StaffsVerse: Building a Metaverse Campus Utilising the Unreal Editor for Fortnite

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Abstract: In pursuit of redefining the conventional campus introductory experience, this paper presents the development and implementation of the StaffsVerse project - a virtual campus immersion tool. Designed as a Metaverse representation, the StaffsVerse project intends to transform the physical campus of Staffordshire University into an interactive digital environment. Its purpose extends to serving as a versatile tool for remote education delivery, virtual campus tours, public science outreach, and facilitating a seamless transition for students into the university community. Through immersive digital engagement, the StaffsVerse project seeks to bridge the gap between remote learners and the campus environment while facilitating a smooth integration into academic and social aspects of university life. In contrast to previous implementations of virtual campuses, the StaffsVerse project is unique in leveraging the capabilities of Unreal Editor in Fortnite (UEFN). This approach enables the development of highly detailed, interactive, and engaging environments within the expansive Fortnite ecosystem. The project's primary objective is to harness the infrastructure and extensive user base of one of the world's most widely played multi-platform games, thereby ensuring a low barrier to access. Therefore, this paper will explore how the UEFN system's adaptability can effectively create an accurate virtual replica of the physical Staffordshire University campus. The key contribution of this paper includes an overview of the design and developmental journey of the StaffsVerse project. The evolution of the project will be outlined by discussing the two pivotal iterations of the game-based implementation and explaining the decision-making process that led to the resulting version. The examination extends to the unique features of the UEFN build, addressing the inherent challenges and opportunities specific to the platform. Furthermore, specific game-based decisions are discussed, such as replicating essential campus locations, integrating interactive features, and incorporating elements unique to the virtual environment. The paper will discuss the specific educational opportunities UEFN offers, including the potential for enhancing student engagement through gamified campus experiences, insights into creating a Metaverse university campus, and contributions to the growing discourse on the intersection of game-based virtual environments in learning.

Keywords: Metaverse, Student Engagement, Virtual Worlds, Onboarding, Virtual Campus

1. Motivation

Student demographics have driven transformational thinking in how educational services are delivered and experienced. This shift is particularly critical in higher education, where traditional methods often limit accessibility and fail to engage a technologically proficient student body. The advent of virtual environments and digital platforms presents an opportunity to redefine engagement paradigms.

Student transition is a known challenge in higher education. University is for many individuals, their first time living away from home. It requires adapting to new ways of learning, and increased autonomy, and this transition can create challenges. Typically, universities have used welcome ("fresher") weeks to support this adjustment. But this often only begins once the student has arrived on campus. Other institutions have explored using their VLE to provide some pre-enrolment transition activities, but these often suffer from limited participation.

There is also the challenge of location acclimation. Most students will find themselves getting lost in their first few weeks of study while they try to learn to navigate a large campus. While many institutions offer "open" days and applicant sessions, these only provide a small opportunity to experience the campus. However, in recent years, due to the cost-of-living crisis, an increasing number of students are struggling to attend these sessions. For this reason, traditional campus tours and orientation processes can be intimidating and inaccessible for many potential students, especially those from international or remote backgrounds.

By creating a metaverse version of the Staffordshire University campus, the project aims to democratise access to campus experiences, allowing students to explore and interact with the campus environment from anywhere in the world. The Staffsverse project leverages the interactive capabilities of UEFN to create a dynamic learning

environment that goes beyond static online courses and video lectures, offering real-time interaction and exploration of educational content.

The choice to use Unreal Editor in Fortnite (UEFN) for developing StaffsVerse is driven by the popularity and extensive reach of the Fortnite platform. Fortnite's global popularity ensures that the virtual campus is accessible on a platform many students are already familiar with and enthusiastic about. This approach not only lowers the barrier to entry by using a familiar interface but also taps into the engaging and interactive elements of gaming to enhance the learning and orientation process.

Finally, the development of StaffsVerse is motivated by a forward-looking vision for the future of education. As digitally capable individuals become the primary demographic in educational institutions, there is a growing need to incorporate technology not just as a tool, but as an integral part of the campus infrastructure. A student's online engagement will need to offer an experience that compliments the physical resources of the institution.

2.   Background

In the evolving landscape of Higher Education (HE), the shift towards virtual environments is driven by the need to adapt to the changing demographics and technological proficiency of students (Díaz et al., 2020). The StaffsVerse project, leveraging Unreal Editor in Fortnite, exemplifies this transformation by offering an immersive, interactive virtual campus that enhances the introductory and ongoing campus experience for remote learners. This exploration discusses the transformative impact of digital platforms in HE, and explores the development and utility of virtual campuses, the integration of gaming elements for learning, and the significant potential of metaverse technologies to enhance both academic learning and social connection in university settings.

2.1 Virtual Campuses and Online Tours

Virtual campuses have been a part of the educational technology landscape for over two decades (Anderson et al, 2020). One of the earliest and most notable implementations of virtual campuses occurred in environments like Second Life, where institutions such as Stanford University and the Open University established virtual campuses (Rymaszewski, 2007). This initiative was specifically designed to ease the transition for incoming students by creating a virtual replica of the campus environment. As part of their introduction to university life, students navigate through various interactive tasks and scenarios that simulate real-world campus activities. Studies from this period, such as those by Dalgarno (et al., 2010), have emphasised the importance of these interactions in creating engaging learning environments that extend beyond traditional classroom settings (Dalgarno et al, 2010; Jin et al., 2022).

As technology evolves, the focus of research shifted towards the immersive capabilities of technologies such as Virtual Reality (VR) (Heise et al., 2021). Recent advancements have seen the development of VR tours and interactive maps that enhance the induction process for new students. These tools serve not only to introduce students to campus layouts but also to significantly lessen the anxiety associated with navigating a new and often overwhelming physical environment (Concannon et al., 2020; Hawes & Arya, 2023). Research by Montana (et al., 2019) highlights that these virtual introductions can greatly ease the transition for incoming students by reducing initial stress and building familiarity, which in turn helps in smoothing their integration into their university life (Montana et al., 2019; Di Natale, 2024).

Moreover, these virtual experiences are increasingly recognised for their potential to make campus tours accessible to all, which can be particularly beneficial considering barriers that might prevent prospective students from visiting campuses (Baguma & Wolters, 2021; Dwyer et al., 2023). As institutions continue to explore these technologies, the emphasis is on creating more inclusive, engaging, and supportive virtual environments that cater to a globally dispersed student demographic. This shift not only reflects an adaptation to student needs but also aligns with broader educational goals of increasing accessibility and reducing barriers to higher education.

2.2 Transitional Games

Within the dynamic and evolving landscape of Serious Games (SG), where the integration of play and learning extend beyond mere entertainment to educational and therapeutic applications, a distinct category emerged - Transitional Games. Defined as "A subset of Serious Games, with the aim of supporting an individual through a period of transition, whether it be emotional or physical" (Threlfall et al., 2022). These types of games are

meticulously designed to assist individuals as they navigate significant changes in their lives, which can range from entering new educational environments, adjusting to different social settings, moving through different life stages, or recovering from physical or mental health conditions.

Transitional Games uniquely blend the engaging elements of gaming - such as storytelling, interactive gameplay, and immersive environments - with the structured support needed to facilitate a smooth transition. By focusing on both the emotional and practical aspects of change, these games provide a valuable resource for learning and adaptation. They do this by creating scenarios that mirror real-life challenges, thereby offering players the opportunity to practice responses and strategies in a controlled, risk-free setting.

This innovative approach allows players to develop necessary skills and coping mechanisms that can be critical during times of change. By fostering a deeper connection to the experiences faced during transitions, Transitional Games contribute significantly to the field of SG. They not only entertain but also empower individuals, helping them to face their real-world situations with confidence and a stronger sense of preparedness (Threlfall et al., 2022).

2.2.1   Examples of Transitional Games

Transitional games represent a dynamic subset within the field of SG, specifically designed to aid individuals during significant periods of change. These games effectively address various transitional needs, from easing students into university life to supporting young individuals in managing mental health challenges. The breadth and impact of serious gaming as a transformative educational and emotional support tool are clearly demonstrated through these applications.

2.2.1.1   Campus Quest

In response to the challenges new students face when transitioning to higher education, Curtin University teamed up with 2and2 to create Campus Quest, a gamified environment that allows players to get a glimpse of university life (Tutty & Leslie-McCarthy, 2012). This game targets young people from diverse backgrounds - including low-socioeconomic, regional, and indigenous communities. In the game, players strive to excel academically while managing four critical metrics: time, income, research, and social life. By engaging in various quests, each impacting these metrics differently, players gain insights into essential aspects of university life, such as securing housing, finding part-time jobs, and navigating support services.

Figure 1

The game's design simulates the delicate balance required in university life, where students must adeptly juggle academic responsibilities with social activities and financial management (Tutty & Leslie-McCarthy, 2012). Success in the game depends on maintaining a sustainable balance among these aspects, reflecting the real-life strategies that can help students thrive in higher education settings. Through this interactive experience, Campus Quest goes beyond mere entertainment; it serves as a practical tool that prepares students for the multifaceted challenges of university life. The transition from secondary to higher education is not just a change in academic setting but a significant life event. Campus Quest incorporates pedagogical principles that teach players about balance, resource allocation, and time management, key skills that support a successful adaptation to higher education.

2.2.1.2 SPARX

SPARX represents an innovative approach to mental health designed specifically for young people navigating the emotional transitions associated with adolescence to early adulthood. Developed through a partnership between the University of Auckland and the New Zealand Ministry of Health, SPARX is an interactive computer gam grounded in cognitive-behavioural therapy (CBT) principles to help teenagers manage symptoms of depression and anxiety (Merry et al., 2012; Lucassen et al., 2021). Within the game, players embark quests within a fantasy world where they are tasked with restoring balance to a virtual environment clouded by negative thoughts. As they advance through various levels, players face challenges that teach vital coping strategies, including breathing techniques, the identification and restructuring of negative thought patterns, and participation in activities that foster positive emotional growth.

Figure 2

The game structure allows players to learn at their own pace within a safe and engaging environment. Each level is designed to build upon the previous one, ensuring a gradual increase in skill and understanding. The game's narrative and challenges mimic real-life situations that might trigger stress or anxiety, providing players with practical skills they can apply in their daily lives (Merry et al., 2012; Lucassen et al., 2021). This helps to facilitate a smoother transition through potentially turbulent times by equipping players with the tools they need to manage their mental health effectively.

SPARX is exemplary of a transitional game as it aims to mitigate the emotional challenges of transitioning into adolescence and beyond. It serves not only as an educational tool but also as a therapeutic intervention that promotes mental well-being in a format that is accessible and relatable to young people. By blending therapeutic principles with engaging gameplay, SPARX effectively prepares its players for the emotional aspects of growing up, making it a critical tool in the landscape of educational and supportive serious games (Merry et al., 2012; Lucassen et al., 2021).

3. Universities and the Metaverse

The rise of the metaverse marks a significant evolution in the digital landscape, offering universities innovative ways to create, interact, and engage. As an advanced virtual environment, the metaverse provides persistent, immersive, and interactive experiences that goes beyond the capabilities of earlier virtual learning environments (Tan et al., 2022). Universities are increasingly drawn to these platforms for their potential to not only replicate physical spaces but also to foster new educational standards and enhance student engagement (Zhang et al., 2022).

Metaverse platforms allow universities to create dynamic virtual campuses that facilitate a range of interactions—from academic lectures to social gatherings—thus extending the traditional educational environment into a more flexible and accessible digital realm (Wang et al., 2022). These platforms support a variety of learning activities that can adapt to different learning styles and needs, thereby offering a more personalised educational experience. Research by Lee et al. (2021) emphasises how the metaverse can transform pedagogical approaches, allowing educators to implement experiential learning, simulations, and real-time collaboration on a global scale (Lee et al., 2021).

The StaffsVerse project, utilising the Unreal Editor in Fortnite, exemplifies this innovative approach by integrating the educational framework within a platform widely recognised and used by students around the globe. This not only reduces the technical and financial barriers to entry but also capitalises on the engaging and

interactive elements inherent to modern gaming environments. Furthermore, the StaffsVerse initiative is illustrative of how universities can leverage popular culture and technology to enhance educational accessibility and engagement. The use of a well-known gaming platform helps to bridge the gap between recreational and educational activities, attracting students who might not otherwise be reached through traditional methods. This approach also taps into the collaborative and competitive spirit of gaming to foster a deeper connection with educational content, encouraging more active participation and retention of information.

In conclusion, as universities continue to explore the metaverse, the potential for these platforms to revolutionise education becomes increasingly apparent. The metaverse not only supports the replication of physical campuses in a digital format but also encourages the development of innovative teaching methods and new forms of academic and social interaction. This shift towards immersive digital education platforms like the StaffsVerse project represents a forward-thinking approach to education, promising to enhance learning experiences, increase accessibility, and prepare students for a future where digital and physical realities are increasingly intertwined.

4.   Pilot: The Mars Campus

Implementing the StaffsVerse campus was done in two phases. We initially constructed a pilot to explore several key questions, specifically regarding scalability and user experience. This Campus pilot was the "Staffordshire Mars Campus", pictured in Fig.1.

Figure 3: The Staffordshire Mars Campus. Pictured from left to right is the Melor, Beacon, and Flaxman buildings.

We made a number of design decisions in the implementation. Most notably, we chose to implement the campus as a creative "interpretation" rather than a true to life representation. We made the choice for two main reasons.

1.   It enabled us to focus on the general navigational experience, avoiding unnecessary detail.
2.   It facilitated a low-resolution rendering style that would be more efficient to deliver.

For this we chose the theme of a university on Mars and used that narrative direction to influence the visual elements of the implementation. However, although the visuals were a creative interpretation, the environment was implemented at a 1:1 scale implementation of the real-world campus. This meant that all the virtual features were in the same positions (and size) as their physical counterparts, this ensured that the navigation experience was analogous to navigating our Stoke-on-Trent campus.

We used this pilot to explore a number of technical challenges, but critically how to deliver a large-scale open world environment to multiple concurrent users. The aim of the pilot project was to create a live world that users would be able to login, interact with other players and engage in activities in real-time. Development of a bespoke implementation of a metaverse like application whereby potentially 100s of users can access the platform at any given time possess a huge technical and costly feat to ensure a smooth uninterrupted and secure play experience.

Historically, peer-to-peer (P2P) networks were a popular choice for hosting multiplayer games. However, over the years, the approach has fallen out of fashion. In a P2P setup, the responsibility of managing connections falls directly on the user. This requirement can prove technically daunting for average players who may lack the necessary expertise particularly when network configuration such as port-forwarding is required.

Moreover, P2P networks are inherently fraught with security management challenges. The decentralised nature of these networks, while offering certain benefits, significantly complicates the implementation of effective security measures. As a result, these networks are more vulnerable to attacks and breaches, which can compromise user data and game integrity (Glazer & Madhav, 2016).

Additionally, the structural attributes of P2P networks facilitate easier game outcome manipulation, making cheating a more prevalent issue. Players can exploit the network's vulnerabilities to alter game data or disrupt other users' connections, which undermines the fairness and competitive spirit of the gaming environment (Yahyavi & Kemme, 2013).

Given these issues, the gaming industry has gradually shifted towards more centralised (client server) network models (Lindner, 2023). These alternatives not only relieve the user from the burden of network management but also enhance security protocols and provide a more controlled and equitable gaming experience. This transition reflects an ongoing effort to address the intrinsic weaknesses of P2P networks while embracing the technological advances that promote a safer and more enjoyable multiplayer gaming landscape.

Games as a Service style games that can be updated in real-time require the use of dedicated servers, which allows developers to add new features to the application on the back end to add more playable content (Vaudour & Heinze, 2019). By focusing on this model for StaffsVerse events could be created around key points of the academic year such as open days, Welcome Week and large-scale events. This would enable the development of an ever-evolving environment where students could gain an understanding of these events at their own pace.

Commercial games and metaverse applications typically achieve this by hosting portions of the game in the cloud using solutions such as Amazon GameLift (Amazon) and Azure PlayFab (Microsoft). However, this comes with a significant cost, both in the rental of cloud computation and the cost of maintaining a self-managed system. This approach has the benefit of being able to rapidly spin-up additional servers should capacity be required.

However, these systems are primarily funded by the users themselves. Specifically, as players purchase or subscribe to a game, their contributions directly finance the necessary server capacity (Davidovici-Nora, 2013). This financial model aligns the scalability of the system closely with user growth. moreover, as our objective was to provide this service free of charge, we faced challenges in achieving the same financial sustainability. Following a detailed cost analysis, it became clear that hosting on a commercial cloud server was not a financially viable option for our project.

Another issue that was present was ensuring accessibility of the software. We developed this platform for Windows and targeted lower-end graphics cards. However, we could not guarantee the potential player base had access to the required hardware. Developing the application for more platforms such as consoles (PlayStation, Xbox and Switch) and mobile devices (iOS and Android) would only add to the increasing cost of development and maintenance.

In response, we explored alternative funding models and cost-effective hosting solutions that could support our vision without compromising service quality. This included considering partnerships and seeking sponsorships to offset operational costs, thereby ensuring the longevity and accessibility of our service. However, the release of the Fortnite Creator programme provided a suitable alternative.

5.   Building Fortnite Maps in UEFN

5.1 What is UEFN?

Unreal Editor for Fortnite (UEFN), is the PC-only software used for creating custom experiences in the Fortnite ecosystem (Epic Games[1], 2024). UEFN provides a 3D viewport workstyle which will be familiar to developers who are used to working with Unreal Engine and the standard Unreal Editor.

UEFN allows developers to create Islands which Fortnite players can access through the Fortnite game client.

UEFN runs on Unreal Engine 5 (UE5), providing access to Unreal Engine's powerful rendering systems including Nanite and Lumen with preset islands delivering the Fortnite lighting aesthetic straight out the box. The toolset delivers a very familiar experience with most toolsets including Niagara (particle systems), the Material Editor, Sequencer (cinematic animations) and Control Rig (skeletal mesh animation), and the Landscape sculpting tools being available in UEFN.

The one key difference between UEFN and UE5 is the lack of script editing in Blueprints. Instead, opting to provide pre-set building blocks for games from "Fortnite Creative known as Devices" (Epic Games[1], 2024) which can be expanded with the Verse, a new programming language from Epic Games which has debuted in the UEFN ecosystem.

Fortnite is a Free-to-Play Game with no upfront cost to install the game or access User Generated Content (UGC) such as our virtual campus experience. Additionally, the wide array of possible hardware that Fortnite can be installed on reduces the need for purchasing of new systems to interact with the experience.

5.2 Rationale of using Fortnite to build a Virtual Campus

UEFN offers multiple key benefits compared to using UE5. Distribution of the project is important to its success, "UEFN is designed to create experiences for Fortnite. This means every experience you create is published to the Fortnite ecosystem, reaching a built-in audience of millions." (Epic Games[1], 2024), this means there is a high potential that applicants and students will at least have some level of familiarity with Fortnite's gameplay and menus, improving accessibility to the virtual campus experience.

5.2.1 Device Support

Fortnite itself is available for download on a wide array of devices, so instead of being restricted to a PC-only experience with UE5 (console release requires additional hardware and licensing), a UEFN developed experience can be released onto everything from PC to mobile devices (Epic Games[2], 2024), including both 8th generation consoles including Sony's PlayStation 4 , Microsoft's Xbox One, and the Nintendo Switch, and 9th generation games consoles including the PlayStation 5 and Xbox Series X/S devices.

Fortnite can be played on mobile devices natively using Android systems or via game streaming services (Epic Games[3], 2024) including Xbox Cloud Gaming, which offers access to Fortnite for iOS users on iPhone or iPad, and Nvidia Geforce Now which provides expanding the userbase for Fortnite to additional users include those with Chromebooks and a variety of TVs.

5.2.2 Decreasing Development Time

UEFN provides a significantly shorter pipeline of development due to having a large selection of features and functionality already in place, reducing the need to develop significant parts of the project.

This includes the core mechanics such as inputs, cameras, movement, interaction, and weapon-based combat to create third person games. The ease of access to a third person game template is ideal for the virtual campus experience although we made the decision to remove the default weapons from the experience.

These elements contribute to shorter development times for game developers, Bungie co-founder Alex Seropian setup Look North World to exclusively make games in Fortnite (Ferdinand, 2023), in discussion with YouTube channel GameDevAdvice *(2024)* stated "we've been going for six months, we've we just released our third game", highlighting a severely reduced development cycle time compared to normal games development which can take two to seven years to develop (Juegoadmin, 2023).

5.3 Overcoming the Technical Challenges by utilising UEFN

As well as mechanics already being setup and ready to use, certain technical challenges have been solved ahead of development, removing the need for lengthy, complex development processes to meet the requirements of the virtual campus experience including online gameplay, distribution, user management, and platform specific engine development.

5.3.1 Network Replication

UEFN removes the need for the development of network programming and dealing with replication of entities across networks due to built-in networking code which is running inside the Fortnite Framework. Fortnite

already supports up to 100 concurrent players on an Island (Epic Games[4] ,2024) with full replication of players, the world and actors within it.

5.3.2   Distribution

Islands created in UEFN are accessible from the main menu of the Fortnite game client by entering an island code in the search tool or by selecting featured islands from the graphical interface. Islands are downloaded via the game client and matchmaking is launched once complete.

5.3.3   User Management

Utilising the Islands system in Fortnite means all user management including login / join and logout / leave as well as having built in communication systems such as chat, parties, and friends etc.

5.3.4   Source Control

A bonus of UEFN is the inclusion of Unreal Revision Control allowing teams to work collaboratively on projects and reduces risk of lost work. Unreal Revision Control includes an Auto Checkout feature which, when enabled, locks assets the moment they are modified to prevent concurrent changes and merge conflicts. (Epic Games[5], 2024)

5.4   Insights from Implementation

During development of the UEFN version of the project, we identified the following approaches to assist with creating the virtual campus experience:

UEFN has a limitation on the size of the island, with a download size limit for users of just 400MB. With the need to focus on accurately representing the buildings and the location of the Stoke-on-Trent campus, we decided to weight our custom assets for the island to be meshes as opposed to textures or materials. To do this, we utilised existing textures and materials from Fortnite with tweaks and colour tints which also assisted the team in achieving the Fortnite art aesthetic. The memory usage of the project at time of writing is shown in Fig.2, currently using around a quarter of the available resources with most of the new assets in place.
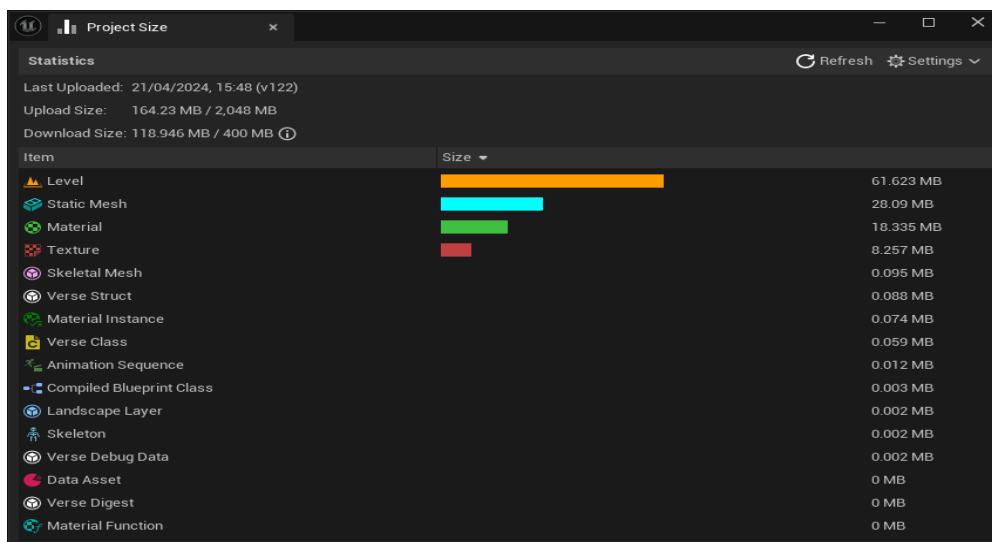

Figure 4: Screenshot of Project Size dialog of the StaffsVerse Island in UEFN

To maintain the technical consistency of Fortnite and allow us to use existing art assets and modular building pieces, all buildings were constructed using new assets, built to the same modular piece size as the existing Fortnite assets. All modular pieces were built around a base dimension of 512cm x 16cm x 384cm with some deviation allowed for unique assets or assets which required a particularly difficult form to achieve whilst maintaining those base dimensions. Trims were also created with sizes of 32, 64, 128, 256 etc. to facilitate further decoration of campus buildings.

Based on our experience, we highlight the following as key insights:

- Fortnite / UEFN provides an ecosystem which will speed up project development due to the built-in solutions for user management, networking and distribution.
- The third person gameplay mechanics of Fortnite are ideal for location exploration experiences.
- Utilise existing assets in UEFN to keep Island Size low using existing textures to maintain the Fortnite art style and matching dimensions to make better use of existing meshes.

6.   StaffsVerse

Overview of the metaverse campus

Figure 5

Figure 6

Figure 7

Figure 8

7.   Conclusion

In conclusion, the StaffsVerse project represents a significant step forward in the integration of virtual environments within higher education. By leveraging the capabilities of Unreal Editor for Fortnite (UEFN), this initiative not only offers a novel solution to the challenges of student onboarding and campus familiarization but also redefines the educational landscape by providing an immersive, accessible, and engaging digital experience. The successful implementation of the StaffsVerse campus underscores the potential of the metaverse to transform traditional educational models, bridging the gap between physical and virtual learning spaces. Furthermore, the project demonstrates how modern gaming platforms can be harnessed to create dynamic educational tools that are both cost-effective and widely accessible.

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