student information, including personal details, course enrolments, academic records, and performance metrics. Key components within the SIS include the Admin Portal, the Analytics Portal, and various Communication Tools:

- The Admin Portal enables administrators to manage users, control access permissions, and oversee various system operations, ensuring that students, educators, and staff have the appropriate roles and permissions.
- The Analytics Portal provides data-driven insights into student engagement, course performance, and overall platform usage, helping administrators and

educators make informed decisions to improve learning outcomes and system efficiency.

- Communication Tools can include built-in or integrated email marketing tools, allowing institutions to send targeted communication to prospective students, current students, and alumni.

3.4 Functional Requirements

The functional requirements of the DigiWind Virtual campus are numerous and interlink with many other components of the DigiWind system, provided by the other members of the consortium.

Starting from a user perspective, the system users are split into the following groups:

1. Learners
2. Educators
3. Administrators

Definitions and detail of the users, and how they interact with each other and the DigiWind Virtual Campus, are detailed in the User Definitions section.

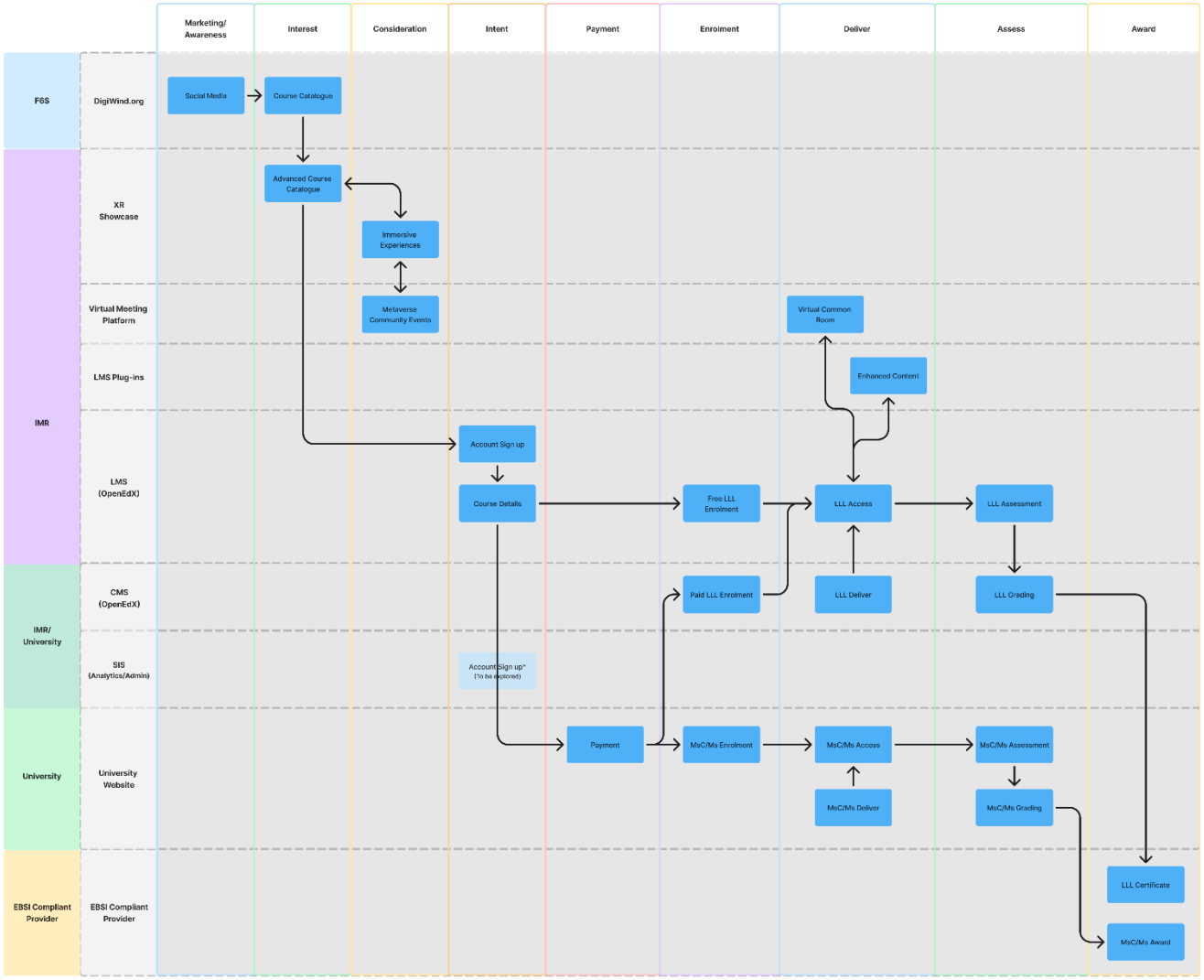


Figure 2: DigiWind Platform Learner Journey

The Virtual Campus learner journey encompasses multiple stages, guiding learners from initial awareness through to course completion and certification. The above diagram visualises the flow of the user journey for a learner and is broken down into the following stages:

Marketing/Awareness Stage: The user journey begins by building awareness through social media campaigns and directing potential students to the DigiWind.org platform via channels such as LinkedIn, Digital Skills and Jobs platform and WindEurope among others. From here, users can explore the Course Catalogue and get a broad overview of available programs. To further engage prospective learners, the XR Showcase and Virtual Meeting Platform offer immersive experiences and virtual events, drawing attention to course content and technologies.

Interest Stage: Users deepen their interest by browsing the Advanced Course Catalogue, which provides more detailed information about individual courses, including learning outcomes and structure. During this stage, users might also engage in Mid-course Community Events, which offer live interactions with instructors and current students, further sparking interest and helping them consider their enrolment options.

Consideration Stage: As users move toward deciding, they create an account on the platform, completing the Account Sign-up process. After registering, they can access detailed Course Information that includes specific requirements, schedules, and content previews. This stage ensures users have all the necessary information before committing to enrolling in a course.

Intent Stage: At this point, the user decides to enrol in either a free or paid course. If the course is free, the user moves directly to enrolment. For paid courses, the user moves forward by selecting the course and proceeding to the University Payment System to complete the transaction.

Payment Stage: For paid courses, the user is guided to the University Payment System, where they complete their transaction to finalize enrolment. Once the payment is confirmed, the user is officially enrolled and granted access to the course materials. The system securely processes payments, ensuring a smooth and reliable transaction process.

Enrolment Stage: Upon successful enrolment (free or paid), users gain LLL access to course content and tools. They may be granted entry to the Virtual Common Room for group collaboration or additional course-related discussions. This stage fully integrates learners into the course, enabling them to engage with all necessary materials and features.

Delivery and Assessment Stage: Courses are delivered via the LMS, where students access the materials and engage with the course content. Depending on the course design, students might also have access to enhanced content through LMS plug-ins and immersive experiences through the XR Showcase. The Virtual Common Room continues to facilitate collaboration throughout the course. Students are assessed either throughout or after the course by way of assignments or exams submitted through the LMS. The system tracks their submissions and processes them through

the LLL Grading system, allowing for accurate and timely assessment of their performance.

Award Stage: Following successful completion of assessments, students receive certificates or awards through the system. This might involve issuing digital credentials via an EBSI-compliant provider, allowing students to securely access and share their certifications. This concludes the user's journey in the course.

3.5 Functional Requirement List

3.3.1 Learners

XR Showcase	
Requirement ID	**Requirement Detail**
FR-XRS-L01	The public will have access to a platform to view all the offerings by the DigiWind project and sign up to the DigiWind social media accounts.
FR-XRS-L02	The public will have the ability to browse a list of current and upcoming LLL courses that will be available on the DigiWind Virtual Campus.
FR-XRS-L03	The public will have the ability to view detailed information on individual LLL courses, like description, start/end date, cost and credits.
FR-XRS-L04	The public will have the ability to view information about interrelated course offerings and how multiple courses may be stacked into a specialisation.
FR-XRS-L05	The public will have access to immersive and enhanced content relevant to a LLL course, to better understand the LLL courses on offer. (if provided by the Learning Institution)
FR-XRS-L06	The public will be provided a link to enable them to navigate to the enrolment section for the LLL course.
FR-XRS-L07	The public may have the ability to view funding opportunities available for that LLL course (If available)

Learning Management System (LMS)	
Requirement ID	**Requirement Detail**
FR-LMS-L01	Registered Learners will have the ability to view a list of all available courses on the LMS.
FR-LMS-L02	Registered Learners will have the ability to initiate enrolment onto a selected course
FR-LMS-L03	If required, the Registered Learner will be directed to the Learning Institution payment portal to complete the payment.
FR-LMS-L04	Once the payment has been (automatically or manually) confirmed as complete, the Registered Learner will be enrolled in their chosen course, making them an Enrolled Learner.
FR-LMS-L05	Enrolled Learners who are logged in will have the ability to view all the courses they are currently enrolled in.
FR-LMS-L06	Enrolled Learners who are logged in will have the ability to access course content on the LMS.
FR-LMS-L07	Enrolled Learners will be shown suggested courses relevant to them.

FR-LMS-L08	Enrolled Learner users will have the ability to complete their learning and monitor their learning progress.

3D Meeting Platform	
Requirement ID	**Requirement Detail**
FR-3DM-L01	The public, Registered Learners and Enrolled Learners will have the ability to take part in promotional, scheduled events in the 3D meeting platform to network and learn about upcoming courses
FR-3DM-L02	Registered Learners will have the ability to take part in ongoing (always open) 3D meetings as a DigiWind common room and social space.
FR-3DM-L03	Enrolled Learners will have the ability to participate in ongoing (always open) 3D meetings as a Course common room and social space.
FR-3DM-L04	Enrolled Learners will have the ability to take part in Scheduled 3D meetings as a Course event. These can be social, or education events, with guest speakers, etc.

Support Desk	
Requirement ID	**Requirement Detail**
FR- SD - L01	Users can view frequently asked questions.
FR- SD - L02	Users can check the status of their submitted support tickets to stay informed about the resolution process.
FR- SD - L03	Users can submit a support ticket for further assistance.

3.3.2 Educators

Content Management System (CMS)	
Requirement ID	**Requirement Detail**
FR-CMS-E01	Educators will receive a unique login for the virtual campus from Administrators of the system that will enable access to the Content Management System (CMS) under Single Sign-On (SSO)
FR- CMS -E02	Educators will have the ability to create a new course
FR- CMS -E03	Educators will have the ability to preview course contents as if accessed by learners
FR- CMS -E04	Educators will have the ability to schedule an instance of a course.
FR- CMS -E05	Educators will have the ability to update an existing course that is already uploaded and active on the DigiWind LMS
FR- CMS -E06	Educators will have the ability to track student participation in course content and activities.
FR- CMS -E07	Educators will have the ability to create, distribute, and manage assignments, quizzes, exams, and projects within the platform.
FR- CMS -E08	Educators will have the ability to detail funding opportunities available for a LLL course (if any)
FR- CMS -E09	Educators will have the ability to interact with learners enrolled on their courses
FR- CMS -E10	Educators will have the ability to review a learner's progress / results so that their EBSI record can be updated.

FR- CMS -E11	Educators will have the ability to independently upload their courses and course details to the CMS.
FR- CMS -E12	Educators will have the ability to independently upload immersive course material (including 2D HD Video, 3D 4k video, 360 4k Video, 360 3D 4k video, 3D models with annotations, and XR applications).
FR- CMS -E13	Educators will have the ability to publish all course information and content to the XR Showcase and the LMS.
FR- CMS -E14	Educators will have the ability to set the payment platform / link and cost information for their courses (needs to be confirmed by each institution)

Student Information System (SIS)	
Requirement ID	**Requirement Detail**
FR-SIS-E01	Educators will receive a unique login for the virtual campus from Administrators of the system that will enable access to the Student Information System (SIS) under Single Sign-On (SSO)
FR-SIS-E02	Educators will have the ability to manually add Registered Learner accounts to their courses.
FR-SIS-E03	Educators will have the ability to view and output statistics for their courses
FR-SIS-E04	Educators will have access to view general trends, such as overall user activity, and course completion rates.
FR-SIS-E05	Educators will have access to view detailed statistics on student enrolments across various courses.
FR-SIS-E06	Educators will have access to metrics such as time spent on each module, participation in discussions, and frequency of logins
FR-SIS-E07	Educators will have access to data on learners' academic performance across different assessments and activities
FR-SIS-E08	Educators will have access to a detailed view of individual learner activities within the Virtual Campus, including access logs, completed tasks, and interaction history

Support Desk	
Requirement ID	**Requirement Detail**
FR-SD-E01	Educators can view frequently asked questions.
FR-SD-E02	Educators can check the status of their submitted support tickets to stay informed about the resolution process.
FR-SD-E03	Educators can submit a support ticket for further assistance.

3D Meeting Space	
Requirement ID	**Requirement Detail**
FR-3DM-E01	Educators will have the ability to create a one-time event virtual 3D meeting space, and set the list of authorised attendees
FR-3DM-E02	Educators will have the ability to create an ongoing event virtual 3D meeting space, and set the list of authorised attendees
FR-3DM-E03	Educators will have the ability to load traditional presentation content into their virtual 3D meeting space, for attendees to watch

3.3.3 Administrators

Student Information System (SIS)	
Requirement ID	**Requirement Detail**
FR-SIS-A01	Administrators will have the ability to send targeted communication to prospective students, current students, and alumni.
FR-SIS-A02	Administrators will have the ability to measure the effectiveness of marketing efforts related to student recruitment and retention.
FR-SIS-A03	System Administrators will have the ability to establish new groups for individual institutions, which can then be assigned specific roles and permissions within the CMS.
FR-SIS-A04	System Administrators can modify user permissions of institution admins, ensuring that they have the appropriate level of access to resources and tools.
FR-SIS-A05	System Administrators can remove institution admins from the system.
FR-SIS-A06	Institution Administrators will create Educator accounts.
FR-SIS-A07	Institution Administrators can adjust Educator accounts access within their specific group.
FR-SIS-A08	Institution Administrators can remove access for Educator accounts who no longer need to be part of the system.

Support Desk	
Requirement ID	**Requirement Detail**
FR-SD-A01	Administrators can access and review the details of submitted tickets.
FR-SD-A02	Administrators can escalate a ticket to the appropriate team or supervisor.
FR-SD-A03	Administrators can resolve a ticket, after which the resolution will be communicated back to the user and the ticket is closed.

3.6 Non-functional requirements

Portability	
NF-1	The virtual campus should be operable on various operating systems, including Windows, macOS, Linux, iOS, and Android, without requiring significant modification. The platform should also be compatible with web browsers like Chrome, Safari, and Edge.
NF-2	The virtual campus should function across different types of devices, including desktops, laptops, tablets, smartphones, and VR/AR headsets that support modern web browsers.
NF-3	The virtual campus should adhere to web standards (HTML5, CSS3, JavaScript) to ensure it can run on any modern web browser.
NF-4	Standardized APIs should be provided to facilitate integration with external systems and ensure that the LMS can interact with various third-party services, tools, and platforms without modification.
NF-5	Educational content (e.g., courses, assignments, multimedia) can be transferred between different learning management systems (LMS) or virtual campus environments using industry-standard formats such as SCORM or xAPI.

Maintainability	
NF-7	The system should be designed with a modular architecture to facilitate easy updates, bug fixes, and feature enhancements without affecting the entire platform.
NF-8	Comprehensive documentation should be provided for developers, administrators, and end-users to support ongoing maintenance, troubleshooting and upgrades.
NF-9	Implement testing (unit, integration, and regression) to ensure that updates do not introduce new bugs or degrade system performance.

Reliability	
NF-10	The system must consistently perform as expected under both normal and peak loads, ensuring data integrity and transaction consistency.
NF-11	Robust error handling should be implemented to provide clear feedback to users and automatic recovery from transient issues without user intervention.
NF-12	Critical components of the system should have redundancy to prevent single points of failure and ensure continuous operation.

Scalability	
NF-13	The platform should be able to scale out by adding more nodes to handle increased user load and data processing requirements.
NF-14	The platform should also support scaling up by enhancing the capacity of existing infrastructure components.
NF-15	Implement auto-scaling mechanisms to adjust resources based on real-time demand, ensuring optimal performance during peak usage.

Performance	
NF-16	The platform must support the concurrent presence of thousands of users in the virtual campus without performance degradation. It should be capable of scaling horizontally and vertically to handle varying loads
NF-17	The system should maintain low latency, especially in scenarios like live classes, real-time collaboration or where a large number of concurrent users are consuming course content from the LMS with a target latency of under 100ms for critical interactions.
NF-18	The system must efficiently handle high-throughput data processing for real-time activities such as streaming, file transfers, and user interactions.

Availability	
NF-19	The platform should maintain a scheduled availability of 99% or higher to ensure users can access the virtual campus without unexpected downtime.
NF-20	The system should be designed to tolerate and recover from failures, ensuring continued operation without data loss or significant service disruption.
NF-21	Robust disaster recovery mechanisms, including automated failover, backup, and recovery processes, will be employed.

Flexibility	
NF-22	The platform should be designed to be extensible, allowing for the addition of new features and functionalities without requiring significant rework of existing components.
NF-23	Options should be made available to allow for customisation of branding, curriculum and user experience requirements.

4 User Definitions

As mentioned in the Requirements section above, the DigiWind Virtual Campus is split into three core user types: educators, learners, and administrators. A functional requirement is that a single user may have multiple roles – e.g., both educator and administrator, or even learner. To ensure that users can access the relevant features and content tailored to their specific roles, the system must allow users to choose between different "views" for educator, learner, or administrator roles whichever the user is authorized for.

Learners

Learners are defined as members of the public who are at any stage of the Learner User journey, either considering or are already enrolled on a course provided by the DigiWind Platform. This encompasses unregistered, browsing users who are not enrolled on any course through to graduates of courses viewing the qualifications they have achieved, or anywhere in between.

Learner users will fall into one of the following categories:

a) Browsing Learner users, Unregistered, and not enrolled in any current or previous course
b) Engaging Learner users, actively working to become an enrolled student
c) Enrolled Learner users, part of a current active course or courses
d) Graduate Learner users, who have completed a previous course, and have obtained a qualification through the DigiWind platform.

It is anticipated that Learner Users will have the ability to enrol on more than one course at a time. Equally, Graduate Learners will have the ability to enrol on other courses, making them both Graduate Learner and Enrolled Learner users.

Educators

Educators are primarily staff from the learning institutions who provide and assess learning. They are responsible for creating and delivering course content, assessing student progress, and maintaining an engaging and supportive learning environment. Their role is to facilitate learning, guide students through their academic journey, and ensure that educational objectives are met within the virtual campus.

The role of educator can also be applied to unregistered visitors who are granted partial access permissions either to analytics for research purposes, or to specific events held on the virtual campus to deliver lectures on relevant topics, participate in collaborative learning programmes, or deliver mentoring to existing students.

Administrators

Administrators are the backbone of the online learning environment. They ensure the platform is secure, functional, and aligned with the participating institution's goals. Their role is to support educators and students by providing a well-maintained, user-friendly platform, and by facilitating the smooth operation of the virtual campus.

Administrators can be at a system level, with full permissions to access, manage and update any aspect of the virtual campus platform, at a support level to provide Level 2 and Level 3 technical assistance to platform users, or at developer level to facilitate design, development, testing and releasing of new and updated features on the platform.

4.1. User Roles & Personas

User Type	Learner
User Role	Visitor
User Definition	Unregistered visitor who is typically browsing information around Wind Energy Systems and demo DigiWind courses/videos or gathering information on available DigiWind courses.
User Goals	Understand the courses on offer in DigiWind and how to register for a course.

User Type	Learner
User Role	Registered Student
User Definition	Registered user who is engaging with educational content, attending lectures, collaborating on projects and participating in virtual events.
User Goals	Access DigiWind course material and supplementary learning aids as well as attend DigiWind social and collaborative events and spaces with the goal of achieving a grade/certificate in a DigiWind course.

User Type	Educator
User Role	Educator
User Definition	User with partial administrator permissions to upload content to the DigiWind Learning Management System
User Goals	To create and upload courses to the DigiWInd virtual campus, direct learning activities, deliver lectures, interact and deliver feedback on assignments to registered students.

User Type	Educator
User Role	External Partner/Guest
User Definition	Unregistered visitor who is granted guest permissions to facilitate access to lectures and educational events by request of course providers.
User Goals	To deliver lectures on course material or industry specific topics of interest, to recruit students for graduate employment by way of recruitment events or to participate in collaborative learning initiatives.

User Type	Educator
User Role	Researcher
User Definition	Unregistered visitor who is granted guest permissions to facilitate access to specific analytics deeds for research purposes.
User Goals	To conduct research on DigiWind user behaviour, investigate the use of VR/AR in education and use this information to advance virtual learning.

User Type	Educator
User Role	Alumni
User Definition	Unregistered visitor who is granted guest permissions to facilitate access to specific alumni events by request of faculty administrators.
User Goals	To connect with alma mater, participate in alumni events and mentor students.

User Type	Administrator
User Role	System Administrator
User Definition	User with full administrator permissions to oversee user accounts, monitor platform usage and ensure compliance with policies but without access to source code.
User Goals	Administer the DigiWind platform ensuring that users are granted appropriate permissions, and that the platform is operational and remains compliant with academic and legislative policies.

User Type	Administrator
User Role	Support Staff

User Definition	User with partial administrative permissions to provide technical support to other user groups as well as guidance on platform features and to deliver tutorials and training on platform usage.
User Goals	Ensure that the DigiWind virtual campus remains live and operational and is accessible to all user groups.

User Type	**Administrator**
User Role	Designer/Developer
User Definition	Users with full administrator privileges designing, developing, testing and releasing new and updated features to the DigiWind virtual campus based on user feedback.
User Goals	To design and develop the DigiWind platform based on user requirements

4.2. User Stories

Epic 1: Unregistered User browsing the DigiWind Showcase website

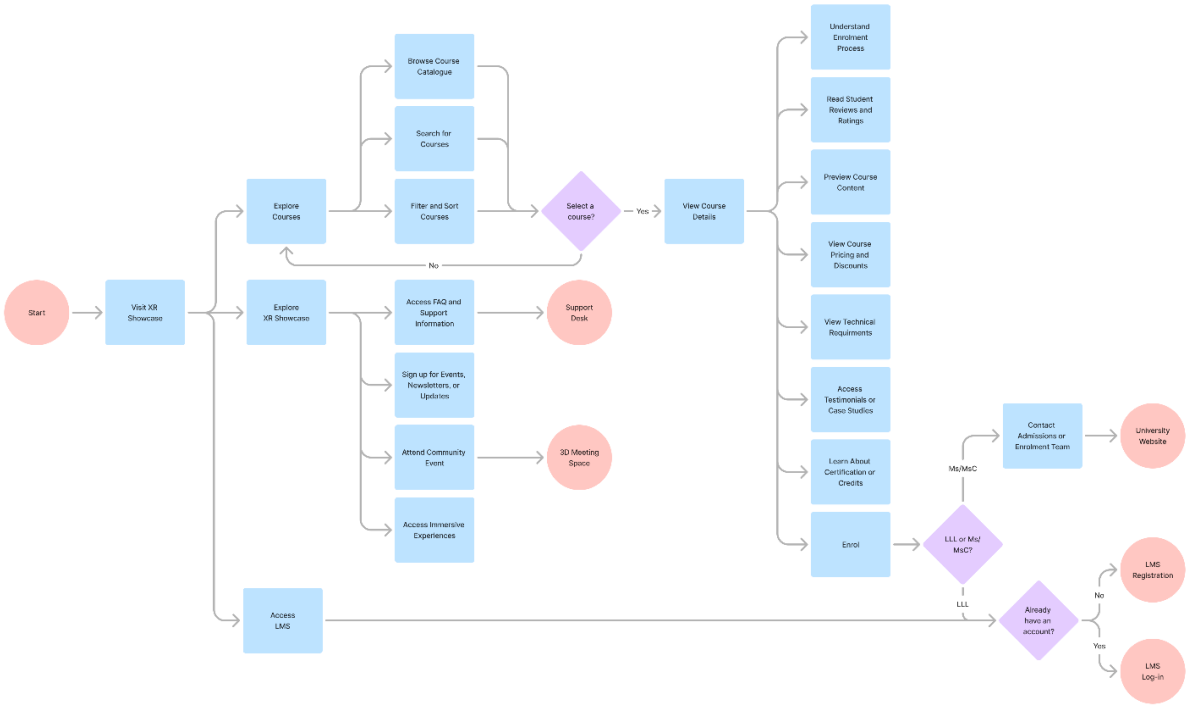


Figure 3: Unregistered User browsing the DigiWind Showcase website flowchart

User Story	**Access the virtual campus showcase website**
	As an unregistered user, I want to access the virtual campus showcase website so that I can explore the available courses and understand what the platform offers.

User Story	Browse Course Catalogue
	As an unregistered user, I want to browse the course catalogue so that I can see the variety of courses offered by the virtual campus and find ones that interest me.

User Story	Search for Courses
	As an unregistered user, I want to search for courses using keywords, subjects, or topics so that I can quickly find courses that match my interests or learning needs.

User Story	Filter and Sort Courses
	As an unregistered user, I want to filter and sort courses by criteria such as difficulty level, duration, start date, language, or instructor so that I can narrow down the course options to those most relevant to me.

User Story	View Course Details
	As an unregistered user, I want to view detailed information about each course, including course description, syllabus, instructor profile, duration, format, prerequisites, and fees so that I can determine if a course meets my needs and expectations.

User Story	Read Student Reviews and Ratings
	As an unregistered user, I want to read reviews and ratings from other students who have taken the course so that I can gain insights into the course quality and make a more informed decision.

User Story	Preview Course Content
	As an unregistered user, I want to preview sample content or watch introductory videos for a course so that I can get a sense of the teaching style, course material, and content quality before enrolling.

User Story	Understand Enrolment Process
	As an unregistered user, I want to understand the enrolment process, including steps, requirements, and deadlines so that I know how to proceed if I decide to register for a course.

User Story	View Course Pricing and Discounts
	As an unregistered user, I want to view the pricing, payment options, and any available discounts or scholarships for courses so that I can make an informed financial decision about enrolling.

User Story	Access FAQ and Support Information
	As an unregistered user, I want to access the FAQ section or contact support so that I can get answers to any questions I have about the courses or platform.

User Story	Learn About the Virtual Campus
	As an unregistered user, I want to learn more about the virtual campus, including its mission, values, accreditation, and partnerships so that I can assess the credibility and quality of the institutions.

User Story	Sign Up for Events, Newsletters or Updates
	As an unregistered user, I want to sign up for newsletters or updates about new courses, events promoting new courses, or special offers so that I can stay informed about opportunities that may interest me in the future.

User Story	Register for an Account
	As an unregistered user, I want to easily register for an account so that I can enrol in courses, access additional features, or participate in the virtual campus community.

User Story	Access Testimonials or Case Studies
	As an unregistered user, I want to access testimonials or case studies from successful students or alumni so that I can see real-world outcomes and successes from previous students.

User Story	View Technical Requirements
	As an unregistered user, I want to view the technical requirements for participating in courses (e.g., internet speed, required software) so that I can ensure that I have the necessary tools to participate effectively.

User Story	Learn About Certification or Credits
	As an unregistered user, I want to learn if a course offers a certificate, academic credit, or professional development units to understand the potential benefits of completing the course.

User Story	Learn About Taking a Specialisation
	As an unregistered user, I want to follow related/complementary courses to learn about taking a specialisation.

User Story	Contact Admissions or Enrolment Team
	As an unregistered user, I want to contact the admissions or enrolment team directly through chat, email, or phone so that I can get personalized assistance with my questions or concerns.

User Story	Understand the Learning Experience
	As an unregistered user, I want to understand the learning experience offered, including the use of virtual reality, simulations, digital tools, and interactive elements so that I can assess whether the teaching methods align with my preferred learning style.

Epic 2: Registered User taking part in a course

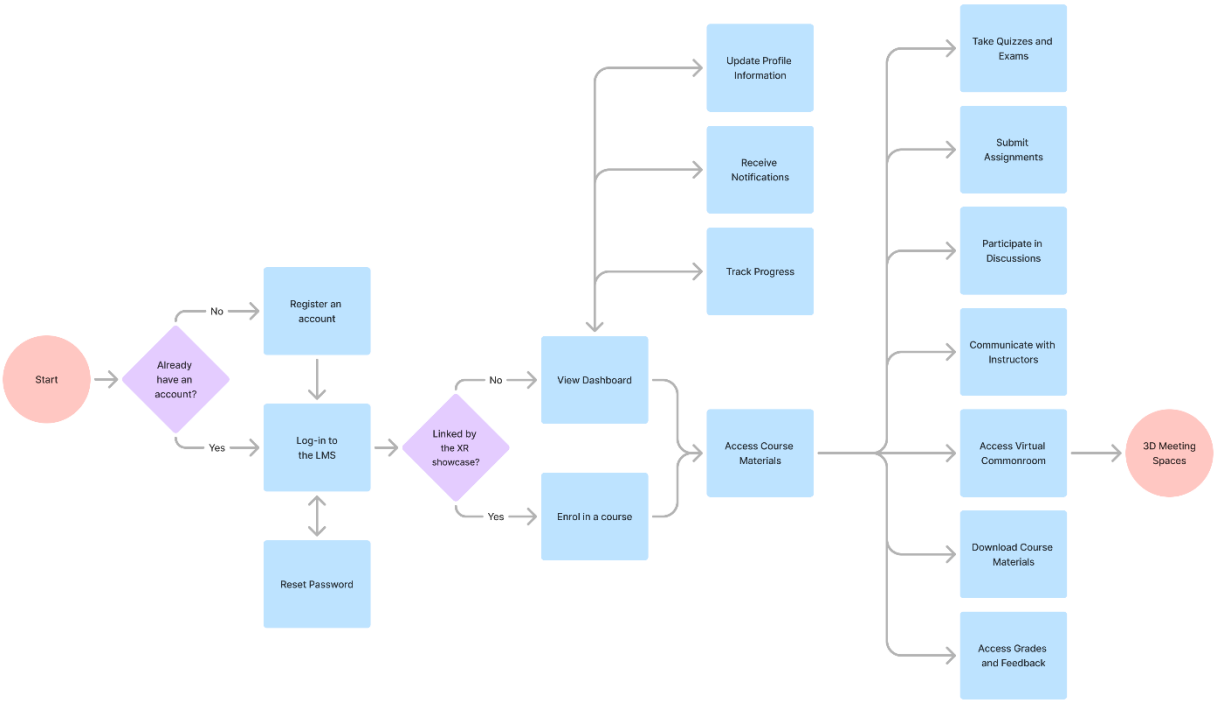


Figure 4: Registered User taking part in a course flowchart

User Story	Log In to the LMS
	As a registered user, I want to log in using my email or username and password so that I can securely access my learning dashboard and course materials.

User Story	Reset Password
	As a registered user, I want to be able to reset my password so that I can regain access to the LMS if I forget my password.

User Story	View Dashboard
	As a registered user, I want to view a personalized dashboard so that I can see an overview of my enrolled courses, recent activities, upcoming deadlines, and announcements.

User Story	Enrol in a Course
	As a registered user, I want to browse available courses and enrol in the ones that interest me so that I can start learning new content or fulfil specific academic requirements

User Story	Access Course Materials
	As a registered user, I want to access course materials like videos, documents, presentations, readings and immersive learning

	support content *so* that I can complete my coursework and study at my own pace.

User Story	**Participate in Discussions**
	As a registered user, I want to participate in course-related discussions and forums *so* that I can interact with peers, ask questions, and enhance my understanding of the subject matter.

User Story	**Submit Assignments**
	As a registered user, I want to be able to submit my assignments online so that I can complete my coursework and receive feedback from instructors.

User Story	**Take Quizzes and Exams**
	As a registered user, I want to take quizzes and exams within the LMS so that I can assess my knowledge and understanding of the course material.

User Story	**Track Progress**
	As a registered user, I want to track my progress in each course, including grades, completed modules, and upcoming tasks so that I can stay on top of my learning objectives and deadlines.

User Story	**Receive Notifications**
	As a registered user, I want to receive notifications about upcoming deadlines, new course content, announcements, or messages so that I am always aware of important updates and can manage my time effectively.

User Story	**Communicate with Instructors**
	As a registered user, I want to send messages or emails to instructors so that I can ask questions, seek clarification, or get additional support.

User Story	**Access Virtual Classrooms**
	As a registered user, I want to join live virtual classrooms or webinars so that I can participate in real-time learning sessions and interact with instructors and peers.

User Story	**Download Course Materials**
	As a registered user, I want to download course materials for offline access so that I can study without needing an internet connection.

User Story	**Access Grades and Feedback**

	As a registered user, I want to view my grades and feedback on assignments and exams so that I can understand my performance and areas for improvement.

User Story	**Update Profile Information**
	As a registered user, I want to update my profile information, such as my name, contact details, or profile picture so that my account reflects accurate and up-to-date information.

User Story	**Access Help and Support**
	As a registered user, I want to access help and support resources, such as FAQs, tutorials, or live chat so that I can resolve any issues I encounter while using the LMS.

User Story	**Provide Feedback on the Course**
	As a registered user, I want to provide feedback or rate a course upon completion so that the course administrators and instructors can understand the strengths and weaknesses of the course content.

User Story	**Log out of the LMS**
	As a registered user, I want to log out of the LMS when I finish my session so that my account remains secure and inaccessible to unauthorized users.

Epic 3: Educator creating and uploading a course to the LMS

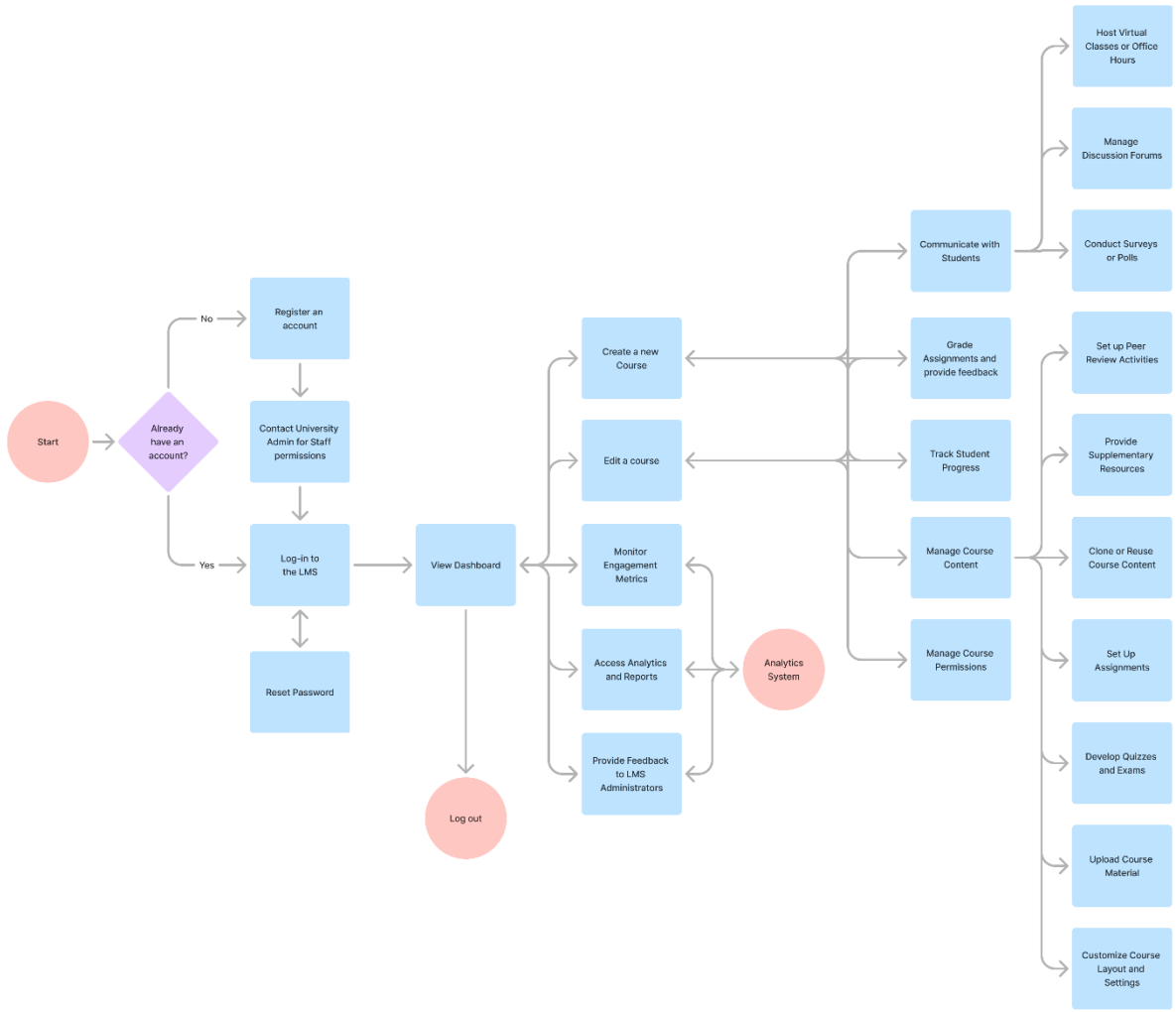


Figure 5: Educator creating and uploading a course to the LMS flowchart

User Story	Log In to the LMS
	As an educator, I want to log in using my credentials so that I can access my courses and manage content effectively.

User Story	Create a New Course
	As an educator, I want to create a new course within the LMS so that I can offer new learning opportunities for students.

User Story	Upload Course Materials
	As an educator, I want to upload course materials, such as lecture notes, slides, videos, and readings so that my students can access the resources they need for their studies.

User Story	Manage Course Content
	As an educator, I want to organize course content into modules or units so that students can easily follow the structure of the course and progress through the material logically.

User Story	Set Up Assignments
	As an educator, I want to create and set up assignments, including descriptions, due dates, and grading criteria so that students know what is expected of them and by when.

User Story	Develop Quizzes and Exams
	As an educator, I want to create quizzes and exams with various question types (e.g., multiple-choice, short answer, true/false) so that I can assess my students' understanding of the course material.

User Story	Grade Assignments and Provide Feedback
	As an educator, I want to review, and grade submitted assignments and provide personalized feedback so that students understand their performance and areas for improvement.

User Story	Track Student Progress
	As an educator, I want to track student progress through course modules, assignments, and assessments so that I can identify those who may need additional support or intervention.

User Story	Communicate with Students
	As an educator, I want to send announcements, messages, and reminders to individual students or the entire class so that they are informed about important updates, deadlines, or changes in the course.

User Story	Host Virtual Classes or Office Hours
	As an educator, I want to schedule and host virtual classes, live lectures, or office hours via integrated video conferencing tools so that I can engage with students in real time and address their questions or concerns.

User Story	Manage Discussion Forums
	As an educator, I want to create and moderate discussion forums or online discussion boards so that students can engage in course-related discussions, ask questions, and share ideas.

User Story	Customize Course Layout and Settings
	As an educator, I want to customize the layout and settings of my course page so that it reflects my teaching style and enhances the user experience for my students.

User Story	Provide Supplementary Resources
	As an educator, I want to provide supplementary resources such as additional readings, practice problems, and external links so that students can deepen their understanding of the subject.

User Story	Set Up Peer Review Activities
	As an educator, I want to set up peer review activities where students can evaluate each other's work so that they can engage in collaborative learning and critical thinking.

User Story	Monitor Engagement Metrics
	As an educator, I want to monitor engagement metrics, such as time spent on course materials, participation in discussions, and assignment submission rates so that I can evaluate student engagement and make data-driven adjustments to my teaching strategies.

User Story	Access Analytics and Reports
	As an educator, I want to access detailed analytics and reports on student performance, completion rates, and overall course effectiveness so that I can evaluate the success of the course and identify areas for improvement.

User Story	Provide Feedback to LMS Administrators
	As an educator, I want to provide feedback on the LMS features, usability, and performance so that the platform can be continuously improved to better meet my needs and those of my students.

User Story	Manage Course Permissions
	As an educator, I want to manage course permissions, including access for teaching assistants or guest lecturers so that they can contribute to course management and delivery as needed.

User Story	Clone or Reuse Course Content
	As an educator, I want to clone or reuse content from previous courses or semesters so that I can save time and ensure consistency in course delivery.

User Story	Conduct Surveys or Polls
	As an educator, I want to create and conduct surveys or polls within the course so that I can gather feedback from students on their learning experience and preferences.

User Story	Log Out of the LMS
	As an educator, I want to log out of the LMS when I finish my session so that my account remains secure and inaccessible to unauthorized users.

Epic 4: Researcher exploring DigiWind analytics to help improve courses

User Story	Login
	As a researcher, I want to have sufficient login permissions to access the analytics dashboard of the virtual campus.

User Story	Access Analytics Data
	As a researcher, I want to access analytics data across different courses and departments, so that I can identify trends in academic achievement and inform educational strategies.

User Story	Track Student Interactions
	As a researcher, I want to track how students interact with different types of content (e.g., videos, immersive content, quizzes, reading materials), so that I can identify which resources are most effective in enhancing learning.

Epic 5: University administration managing internal staff access

User Story	Create New Institute Group
	As an Administrator, I want to create a new group for an individual institution, which can then be assigned specific roles and permissions within the CMS.

User Story	Edit Admin User Permissions
	As an Administrator, I want to modify user permissions of institution admins, ensuring that they have the appropriate level of access to resources and tools.

User Story	Delete Admin User
	As an Administrator, I want to remove an institution admin from the system.

User Story	Edit Staff User Permissions
	As an Institution Administrator, I want to adjust staff access within their specific group.

User Story	Delete Staff User
	As an Institution Administrator, I want to remove access for staff who no longer need to be part of the system.

Epic 6: Virtual campus support staff managing support desk system

User Story	Access Support Ticket
	As Support staff, I want to access and review the details of submitted tickets.

User Story	Escalate Support Ticket
	As Support staff, if a ticket requires additional expertise or higher-level intervention, I want to escalate it to the appropriate team or supervisor.

User Story	Resolve Support Ticket
	As Support staff, I want to mark a ticket as resolved, after which the resolution is communicated back to the user and the ticket is closed.

5 Technical Specifications

5.3 Overall Architecture Diagram

This section will include a high-level diagram illustrating the entire system architecture. The diagram is organized into four layers: Users, Front End, Back End, and External. Each layer represents a different aspect of the system's functionality and its interaction with other components:

Users: Depicts all key user roles interacting with the system, such as support staff, developers/designers, system admins, institute admins, researchers, students, alumni, visitors, and educators.

Front End: Shows the user-facing components, including the Admin Portal, Analytics Portal, LMS, XR Showcase, 3D spaces, and CMS.

Back End: Represents the core services and data management components like the Support Desk, Authenticator, Student/Staff Data, and Content Store.

External: Lists the external integrations such as Jira Ticketing, OpenID, Azure SQL Database, Simple Email Service, EBSI Certificates, Payment, and Azure Blob Storage. Additionally, the Content Extensions are broken down into Native Apps, YouTube, Enhanced Content, Campus Tours, and Immersive Experiences.

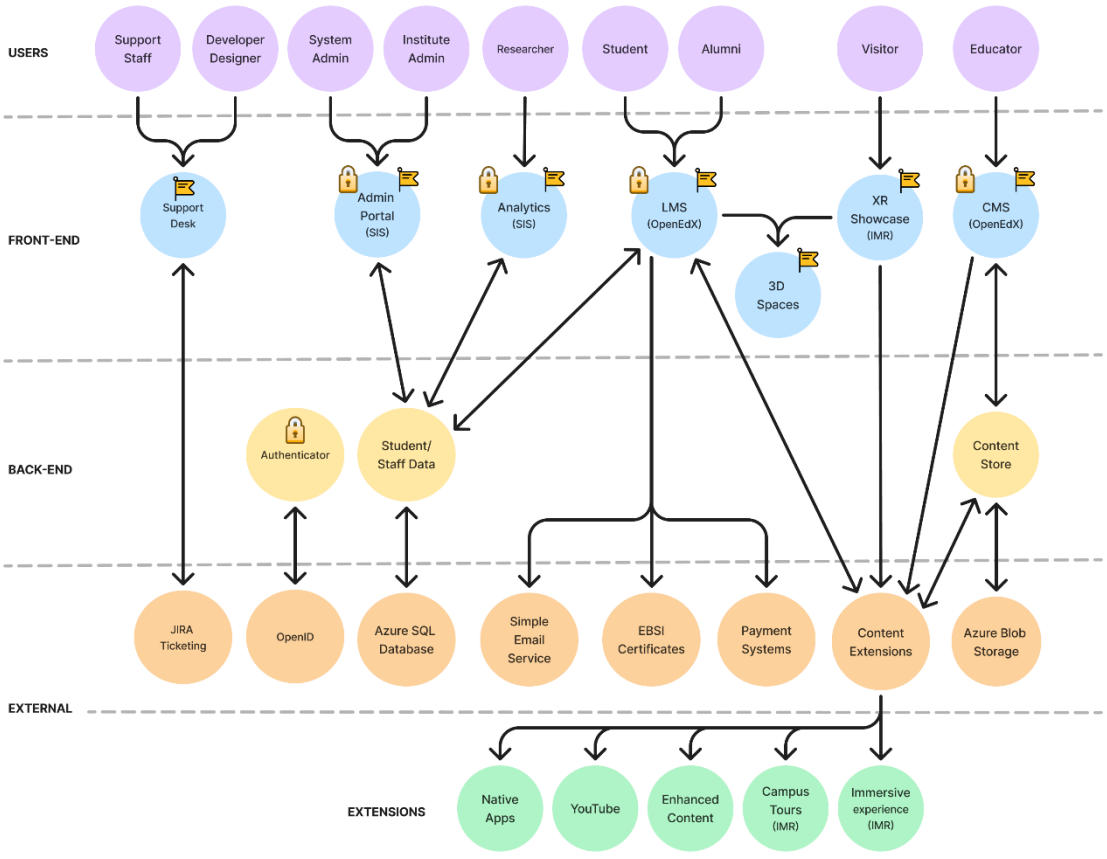


Figure 6: DigiWind Virtual Campus Architecture Diagram

5.4 Component Interactions

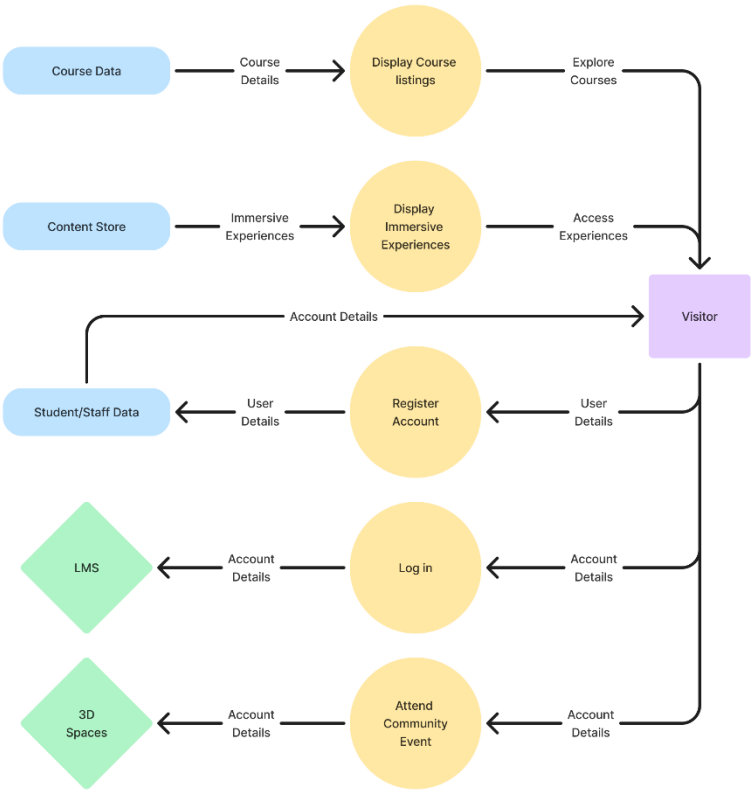
This section details how the different components interact with each other. It explains the communication between the Front End and Back End, as well as how the External services integrate into the system. The interactions include user authentication, content delivery, data storage, and support services, highlighting the flow of data and commands across the architecture.

XR Showcase

The XR Showcase is a custom-built landing page designed to present immersive 3D content, aimed at engaging prospective students, visitors, and alumni. It serves as an interactive space where users can explore dynamic experiences, preview courses, and learn about the institution's offerings.

Display Course Listings: Users request course information, which is retrieved from the Course Data and displayed on the interface.

Display Immersive Experiences: When users select immersive content, the system pulls the relevant 3D models, videos, or simulations from the content store or external content extensions and presents them to the user.



Register Account: User inputs are sent to the authentication system, which interacts with the student/staff data storage to create and store a new user profile.

Log In: Credentials are verified through the authenticator, allowing users to access the LMS.

Attend Community Event: The user's request is processed, connecting them to the 3D

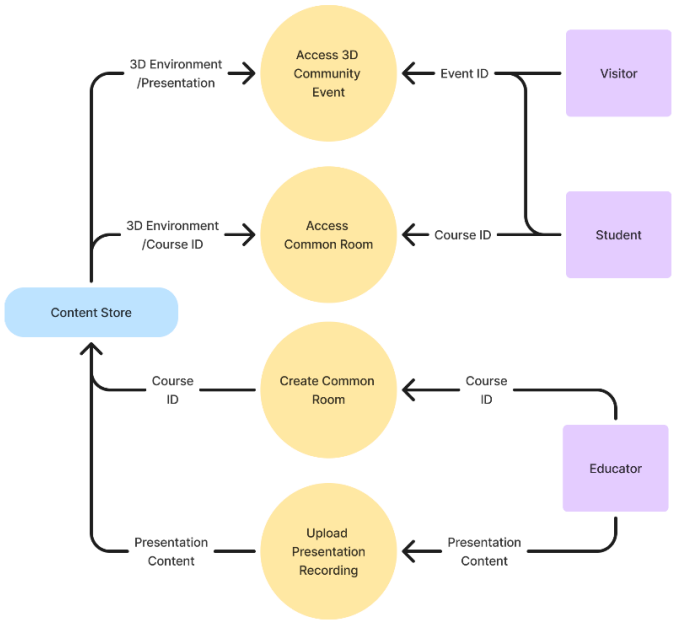
Meeting Space web application.

3D Spaces

The 3D Meeting Space serves as a virtual venue for conferences, community events, and large-scale interactions. It is designed to facilitate open events and networking

opportunities, allowing users to engage with a broader audience and learn more about DigiWind.

In contrast, the 3D Meeting Space also offers a dedicated, course-specific environment available 24/7. This space supports continuous, focused discussions and collaboration among enrolled students and educators, providing a tailored platform for course-related activities and interactions.



Access 3D Community Event: Users join virtual community events held in the public 3D meeting space, participating in discussions and networking opportunities but also guided by a highlighted presentation by an educator.

Access Common Room: Enrolled students and educators access the private, course-specific common room for focused, ongoing collaboration and discussions.

Create Common Room: Educators set up new common rooms within the virtual environment, configuring spaces for specific courses or groups.

Upload Presentation Recording: Educators can upload and share recorded presentations or other materials within the 3D meeting spaces, to lead community events. This functionality will ideally be updated to be a live event in the future upon further review of the institutions recording studio capabilities.

Learning Management System

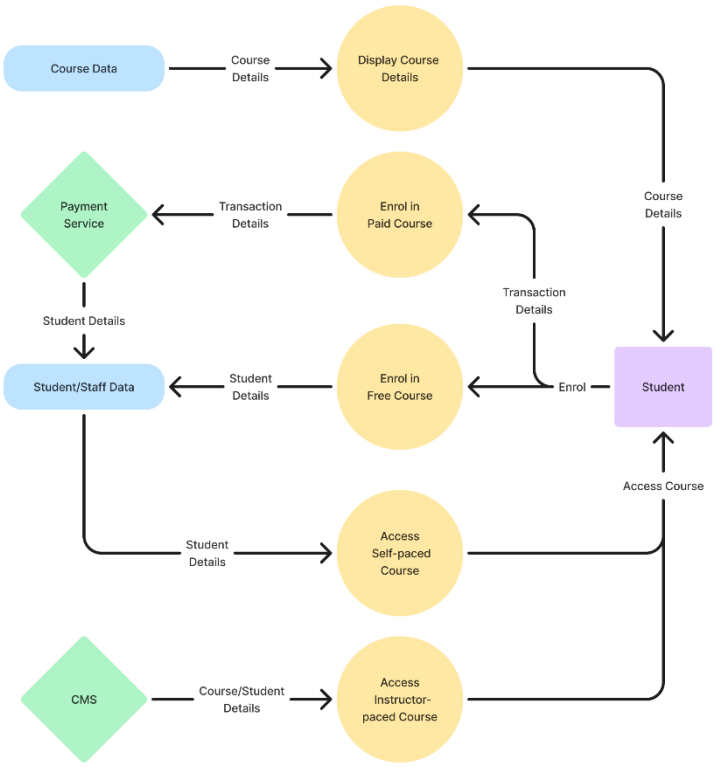
The Learning Management System (LMS) serves as the core educational platform within the Virtual Campus, responsible for delivering course content, managing student data, and facilitating interactions between students and educators. The LMS seamlessly integrates with other components, ensuring that content is accessible, user interactions are recorded, and data is securely managed. The data flow diagrams have been split up into three areas, enrolment, content access, and grading.

LMS - Enrolment

Display Course Details: The system presents available course information, including descriptions, dates, and requirements, allowing users to make informed enrolment decisions.

Enrol in Paid Course: For paid courses, the student is referred to a payment system that is processed by the institutes. Access to the course material is granted once payment is confirmed.

Enrol in Free Course: For free courses, the system immediately grants access upon enrolment, simplifying the process for students.



Access Self-Paced Course: Enrolled users can access self-paced courses, which allow them to progress through the content at their convenience.

Access Instructor-Paced Course: Enrolled users can access instructor-paced courses, which follow a structured timeline with set deadlines and interaction points. This is managed by the educator via the CMS.

LMS - Content Access

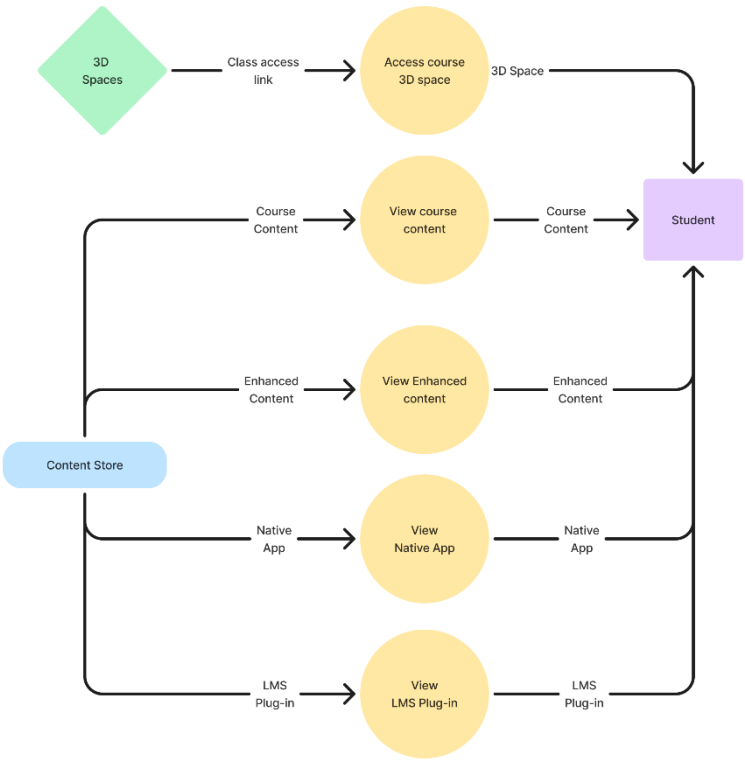
Access Course 3D Space: Students can enter specialized 3D spaces related to their courses via a unique URL with the course ID. The user will be verified via the SSO authentication system.

View Course Content: Users access standard course materials, such as lectures, readings, and assignments, hosted within the LMS.

View Enhanced Content: Students view enhanced course content, which includes more engaging content and has been outlined in D2.2 SOP documentation.

View Native App: Users can download and use native applications that have been uploaded to the LMS.

View LMS Plug-In: Students access additional features or content provided through LMS plug-ins, extending the capabilities of the system.



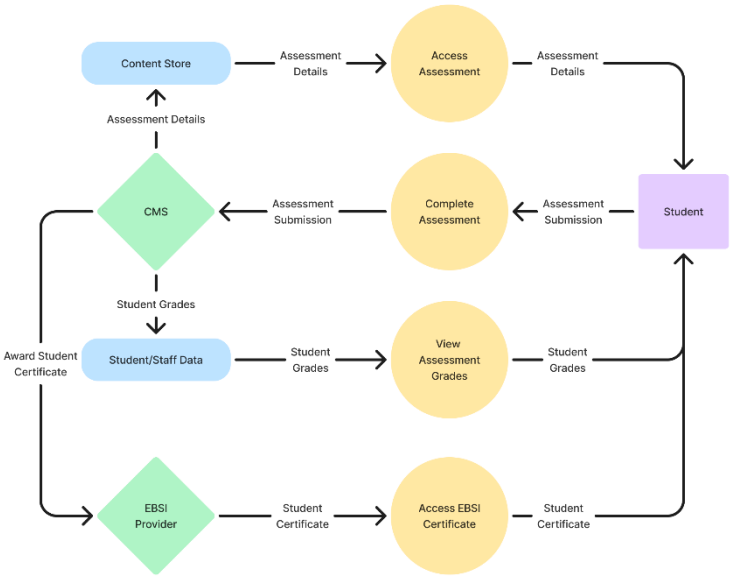
LMS - Grading

Access Assessment: Students access available assessments, including quizzes, tests, and assignments, through the LMS interface.

Complete Assessment: Users complete and submit their assessments, which are processed by the LMS for grading.

View Assessment Grades: Students can view their grades and feedback for completed assessments, providing insights into their performance.

Access EBSI Certificate: Upon successful completion of the course, students can access and download their EBSI (European Blockchain Services Infrastructure) certificates, verifying their achievements.



Content Management System

The Content Management System (CMS) is central to creating, managing, and publishing course materials. To better represent its complexity, the interactions are split into three distinct data flow diagrams: Content Creation, Content Management, and Course Delivery.

CMS - Content Creation

Create New Course: This interaction initiates the process of setting up a new course within the CMS, including defining course details, structure, and associated metadata.

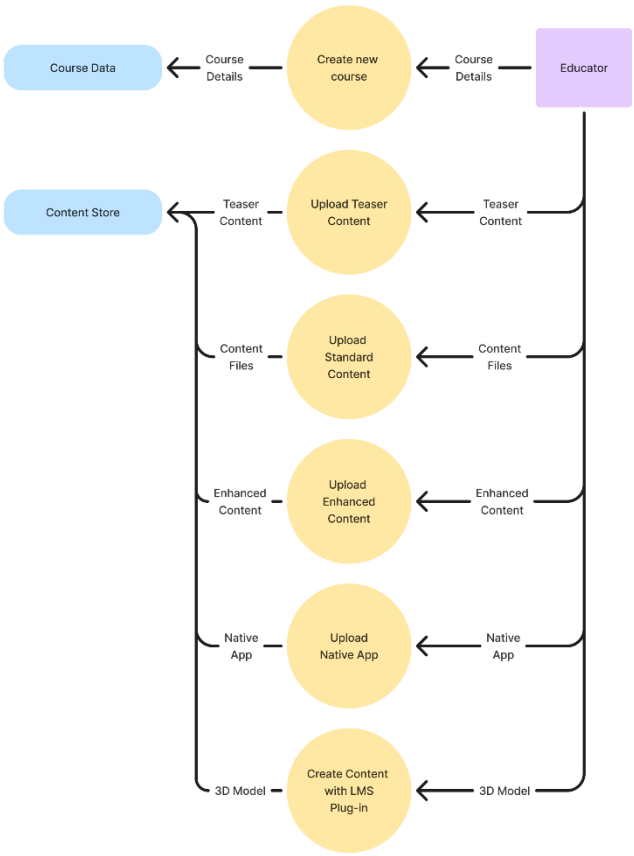
Upload Teaser Content: Instructors can upload introductory or promotional content designed to attract and inform prospective students about the course. This may include videos, images, or brief text descriptions. This will be shown on various systems within DigiWind.

Upload Standard Content: This interaction involves uploading the core course materials, such as lectures, reading materials, and assignments, in standard formats like PDFs, videos, and text documents.

Upload Enhanced Content: Instructors can upload advanced, interactive content, as outlined within the D2.2 SOP documentation.

Upload Native App: This interaction allows for the integration of native applications specific to the course, providing students with tailored tools or experiences beyond standard web-based content.

Create Content with LMS Plug-in: Instructors can leverage LMS plug-ins to create dynamic, interactive course content directly within the CMS.



CMS - Content Management

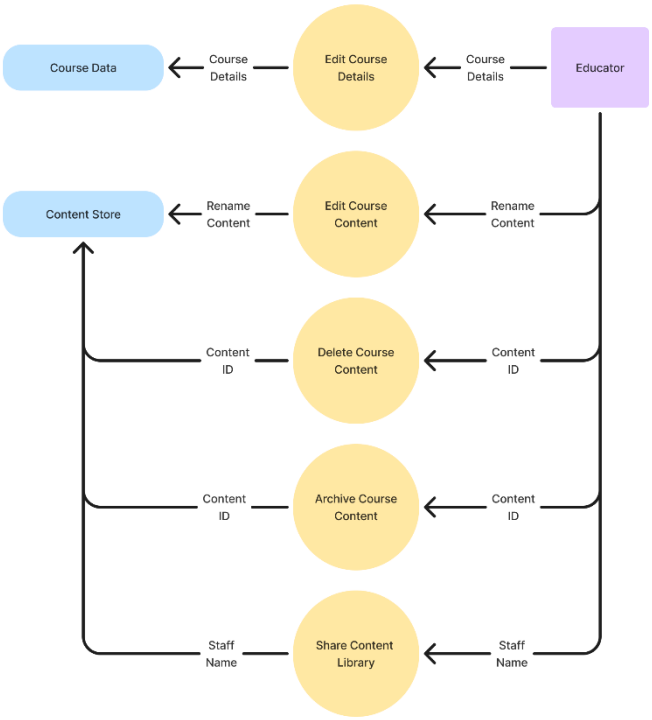
Edit Course Details: This interaction allows instructors or administrators to update key information about a course, such as its title, description, schedule, and other metadata, ensuring the course remains current and relevant.

Edit Course Content: Instructors can modify existing course materials, including updating lectures, readings, or assignments. This ensures that course content can be continuously improved or corrected as needed.

Delete Course Content: This interaction involves removing outdated or unnecessary materials from a course. It helps maintain a streamlined and relevant course structure.

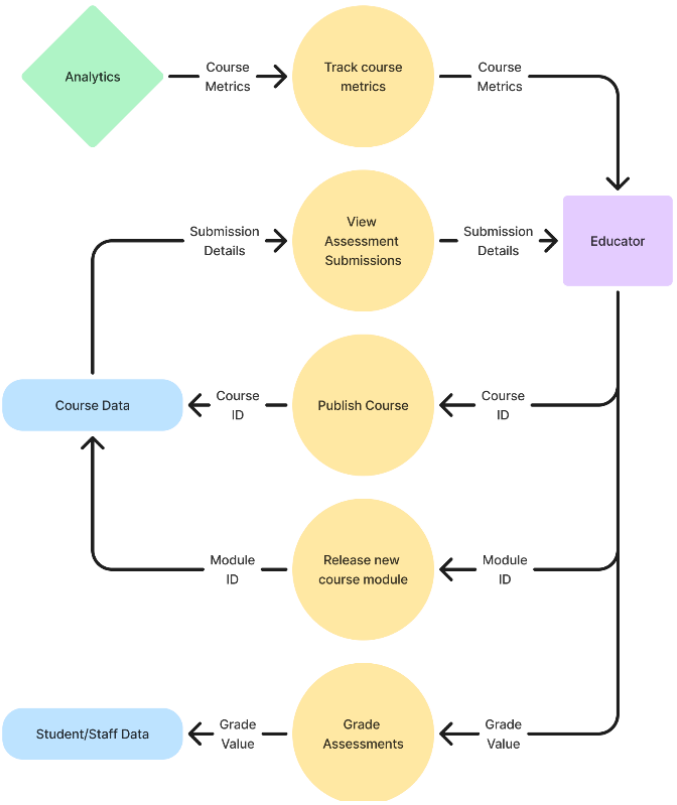
Archive Course Content: Instructors can move older or completed course content into an archive, preserving it for future reference or compliance purposes without cluttering the active course workspace.

Share Content Library: This interaction allows the distribution of course materials across multiple courses or with other instructors, facilitating content reuse and collaboration within the institution.



CMS - Course Delivery

Track Course Metrics: This interaction allows instructors and administrators to monitor various performance metrics related to the course, such as student progress, completion rates, and engagement levels. It provides valuable insights for improving course effectiveness. It is handled on the analytics system provided.



View Assessment Submissions: Instructors can access and review student submissions for quizzes, assignments, and other assessments. This interaction is essential for evaluating student performance and providing timely feedback.

Publish Course: This interaction involves making a course available to students. Once a course is published, enrolled students can access all the materials and begin their learning journey.

Release New Course Module: Instructors can schedule or manually release new modules or lessons to students as the course progresses. This interaction helps maintain a structured learning path and keeps students engaged with fresh content.

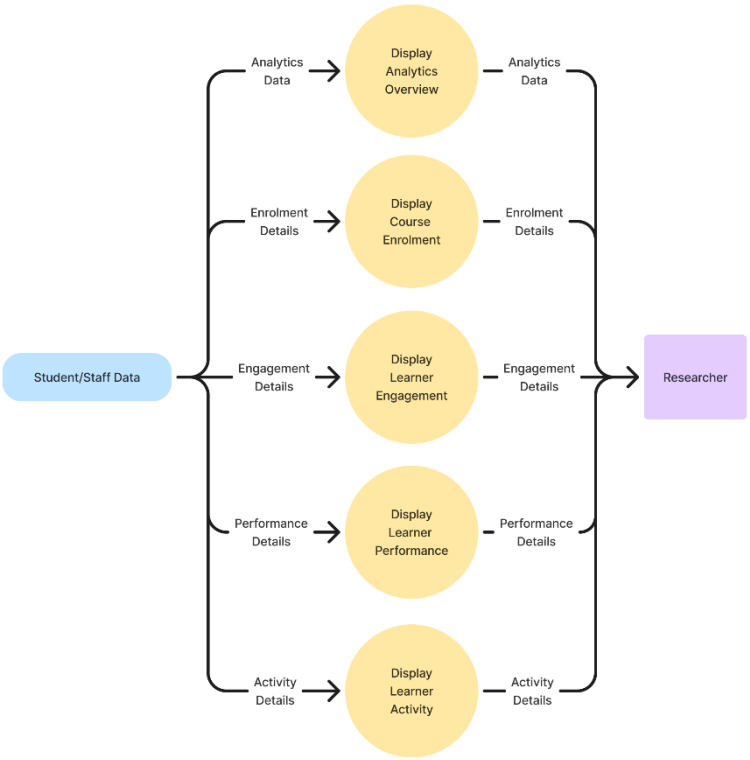
Grade Assessments: Instructors can evaluate student work and assign grades. This interaction is crucial for assessing learning outcomes and providing students with feedback on their performance.

SIS - Analytics

The Analytics component provides valuable insights into the Virtual Campus's performance and user engagement. It tracks and displays key metrics such as course enrolment, learner engagement, performance, and activity. This dataflow diagram for Analytics outlines how data is collected, processed, and presented to researcher, enabling them to make informed decisions, improve course content, and enhance the overall learning experience. This component is vital for understanding the effectiveness of the Virtual Campus and identifying areas for improvement.

Display Analytics Overview: Provides a high-level summary of key performance indicators (KPIs) related to the Virtual Campus. This interaction allows researchers to view general trends, such as overall user activity, course completion rates, and system health metrics.

Display Course Enrolment: Shows detailed statistics on student enrolments across various courses. This interaction helps in understanding which courses are popular, identifying enrolment trends, and assessing the effectiveness of marketing efforts.



Display Learner Engagement: Provides insights into how learners are interacting with the course content. It includes metrics such as time spent on each module, participation in discussions, and frequency of logins. This interaction helps educators identify which parts of the course are most engaging and where learners might be struggling.

Display Learner Performance: Displays data on learners' academic performance across different assessments and activities. This interaction is crucial for educators to track progress, identify at-risk students, and tailor instructional strategies to improve learning outcomes.

Display Learner Activity: Offers a detailed view of individual learner activities within the Virtual Campus, including access logs, completed tasks, and interaction history. This interaction helps in monitoring student participation and ensuring that all students are actively engaging with the course material.

SIS - Admin Portal

The Admin Portal is a critical interface for managing user permissions, institutional groups, and overall system administration within the Virtual Campus. It facilitates the administrative tasks necessary to maintain the system's integrity, ensuring that users have appropriate access and that institutional structures are correctly configured.

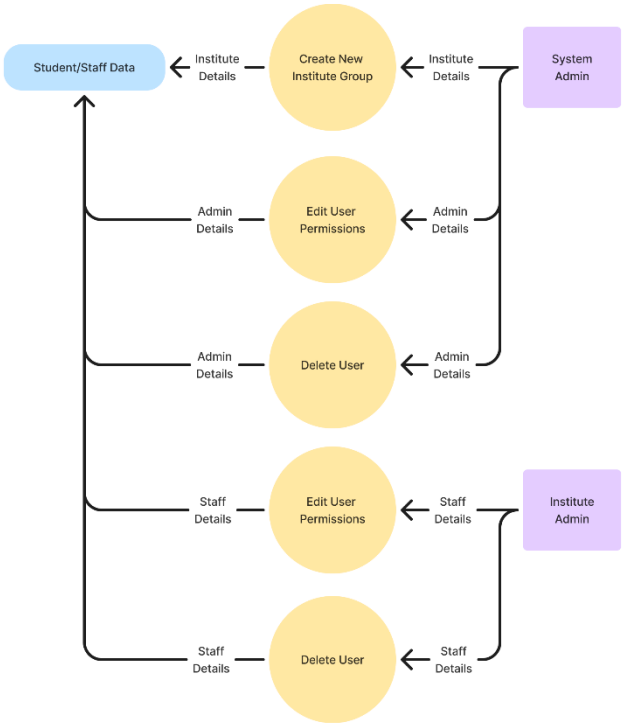
Create New Institute Group: This interaction allows system admins to establish new groups for individual institutions, which can then be assigned specific roles and permissions within the CMS.

Edit Admin User Permissions: System admins can modify user permissions of institution admins, ensuring that they have the appropriate level of access to resources and tools.

Delete Admin User: This function allows for the removal of institution admins from the system.

Edit Staff User Permissions: Institution admins can adjust staff access within their specific group.

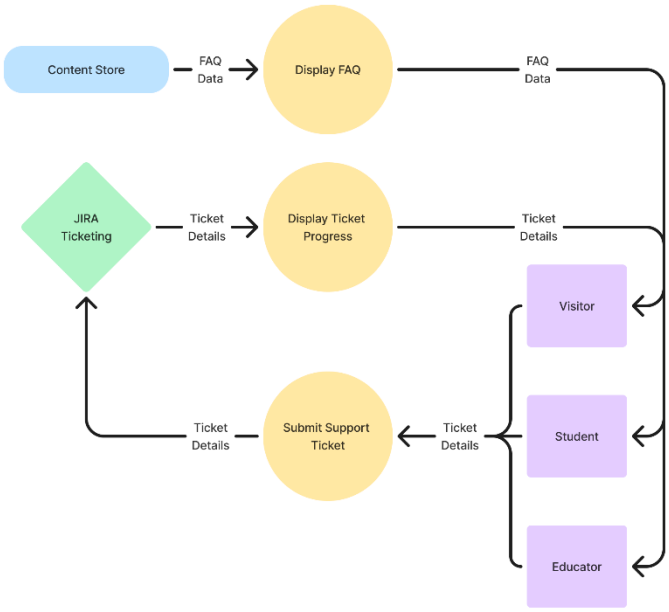
Delete Staff User: Institution admins can remove access for staff who no longer need to be part of the system.



Support Desk

The Support Desk plays a crucial role in maintaining the various Virtual Campus systems by providing timely assistance to users. It manages user inquiries, technical issues, and general support requests through an organized ticketing system. The interactions are divided into user-facing actions, such as viewing FAQs and submitting tickets, and internal processes, including ticket escalation and resolution. The Support Desk ensures users receive prompt and effective support, enhancing their overall experience within the Virtual Campus.

This diagram focuses on how users interact with the support desk system:

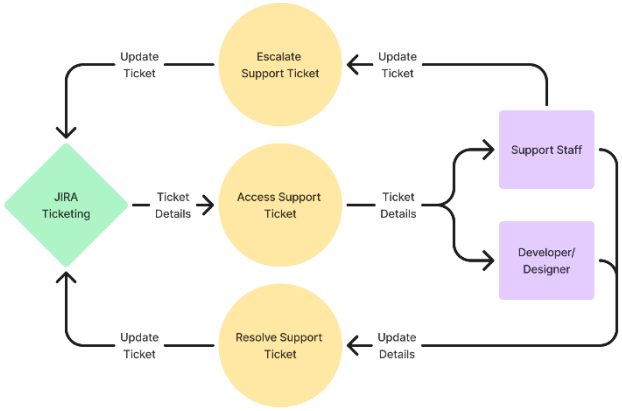


Display FAQ: Users can view frequently asked questions, helping them quickly find solutions to common issues without needing to submit a ticket.

Display Ticket Progress: Users can check the status of their submitted support tickets to stay informed about the resolution process.

Submit Support Ticket: If the issue isn't covered by the FAQ, users can submit a support ticket for further assistance.

This diagram illustrates the internal processes involved in handling support tickets:



Access Support Ticket: Support staff access and review the details of submitted tickets.

Escalate Support Ticket: If a ticket requires additional expertise or higher-level intervention, it is escalated to the appropriate team or supervisor.

Resolve Support Ticket: The support team works to resolve the ticket, after which the resolution is communicated back to the user and the ticket is closed.

5.5 System Data Flow

The System Data Flow diagram provides an overview of how data moves within the Virtual Campus architecture, specifically focusing on two primary application groups: IMR developed web pages and Open edX. These application groups represent the core components through which users interact with the system, and they encompass various functional areas that manage support services, immersive content delivery, learning management, and administrative tasks.

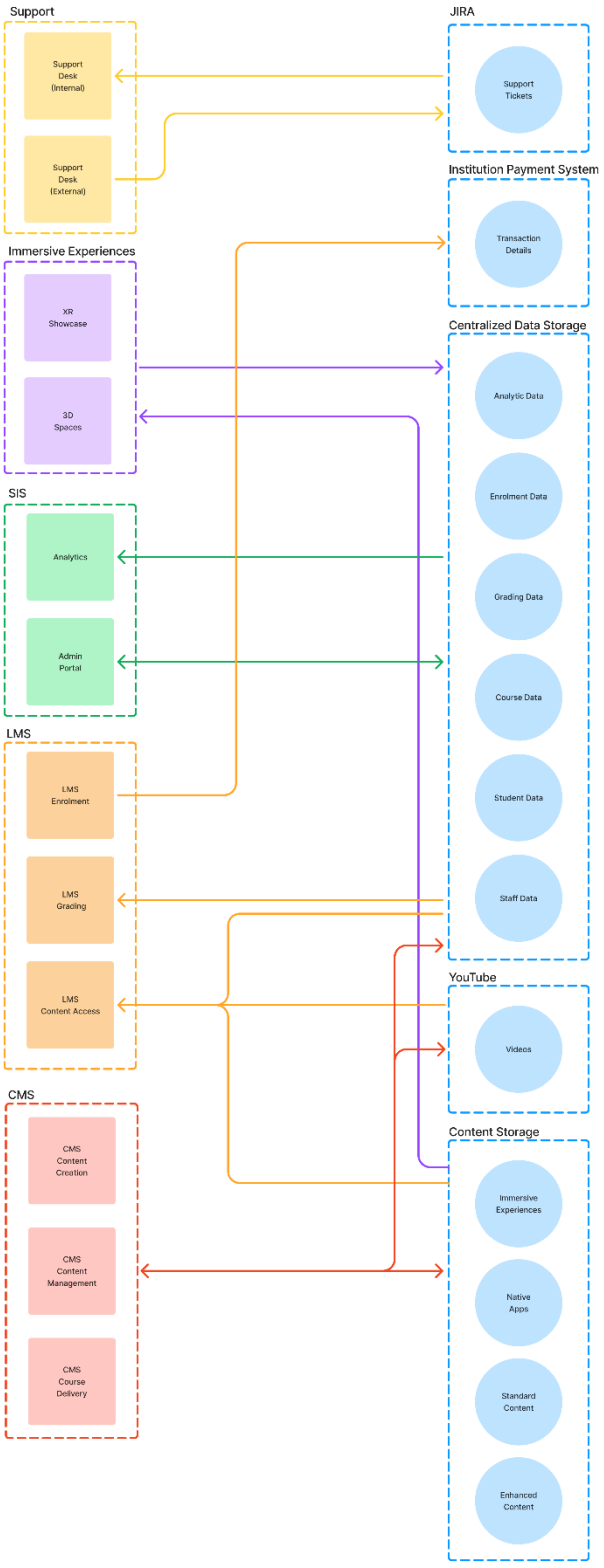


Figure 7: Data Flow through the DigiWind Virtual Campus

6 Supported Content

The DigiWind Virtual Campus will support a range of materials, media and resources that can be created, uploaded and shared within the platform. The main content types, where they are supported and examples of how these might be represented are defined in the following tables:

Content Type	Course Catalogue
Formats	DOC, DOCX, PDF, TXT, HTML
Use Cases	• Core Course Details (Title, Description, Dates, Cost, Credits, Image, Host University) • Links to Course Enrolment • Links to Payment Providers

Content Type	Standard Content
Formats	JPEG, PNG, GIF, SVG, MP4, MOV, AVI, MP3, WAV, PPT, PPTX, Google Slides
Use Cases	• Learning content for the LMS.

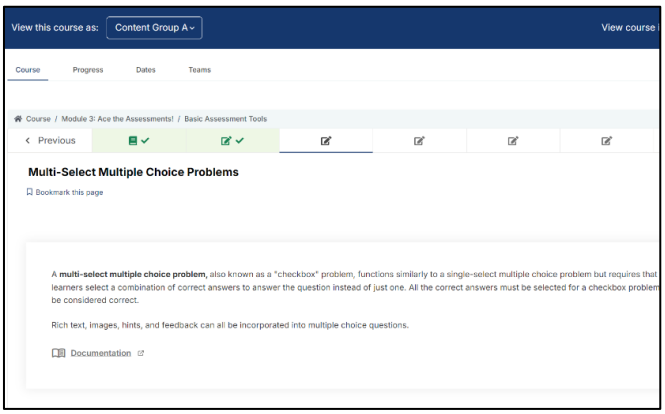
Content Type	Immersive Content
Formats	AR/VR native applications and web viewers. Simulations data represented in an interactive 3D format.
Use Cases	• Marketing/Advertisement • Free learning material to get learners started • Encourage more learner registrations

Content Type	Teaser Content
Formats	Course overview video, sample course content, testimonials, etc... To be confirmed based on university staff bandwidth.
Use Cases	• Encourage more learner registrations • Additional content to compliment course descriptions.

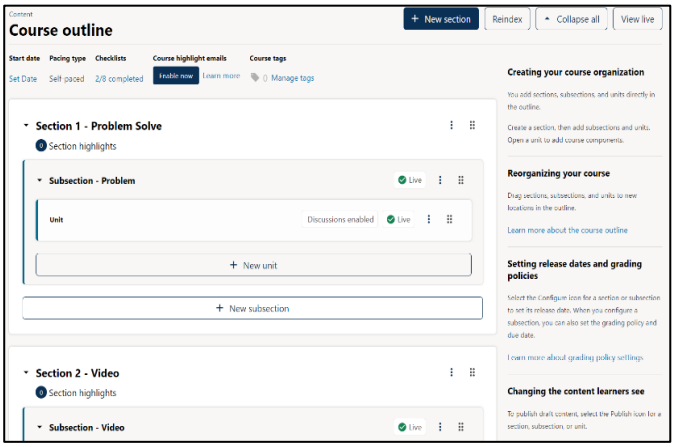
Content Type	Enhanced Content
Formats	As outlined in D2.2 SOP Document
Use Cases	• Increase engagement of learners. • Gather more engagement analytics to help improve courses.

Learning Portal

The Learning Portal is the central hub for all course-related activities, including both the Learning Management System (LMS) and the Content Management System (CMS). The LMS supports various content types within standard and enhanced content, catering to different learning styles and ensuring a comprehensive understanding of the course material.



The CMS within the Learning Portal plays the crucial role in creating and managing all this course content. Instructors can easily upload and organize materials, from standard documents and multimedia to advanced immersive content. The CMS allows for real-time updates and content customization, ensuring that all learning materials are current and aligned with the course objectives. Together, the LMS and CMS provide a robust and flexible platform that enhances both teaching and learning experiences.



The course data can contain multiple file types but will be uploaded as a SCORM file. This course content will follow a standard format as follows:

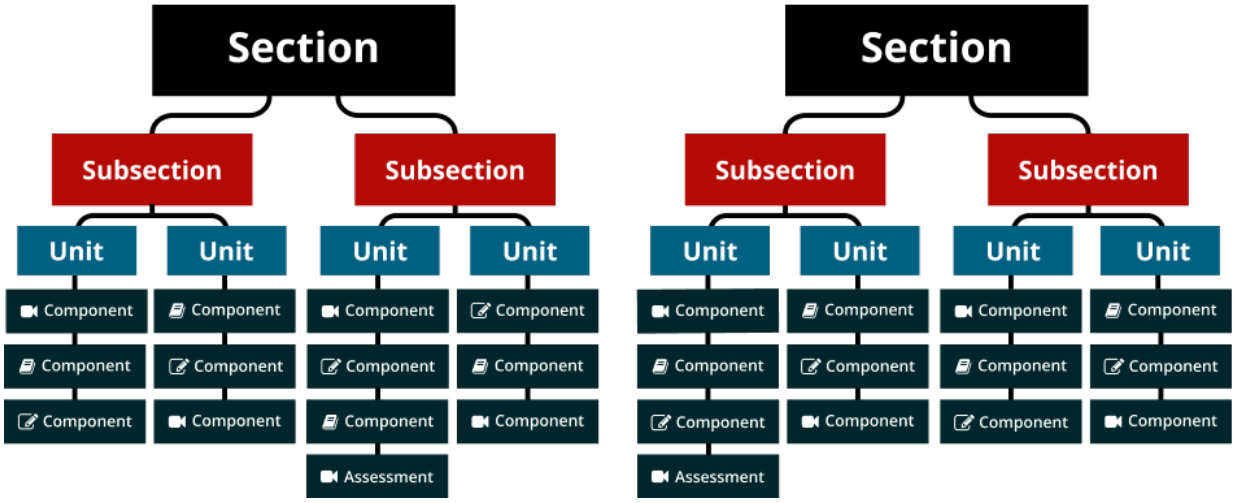


Figure 8: Standard Course format

3D Meeting Platform

The 3D Meeting Spaces are designed to facilitate dynamic community events, making use of Green Room Recording Studios for delivering polished presentations. These events can incorporate various content types, including videos, slideshows, and interactive 3D models, creating an immersive and engaging experience for participants. The space allows for live interactions, Q&A sessions, and networking opportunities, all within a virtual environment that can host large groups and showcase advanced multimedia content.

Figure 9: Example of 3D Meeting Space

For course-specific collaboration, the Virtual 24/7 Common Room offers a dedicated space where students and educators can engage continuously. This environment supports a wide range of content formats, such as documents, simulations, and immersive experiences, enabling rich interaction and ongoing discussions. The

common room is tailored to the needs of each course, providing a flexible platform for sharing materials, conducting group work, and enhancing the overall learning experience.

7 Operating Environment

This section outlines a broad, system-wide view of operations including general hardware, software, hosting, and network requirements.

7.3 Hardware Requirements

The effectiveness and reliability of the Virtual Campus system depends heavily on appropriate hardware infrastructure. This section outlines the necessary hardware specifications for servers, backup systems, and end-user devices to ensure seamless operation and optimal performance. By defining the hardware requirements, we establish a foundation for robust system performance, data protection, and user accessibility, supporting the overall functionality and reliability of the Virtual Campus.

Servers: Current server expectation are based on estimated active user ranges. As user engagement and system usage patterns become clearer, these estimates will be refined. The specified server configurations are designed to address anticipated loads, with future adjustments made as needed based on actual user data and performance metrics.

- **Up to 1,500 Active Users**: A single Azure Virtual Machine, similar to the Standard_D4_v3 instance (featuring a 4-core processor and 16 GB of RAM), would be expected to manage the learning portal within this user range. If during peak usage times, the average CPU utilization consistently reaches high levels, the server would be scaled up using Azure Virtual Machine Scale Sets.
- **More Than 1,500 Active Users**: For this larger user base, it would be expected to distribute the workload across multiple Azure Virtual Machines. This involves separating key data layers onto individual VMs. This strategy would help manage increased demand and maintain performance and reliability, utilizing Azure Load Balancer and Azure Scale Sets to distribute traffic efficiently.

As for the Showcase Website and Virtual Meeting Space server requirements, these will be specified in a future update. These requirements will be determined based on additional research into the platform's performance needs and scalability.

Backup Systems: To ensure data protection and continuity, the Virtual Campus system will use Azure Blob Storage for secure, remote backups to protect against site-specific disasters. A secondary server, managed through Azure Site Recovery, will also be maintained to activate if the primary system fails. Further details on the exact amount of storage space will be outlined once more examples of course content have been reviewed.

User Devices: To ensure a smooth and effective experience with the Virtual Campus, end-user devices must meet certain hardware specifications. This includes both desktop/laptop and smartphone requirements to accommodate diverse user access scenarios. The following tables outline the minimum and recommended hardware

specifications for desktop/laptop computers and smartphones, ensuring compatibility with the LMS and virtual environments while providing a satisfactory user experience.

Desktop/Laptop Expected Hardware Requirements:

Component	Minimum Specification	Recommended Specification
Processor (CPU)	Intel Core i3 or equivalent / AMD Ryzen 3	Intel Core i5 or equivalent / AMD Ryzen 5
Memory (RAM)	4 GB RAM	8 GB RAM
Graphics (GPU)	Integrated graphics	Integrated graphics or basic dedicated GPU
Storage	128 GB SSD or equivalent	256 GB SSD or higher
Display	720p resolution	1080p resolution
Operating System	Windows 10 or macOS Mojave	Windows 10 or macOS Monterey
Internet Connection	3 Mbps download / 1 Mbps upload	10 Mbps download / 3 Mbps upload
Browser	Latest version of Chrome, Firefox, or Edge	Latest version of Chrome, Firefox, or Edge
Peripherals	Basic webcam and microphone	Standard HD webcam and microphone

Smartphone Expected Hardware Requirements:

Component	Minimum Specification	Recommended Specification
Processor (CPU)	Quad-core processor	Octa-core processor
Memory (RAM)	2 GB RAM	4 GB RAM
Graphics (GPU)	Integrated graphics	Integrated graphics or basic dedicated GPU
Storage	32 GB storage	64 GB storage or higher
Display	720p resolution or HD display	Full HD (1080p) or higher resolution
Operating System	Android 9.0 (Pie) / iOS 12	Android 12 or iOS 15
Internet Connection	3G/4G LTE connectivity	4G LTE or 5G connectivity
Browser	Latest version of Chrome, Firefox	Latest version of Chrome, Firefox

Specific Immersive Experience Hardware: The core Virtual Campus platform will not require these devices but may offer downloadable content that does. Details of these devices will be added once native applications immersive content has been developed for a DigiWind module. It is expected that these devices will include, AR/VR headsets, high performance GPUs, and possibly more customised hardware.

Hybrid Classroom Hardware: As outlined within D2.3 of WP2, DigiWind Classroom Exemplar.

7.4 Software Requirements

The Virtual Campus system requires a range of software to support its various components. Below are the key software requirements:

Server Operating System: The Virtual Campus system will be hosted on Linux-based servers, specifically using Ubuntu Server on Azure. Linux is chosen for its stability, security, and strong support in cloud environments, making it ideal for running the LMS, showcase website, and other critical applications.

Client Operating System: Since the Virtual Campus is primarily a web-based system, it will be cross-platform and accessible from any major operating system. This includes Windows, macOS, iOS, and Android, ensuring that users can access the platform from a wide range of devices, whether desktop or mobile.

Database types: MySQL is chosen as the primary database for managing relational data, such as user information, course content, and LMS activities, due to its reliability and seamless integration with Open edX. Additionally, MongoDB will be utilized for handling unstructured data in cases where flexibility and scalability are required.

Web server software: Nginx will be utilized as the primary web server and reverse proxy for its high performance and efficient handling of concurrent connections, particularly for serving the LMS and showcase website.

7.5 Network Requirements

The Virtual Campus system requires a robust and efficient network infrastructure to ensure seamless access and optimal performance. Key network requirements include:

High-Bandwidth Connections: Users should have a minimum internet connection speed of 5-10 Mbps for standard LMS access. For activities involving high-definition video streaming or interactive 3D environments, speeds of 20 Mbps or higher are recommended.

Load balancing: A load balancer will be used for distributing incoming traffic across multiple servers to enhance reliability and maintain consistent performance during high traffic periods. Additionally, it will help with implementing auto-scaling, that

ensures the number of active servers adjusts dynamically based on traffic demand, optimizing resource usage and maintaining system responsiveness.

7.6 Hosting Environment

The Virtual Campus system will be hosted in a cloud environment to leverage scalability, flexibility, and cost-efficiency. Key aspects of the hosting environment include:

Cloud hosting details: The system will be hosted on Azure, leveraging its scalable resources to handle varying user demands while ensuring high availability and disaster recovery. Utilizing multiple Azure geographic regions or availability zones enhances redundancy and reduces latency, ensuring efficient performance for users across various locations.

Hosting configuration: The Virtual Campus system will deploy virtual servers tailored to the specific needs of the LMS, showcase website, and other components. The server specifications will be adjusted based on performance requirements and anticipated user load. Scalable cloud-based storage solutions will be implemented for data and backups, ensuring both high performance and durability. Additionally, the network setup will include configuring virtual networks, security groups, and access controls to ensure secure and efficient communication between system components and end-users.

7.7 Cloud Infrastructure Diagram

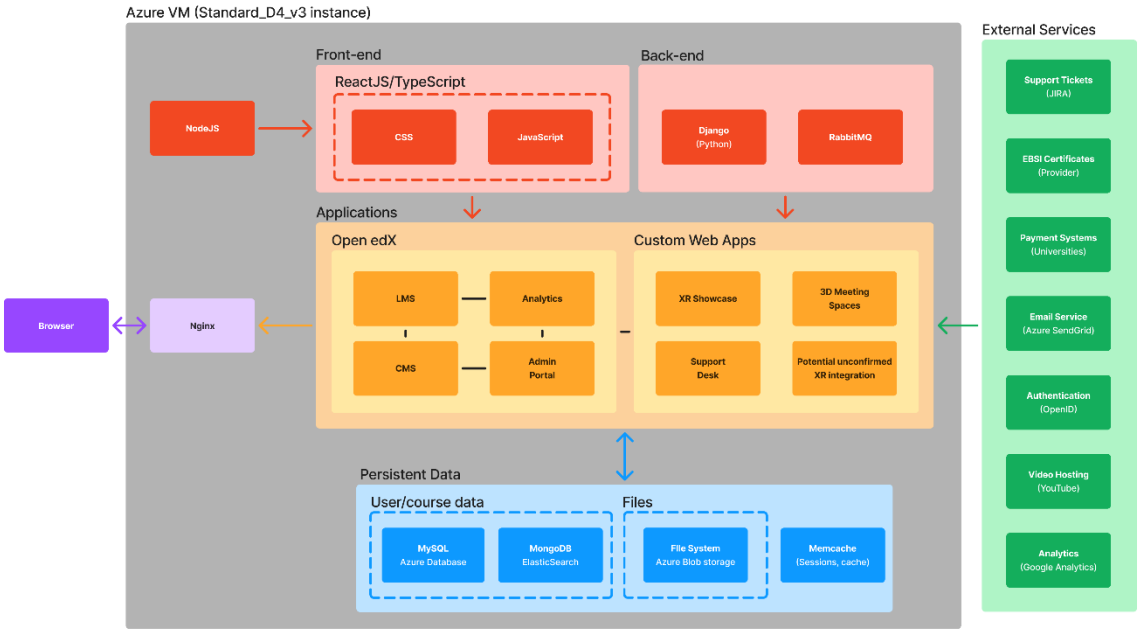


Figure 10: Potential cloud infrastructure example

7.8 Compliance and Standards

Ensuring that the Virtual Campus system adheres to relevant compliance and standards is essential for legal, operational, and user satisfaction. This section details the regulatory, security, and performance standards that the system must meet to operate effectively and responsibly.

Regulatory Compliance: The Virtual Campus system will adhere to stringent regulatory requirements to ensure the protection and privacy of user data. Compliance with data protection laws such as the General Data Protection Regulation (GDPR) is crucial. This includes implementing data encryption, managing user consent, and ensuring secure data storage. Further details on this will be shared following more collaboration with any third-party services.

Security standards: To safeguard the integrity and confidentiality of data, the Virtual Campus system must adhere to robust security standards. Data transmitted within the system should be encrypted using industry-standard protocols like Transport Layer Security (TLS) to protect against unauthorized access. Secure authentication mechanisms, including multi-factor authentication (MFA) and OAuth 2.0, will be implemented to ensure that only authorized users can access the system.

Performance standards: Ensuring high performance is vital for a positive user experience. The Virtual Campus system aims to meet high uptime standards of 99% or greater. The proposed infrastructure is scalable to accommodate varying user loads, especially during peak times such as course registration or exams.

Accessibility: The platform will meet accessibility standards like the Web Content Accessibility Guidelines (WCAG) to ensure usability for individuals with disabilities. This entails providing alternative text for images, ensuring keyboard navigability, and supporting screen reader compatibility. This will mean greatly reduced immersive content when added for promotional purposes. The priority for alternative content will be on key information for students to enrol and complete courses.

8 Development and Implementation

This section details the overall development approach, including the technology stack, implementation phases, and maintenance strategies. It also covers the CI/CD processes, security measures, and support structures needed to ensure the system's successful deployment and ongoing operation.

8.3 Development Approach

The development approach for the Virtual Campus is designed to ensure a flexible, iterative, and collaborative process that accommodates the diverse needs of the system's various components. The approach follows Agile methodologies, emphasizing continuous delivery, user feedback, and adaptability throughout the project lifecycle. This approach is broken down into the following phases:

Requirements Gathering: Detailing requirement with input from all stakeholders, including all consortium members.

Design: Creation of system architecture diagrams, data flow charts, and technical requirements of all components to be shared within one document.

Development: Front-end and back-end development of all components with the necessary integrations between systems. Version control will be implemented using Git, enabling efficient collaboration, tracking of changes, and maintaining codebase integrity. This practice supports branching strategies, code reviews, and continuous integration, ensuring that all development work is systematically managed and easily reversible if needed.

Testing: Individual component testing for functionality and code quality. Along with engaging actual users to validate that the system meets their needs and requirements.

Deployment: Gradual rollout to minimize disruption, as detailed in the Timeline and Milestones section.

Support & Maintenance: Providing helpdesk services, user guides, and training to assist users with any issues. Along with continuous monitoring of system performance and security to pre-emptively address issues.

8.4 Tools and Technologies

Below are the technologies that will be used across all systems. Most of these technologies are web-based given the requirements for the Virtual Campus. Some accompanying XR content will be developed as native applications using Unity.

Front-End: React.js for user interfaces, integrated with BabylonJS/Three.js for 3D content. Unity for any extensive 3D content.

Back-End: Python (Django) for the LMS data management. Node.js for API integrations. WebRTC for real-time communications in Virtual Meeting Spaces.

Database: MySQL for relational data storage. MongoDB for any NoSQL requirements.

Cloud Infrastructure: Azure for hosting and scalability.
Azure VMs: Scalable computing resources to handle varying workloads and user demands.

Azure Blob Storage: To store static assets like course media materials, XR application files, and backups.

Azure SQL Database: Managed database service for MySQL, ensuring high availability, automated backups, and enhanced security management.

CI/CD Pipeline: Jenkins for automated testing and deployment.

APIs: RESTful APIs for integrating with external services, such as Virtual Meeting Spaces, university SIS, EBSI compliant provider and other third-party platforms.

8.5 Implementation Strategy

The Implementation Strategy for the Virtual Campus system focuses on a structured rollout of three main phases and seamless integration of all key components along this process, ensuring a smooth deployment across all six participating universities.

The rollout phases are anticipated as follows:

MVP and Internal Testing: Develop a Minimum Viable Product that includes the core functionalities of the LMS and basic integrations with key components. Conduct internal testing to validate the system's stability and performance.

Pilot Phase: Test the refined system with a limited group (e.g., one university or selected courses) to gather user feedback and identify any remaining issues.

Initial Rollout: Test the system with the wider group to gather user feedback and identify any suggested improvements.

Full Rollout: Deploy the complete system across all six universities, offering the full suite of courses and features.

The Virtual Campus includes many different systems that must be well integrated for a seamless experience but there needs to be an order of implementation for these systems. The order of initial integration is as follows:

1. **OpenEdX (LMS):** Establish as the central platform, providing foundational learning management capabilities for all courses.
2. **OpenEdX (CMS):** Implement to support content creation and management, allowing instructors to efficiently build and update course materials.

3. **Showcase Website (Course Catalogue):** Launch alongside the LMS to provide a unified platform for course discovery, enrolment, and general information about the Virtual Campus offerings.
4. **OpenEdX (Plugins):** Integrate engaging 3D content plugins to enhance course interactivity and immersion.
5. **Advanced Applications:** Incorporate advanced immersive experience applications developed by CADPeople and Whiffle to support enhanced visualization and simulation.
6. **Teach-the-Teacher Toolkit:** Deploy a toolkit designed to train instructors on best practices for using the Virtual Campus tools effectively.
7. **OpenEdX (Digital Certificates):** Integrate DiplomaSafe and other potential providers for (micro)credentials that are in use in partner HEIs with the LMS to automate the awarding of secure, verifiable digital certificates upon course completion.
8. **OpenEdX (Payment):** Implement payment functionalities between the LMS and university payment systems to manage course fees and transactions efficiently.
9. **3D Meeting Space (Common Room):** Integrate a common virtual meeting space to facilitate synchronous interactions, ensuring smooth transitions and synchronization with the LMS.
10. **Support Portal**: Establish a support portal to assist users with technical issues, provide FAQs, and offer resources for navigating the Virtual Campus.
11. **Showcase Website (Immersive Experiences):** Enhance the website with immersive experiences, showcasing advanced applications and engaging content to prospective students.
12. **Showcase Website (Campus Tours):** Integrate virtual 360-degree campus tours for each university, providing a virtual exploration experience for prospective learners.
13. **3D Meeting Space (Community Events):** Develop spaces within the virtual environment for hosting community events, fostering a sense of engagement and interaction among participants.

8.6 Development Environment

The Development Environment for the Virtual Campus project is structured into three key setups to ensure smooth development, testing, and deployment of the system:

Local Development: As recommended for OpenEdX, Docker will be used for consistent local development environments. This approach will help support local testing of across most components.

Staging Environment: A replica of the production environment used for integration testing and validation before final deployment. Enables end-to-end testing of system components, ensuring all integrations function correctly under near-production conditions.

Production Environment: The cloud-based live environment where the system is deployed and accessed by users from all six universities. Implemented with monitoring and support

8.7 Testing and Quality Assurance

The Quality Assurance strategy for the Virtual Campus is designed to ensure that each component of the system meets the required standards for functionality, performance, and reliability. The testing process is divided into several stages, each targeting specific aspects of the system to identify and address issues early in the development cycle.

Unit testing: To validate the functionality of individual components or modules in isolation. This strategy helps to detect and fix bugs at the earliest stage, ensuring each component works correctly before integration.

Integration testing: To verify that different modules and components work together as expected. Identify and resolve issues arising from the interaction between different components, ensuring system-wide functionality.

Load testing: To assess the system's performance under varying levels of user load and ensure scalability. Ensure that the Virtual Campus can maintain performance standards under load, providing a reliable user experience even during high-demand periods.

8.8 Maintenance and Support

The Maintenance and Support strategy is essential for ensuring the long-term reliability, performance, and user satisfaction of the Virtual Campus system. This section outlines the ongoing activities and resources dedicated to maintaining the system, monitoring its health, and providing user support.

Support Desk: This will serve as the central point of contact for all user queries and technical issues. It uses Jira for logging, tracking, and managing tickets, ensuring issues are categorized, prioritized, and resolved efficiently. The support structure will include tiered escalation for more complex problems, with regular updates provided to users. Additionally, a knowledge base will be available to help users resolve common issues independently. Support performance will be continuously monitored through Jira analytics and user feedback.

Maintenance: The Virtual Campus will remain up to date via routine updates that align with the official OpenEdX releases, where appropriate. This incorporates security patches and new features. External system components will utilize the OpenEdX XBlocks and custom plugins allowing for smooth updates and integration. As for bug management, this will be handled through the support desk for efficient issue tracking and resolution.

Monitoring: The Monitoring strategy for the Virtual Campus will leverage custom Azure functions to regularly ping critical systems, such as the LMS and showcase website, ensuring they are operational. These functions will be monitored via a dashboard and trigger alerts if any downtime or issues are detected. Continuous threat detection and periodic security audits will also be conducted to maintain system integrity. Any user feedback and crash reports received via the support desk will also be monitored to quickly address any user experience issues.

9 User Documentation

9.3 User Documentation

User documentation for the LMS (Learner Role) is anticipated to be structured as follows:

LMS User Documentation Overview	
Overview	**Introduction to DigiWind Learning Portal** • Purpose and key features • User roles within the Learning Portal
Getting Started	**Account Setup and Login** • Creating an account • Logging in and out • Managing user profiles **Navigating the LMS Dashboard** • Overview of the dashboard • Understanding the course catalogue • Accessing enrolled courses
Course Participation	**Course Structure** • Understanding course layout (modules, sections, units) • Navigating through course content **Interactive Components** • Quizzes and assessments • Discussion forums • Peer assessments and group work **Progress Tracking** • Viewing grades and feedback • Tracking progress and completion status
Communication Tools	**Using the Discussion Forums** • Posting questions and responses • Moderation and etiquette • Following discussions **Messaging and Announcements** • Receiving and sending messages • Viewing announcements from instructors and peers
Technical Support & Troubleshooting	**Common Issues and Solutions** • Troubleshooting login issues • Resolving content access problems **Getting Help** • How to contact support • Using the help centre or FAQ

User documentation for the CMS (Educator role) is anticipated to be structured as follows:

CMS User Documentation Overview	
Overview	**Introduction to DigiWind Content Management System** • Purpose and key features • User roles within the Content Management System
Getting Started	**Accessing the CMS** • Logging in • Overview of the CMS interface
Course Creation	**Creating a New Course** • Setting up course details (title, description, schedule) • Course Visibility and enrolment settings **Building Course Content** • Adding sections, subsections and units • Uploading content (videos, PDF's, images) • Using content blocks (text, problem types, discussions)
Advanced Course Features	**Interactive Content** • Creating quizzes, assessments and exams • Using video interactions and timelines • Adding problem components (multiple choice, etc.) **Content Organisation** • Structuring the course (prerequisites, pacing) • Setting up sequential or gated content
Publishing and Managing Courses	**Previewing Course Content** • Checking course layout and flow before publishing • Troubleshooting common issues in preview mode **Publishing the Course** • Finalizing and publishing the course for learners • Managing live course updates and maintenance
Collaboration and Version Control	**Working with Teams** • Collaborating with other course authors • Assigning roles and permissions **Versioning and Backups** • Saving versions and restoring previous course versions • Exporting and importing course content
Analytics and Reporting	**Monitoring Course Activity** • Accessing course analytics and student engagement data • Understanding reports on interactive performance and content access **Improving Course Content** • Using analytics to refine and improve course materials

User documentation for the Admin Portal is anticipated to be structured as follows:

Admin Portal User Documentation Overview	
Overview	**Introduction to DigiWind Admin Portal** • Purpose and key features • User roles within the Admin Portal
System Configuration	**User Management** • Creating and managing user accounts • Assigning roles and permissions (instructor, learner, admin) • Importing and exporting user data **Course Management** • Overseeing the course catalogue • Approving and archiving courses • Managing course settings globally (enrolment dates, certificates)
Platform Settings	**Site Configuration** • Customizing platform appearance (logos, schemes, branding) • Configuring global settings (email templates, notifications) • **Integrations and Extensions** • Setting up third-party tools and LTI integrations • Managing plugins and custom extensions
Security and Compliance	**User Privacy Settings** • Configuring privacy policies and settings • Managing data protection and user consent **Access Control and Permissions** • Setting up access controls for different user roles • Monitoring and managing security settings
Reporting and Analytics	**System Wide Reports** • Generating reports on user activity, course performance, and system usage • Customizing reports for specific needs **Audit Logs** • Accessing and understanding audit logs for security and compliance
Maintenance and Support	**System Maintenance** • Scheduling and managing platform updates • Performing backups and restoring data **Technical Support** • Troubleshooting common administrative issues • Escalating issues to the development team or third-party support
Documentation and Resources	**Admin Resources** • Accessing official documentation and community forums • Training resources for new administrators

9.4 Developer/integration Documentation

Developer/integration documentation will be further defined as required as part of the development cycle, covering topics such as API Definitions, Integration guides, Data models and schemas, Security and Compliance and Testing and Quality Assurance, among others.

It is anticipated that an overview of such documentation will be included in an updated version of the User and Technical Requirements Specification as an output of the development phase of the project.

9.5 Teach-the-teacher Toolkit

The Teach the teacher toolkit is split into four core components to be delivered as follows:

1. Webinar Series

Structure: Webinars to be delivered periodically over a 3-year period, as follows:

- **Phase 1:** Basics of e-learning design, focusing on instructional design principles, content creation, and integration with the LMS.
- **Phase 2:** Introduction to immersive learning, covering tools, platforms, and methodologies for designing VR/AR content.
- **Phase 3:** Advanced immersive learning design, including practical examples and case studies, with participants creating their own prototypes.

Frequency: Webinars to be held at an agreed frequency, alternating between e-learning and immersive learning themes.

Resources: Recordings, handouts, and example projects to be made available on the LMS for continuous access.

2. Office Hours

Frequency: Infrequent office hours are proposed as quarterly sessions. They can be either open to all participants or segmented by topics, like troubleshooting LMS issues or discussing immersive learning strategies.

Format: A live Q&A format using MS Teams or similar, with options for participants to submit questions in advance.

Follow up: All questions tackled, documented and made available to the wider consortium.

3. Microlearning Modules

Module Structure: To keep things modular and easy to navigate, the content will be broken into short lessons:

- **Module 1:** Introduction to E-Learning Design Principles
- **Module 2:** Basics of the LMS
- **Module 3:** Creating Interactive Content
- **Module 4:** Introduction to Immersive Learning
- **Module 5:** Tools for Immersive Learning (VR, AR, 360 video)
- **Module 6:** Evaluating and Improving E-Learning Courses

Independent Access: Each module to be independently accessible based on the specific needs of the academic staff.

4. Toolkit for Academics

Resource List: This will include tools, platforms, and methodologies for both e-learning and immersive learning, with categories as follows:

- **E-Learning Authoring Tools:** Examples such as Articulate, Captivate, Rise, Open edX studio etc.
- **Immersive Learning Tools:** Examples such as Unity, Unreal Engine, CenarioVR, and CoSpaces Edu.
- **Best Practices:** Guides on instructional design, gamification, microlearning, learner engagement.
- **Methodology Resources:** Articles, case studies, and templates on designing immersive learning environments.
- **Idea Bank:** Share project ideas, frameworks, and examples of how immersive learning can be implemented in various subjects.

10 Appendices

10.1 Appendix A: Content Creation Process

Figure 11: Content Creation Process - Overview Flowchart

As part of Work Package 4, HEI's can engage IMR to create immersive learning content to supplement their learning material, as well as for promotional purposes including via social media and the XR Showcase. There is a finite budget available for this, so engagements will be on a first come, first served basis, pending suitability.

For the creation of this immersive content, IMR will be following proven development process frameworks, to ensure efficient and effective delivery.

The content creation process is split into 6 key stages:

1. Scoping – Understanding the requirements
2. Ideation – Exploring solution concepts
3. Content Sign-off – POC Development and review
4. Digital Asset Creation – Creation of digital assets
5. Immersive Viewer Development – Optimising content & viewer widgets
6. Virtual Campus Integration – Integration of content into the Virtual Campus

Each of these stages contains the relevant sub-steps including a final review and feedback, enabling HEI review and input.

Some example timings of each stage are given below:

1. Scoping – 1 week
2. Ideation – 2-3 weeks
3. Content Sign-off – 2 weeks
4. Digital Asset Creation – 3+ weeks
5. Immersive Viewer Development – <3 weeks
6. Virtual Campus Integration – 1 week

These timings will vary depending on the complexity of the digital content, target hardware, level of immersion, and other factors.