

# Post COVID-19 Higher Education Empowered by Virtual Worlds and Applications

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**Abstract**— The COVID-19 pandemic forced higher education institutions to switch to remote learning environments, for which many universities lacked prior contingency plans and/or infrastructures to run all of their courses online. Now, it has become compulsory that higher education institutions invest in educational technologies in order to survive and thrive in such a challenging platform, as this has become the ‘New Norm’ in higher education. This paper investigates literature related to post COVID-19 universities’ experiences in applying virtual worlds and applications in higher education worldwide, to achieve a developed remote learning for their students in a risk-free educational environment. The paper highlights the advantages and suitability of virtual world technologies for higher education’s requirements in this period, and provides examples from universities globally, which applied virtual worlds and applications in their students’ education post pandemic. The paper also delivers recommendations to higher education institutions when considering virtual world technologies for their online learning activities.

**Keywords**— virtual worlds, virtual applications, virtual reality, VR, higher education, HE, virtual spaces, COVID-19, coronavirus, teaching, learning, educational technologies, technology.

## I. INTRODUCTION

Higher Education (HE) institutions are still facing challenges in transitioning from in-person to remote learning in post COVID-19 study semesters. More colleges and universities shut/are shutting down their campuses in an effort to curb the spread of COVID-19. Many of these institutions managed to establish procedures and adopted certain applications and technologies to enable the online delivery of their curriculum, which is originally designed for face-to-face learning.

A considerable number of teaching faculties are still in the process of mastering the online delivery, and how to switch to an online platform while altering their teaching and learning styles and techniques, which were only applicable to the physical platform. Being disconnected and isolated from their known learning environment, students in post COVID-19 learning platforms are also expected to adjust, learn as much and achieve well.

This paper discusses the affordances of virtual worlds and applications to support a developed online learning platform for higher education in the post COVID-19 era, and presents

recommendations for higher education institutions to tackle the accompanying challenges.

## II. WHY VIRTUAL WORLDS AND APPLICATIONS FOR HIGHER EDUCATION?

In the years prior to COVID-19, online platforms were marginally addressed in higher education. “Fewer than one in five (18 percent) of US tertiary-level students learned online exclusively; as of fall 2018, about a third had taken at least one course online” [1].

When we mention ‘Online Learning’, the immediate logistical challenge that forces itself into the discussion is ensuring students would have the essential technology that they need to learn remotely. For many HE students, attending physical campuses is not only for learning, but also for the energy and spirit of campus life, and the interaction and engagement with others, all of which have impacts on the quality of learning achieved by students. It is therefore that the selected technology to be applied for online learning in higher education should incorporate such concepts and enable them for students.

Virtual worlds and applications, such as Second Life, and OpenSim, presented themselves well to higher education for decades now. However, the type of online platforms required to address the evolving needs of higher education students in post COVID-19 placed a bigger demand on involving virtual world technologies in higher education. “The idea is to offer virtual spaces in lieu of physical ones to enable the university community to continue to connect” [1].

One of the ways to address this, is to create a central faculty-students virtual space, where HE students are able to meet virtually with their lecturers and peers, discuss, ask questions and share resources. In such spaces, tutors are able to deliver tutorial sessions to their students, and receive/provide direct feedback on learning activities and assessments.

The virtual simulated environment facilitates synchronous collaboration amongst students. Experts in ‘Constructivist Learning’ are able to recognize the potential in this environment, as it offers educators with an accessible means for the creation of “rich, immersive and appealing 3D framework for situated and experiential learning, and also communication tools to support dialogue and collaborative learning” [2]. In addition, virtual worlds and applications were widely used in visualizing complex theory concepts of

different HE courses and data visualization [2][3]. Moreover, research proved that people comprehend and retain information much better in 3D virtual environments compared to 2D – flat screen technological tools, such as videoconferencing [4].

However, the reason behind not massively embracing virtual world technologies in higher education in the previous years, is the lack of sufficient technology infrastructure in universities, both in terms of internet speed and computing hardware power. Such an infrastructure represents an absolute prerequisite for applying virtual worlds and applications in any organization, as it is essential to enable full accessibility to the virtual spaces for lecturers and a large number of students at all times [4].

In certain HE courses, such as science and engineering related, the university lecturers faced extended technical challenges on how they could teach practical lab skills, which require the physical presence of students. *“The immediate transition of moving classes online has therefore not presented as much of a challenge as figuring out how to translate the physical lab components to a completely virtual platform”* [5], in addition to making this transition a feasible and practical solution for the longer term. In such courses, the application of virtual world technologies proved to be much more effective than other tools. This is due to the fact that such technologies facilitate achieving immersive hands-on learning experiences in the virtual world that mimics those in the physical world [2][3]. Moreover, as health and safety are fundamental in lab activities and experiments, virtual labs well introduce a ‘risk-free learning environment’, especially when dealing with a large number of students per lab [3], which COVID-19 pandemic has made impractical to achieve. The following section explains multiple examples of applying virtual labs in universities globally.

With regards to the applications of Virtual Reality (VR) in higher education, and although research did not show a great deal of serious/massive usage of this immersive technology for higher education purposes [5], many universities worldwide considered utilizing both high-end and budget head-mounted displays (HMDs) in the delivery of their courses. Virtual reality, such as HTC Vive and Oculus Rift, has noticeable positive impacts in higher education, as it enables live scenarios for students and *“takes them to places that are either difficult, or sometimes impossible, to access in real-life, e.g. space studies, archeology courses, medical education, chemical engineering and aviation training”* [6], without the risks involved. The application of virtual reality in higher education enables hands-on, immersive, interactive and engaged participation of students in their learning activities, *“compared to the passive way of reading/watching lessons in a traditional classroom”* [6], or using videoconferencing tools such as Zoom.

Research proved that technology-enabled ‘Immersive Learning’ is mainly achieved using virtual worlds and applications. Researchers and educators define ‘Immersion’ as the participation of a user in a virtual platform, during which their awareness of the real-world mainly becomes disconnected. This provides the user with a perception of being in the task environment instead [5]. Accordingly, mirroring the learning in physical campuses, post pandemic,

could well be achieved online with the application of virtual world technologies in higher education, and the design of virtual spaces for students that mimic the learning environments achieved in physical classrooms, or even better. Recent research shows that Virtual Reality has been described as *“the learning aid of the 21<sup>st</sup> century”*, as students are more able to retain information, and can apply what they learned much more effectively, if they had participated and learned using virtual reality [5].

Academic advising is another educational aspect that is strengthened in the virtual world environment. Students need the connection with their advisors, and the virtual platform facilitates students’ access to the virtual offices of their advisors whenever they are available, rather than waiting for specific office hours of the advisors to communicate via the phone or to schedule a Zoon meeting [7].

### III. POST COVID-19 EXAMPLES OF VIRTUAL WORLDS AND APPLICATIONS IN UNIVERSITIES WORLDWIDE

Many universities worldwide started applying virtual worlds and applications for their students and clients. Below are some examples:

- In coordination with the University of Sharjah, UAE, the Centre of Digital Innovation (CoDI), UAE, has developed a virtual reality surgery simulator for medical students to use, in order to learn how to perform surgical operations. *“The project was successfully delivered to the university, which is currently used as an evaluation tool for students”* [8].
- University of Florida, USA, started ‘Student Plaza’, a virtual space in which students are able to conduct study groups, and communicate with academic advisers. [1]
- Maryville University, Missouri, USA, took science labs into the virtual classroom using the PhET’s circuit simulator, which facilitates possible learning experiences that are *“more streamlined in certain ways than their in-person equivalents”*. The tool enabled students to *“virtually experiment with all elements of a circuit like in a traditional laboratory setting”* [9]. The university professors embedded *“simulations and lab exercises as modules within Canvas in a way that is adjustable and easily understood by students”* [9].
- University of Sheffield, UK, invited the public to step into new virtual reality world at its ‘Festival of the Mind’. The visitors were invited to enter ‘Futurecade at Sheffield’s Millennium Gallery’, an immersive exhibition of digital technologies. This festival brings together University academics and professionals from Sheffield’s cultural, creative and digital industries [10].
- Stony Brook University, New York, USA, introduced a virtual version of its ‘Involvement Fair’. This virtual space is designed to help students contributing to club activities, and meet with other students. The university is also working on designing a virtual job and internship fair to help preparing its students for the next steps [11].
- California’s community colleges, USA, utilized virtual laboratories for their science lab-based education for their

students. They signed a deal with Labster, the world's leading provider of virtual science labs, "to provide 2.1 million students in the state with access to 130 virtual lab simulations through the rest of the year" [12].

- Stanford's Graduate School of Business, California, USA, conducts classes on a virtual campus using avatars. This is the university's virtual campus, which also has football fields and a beach, that was built in collaboration with the virtual reality company, VirBELA [13].
- The Business School at Durham University, UK, offers a 'QS Virtual World MBA Connect Tour' for potential MBA students to meet with them virtually, and have the opportunity to tell them more about the university and its programs, technologies, activities, and the city in which it is located [14].
- Brunel University London, UK, applied what leading sport scientists said in a recent study, that was published in the British Journal of Health Psychology: "If you want to exercise harder, enjoy it more and feel it less, pull on a VR headset and plug in some upbeat tunes". The scientists expressed that when exercising, people start to feel better when they "lose themselves in music and computer-simulated environments" [15]. This has led both Brunel University London and University of Exeter, UK, in collaboration with virtual workout games creators, VirZOOM, to join a controlled virtual experiment with 24 volunteers (students, faculties and staff) on exercise bikes, experiencing immersion in Virtual Reality (VR) with music. Following statistics showed that this virtual event "raised perceived enjoyment by 26.4%, compared with a control condition of no VR or music. And the VR combined with music raised enjoyment by 17.5% when compared to music on its own" [15].
- An expert team from University of Birmingham, UK, created a Virtual Reality reconstruction of the Mayflower, "one of the earliest pilgrim vessels and a cultural icon in the history of the United States", for the 400<sup>th</sup> anniversary of sailing. This virtual project recreates the 'Barbican Harbour' area in Plymouth, UK, in the period of 1620s. The project allows virtual reality users to "board a small boat at the original site of the Mayflower Steps before taking a short journey out to the ship and experience passengers and crew preparing to set sail" [16]. This virtual platform will be made available to both students and the public.
- The University of South Wales, Newport, UK, is the first institution in the United Kingdom to pilot a new virtual platform for delivering Hydra simulations. "Hydra methodology has long been embedded in the training of police and emergency service personnel for critical incident decision making". The University of South Wales has been conducting these simulations for almost a decade. Hydra is now a core feature of many undergraduate and postgraduate courses [17].

#### IV. RECOMMENDATIONS

Whether higher education students will be permitted to return to physical campuses in the future, or continue their remote learning for longer, the following recommendations may inspire HE institutions to adopt and launch new initiatives, evaluate the tools and technologies applied, and consider training opportunities for teaching faculties and students, in order to create capabilities that will improve HE online instruction permanently.

- 1) Virtual worlds / virtual reality development for higher education needs to be built based on existing experiments in this field, rather than being exploratory work from scratch [5]. This will improve the success rate, and inspire further enhancements.
- 2) Higher education institutions should invest on the hardware infrastructure needed for the effective running of virtual worlds and applications, namely internet speed and powerful servers [4]. This infrastructure should be perceived as realistic, thus providing real and uninterrupted immersive learning for students.
- 3) Pre-written modules and assessments need to be reviewed to take advantage of potential educational methods and facilities within the virtual world environment. This will enable a more effective application of these technologies in the HE curriculum, and maximize their advantages to students [2].
- 4) Exchange of best practices related to education-oriented virtual worlds/virtual reality, either within or across disciplines in higher education, will allow for a better adoption of virtual world technologies in higher education [5].
- 5) The higher education institutions should hire specialized virtual worlds and applications' staff and/or IT technicians, to administer the usage of their virtual spaces in daily lectures and events, so that they address possible issues and problems on the spot. This will ensure the smooth running of all courses and activities in the virtual platform.
- 6) Both lecturers and students should undergo a training, not only to acquire the skills needed to best utilize the virtual environment, but also to raise their maturity on virtual worlds and their advantages and applications in higher education.
- 7) Higher education lecturers should always have a 'Plan-B' in case of any problem that limits/prevents access to the virtual space. Everyone should always remember that a virtual world is an online platform/application that requires certain technical elements to run successfully.
- 8) Higher education institutions need to stay up-to-date with software licenses and copyrights to prevent any disruption to the delivery of their courses in virtual worlds.
- 9) All the development work in virtual worlds should be completed on the platform before the start of the academic semester, in which virtual world technologies are planned to be applied in the HE curriculum.

10) “*To fulfill the aim of deriving best practices and of describing useful application cases, better evaluation procedures are needed*”. It is usual that experimental work focuses mainly and largely on usability. Therefore, the application of virtual world technologies in higher education should be more thoroughly analyzed and evaluated via utilizing quantitative and qualitative research methods, to assess the level of students’ increased knowledge and skills, as well as students’ improved learning experience [5].

## V. CONCLUSION

The current experience in higher education that is imposed by COVID-19 pandemic requires irregular/innovative approaches to solving the numerous drawbacks identified in traditional online delivery models. Virtual reality and applications promote technology-empowered opportunities for higher education; however, appropriate infrastructures, training and experiments need to be invested on by higher education institutions in order to achieve effective online educational solutions in higher education.

The paper presented a number of recommendations to higher education institutions to consider when deciding to utilize virtual worlds and applications in their online delivery, in order to boost their chances of achieving a successful experience.

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