Academically Speaking

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Moving Towards the Virtual Classroom: Virtual Reality Pedagogy at WIT and its Future Potential

As the cyberpunk author William Gibson prophesied a few decades ago, "The Future is here—it's just not very evenly distributed." Having completed our first semester of teaching with virtual reality devices, we feel that we have seen a glimpse into the future of education where one day classrooms will no longer have walls, nor will they be confined to space and time. This phenomenon is possible via the technology of virtual reality (VR), which involves the use of head-mounted displays (HMDs, such as the Oculus Go) to present immersive visual and auditory experiences that can be manipulated physically and in which the reality presented becomes the user's reality.

Through an EPIC Grant to support the *Augmenting Architectural History Project*, Drs. Jody Gordon (Humanities and Social Sciences) and Anne-Catrin Schultz (Architecture) along with Don Tracia from Learning, Innovation, and Technology (LIT) were able to acquire a range of virtual reality devices and apps that could break down the static 2D classroom experience. The goal was to transform students from passive to active learners by allowing them to use technology to immerse themselves in sites and architectural landscapes first-hand, including those that only exist in ruins. The following sections provide an overview of how each professor fit virtual reality pedagogy into their classes and discuss our collaborative goals for a future virtual reality lab on the WIT campus.

In Prof. Gordon's course, Roman Culture and Technology (HUMN-4200), he prepared six hours of innovative and experiential classroom time focused on a) the socio-economic potential of VR, b) the potential of VR for learning about the ancient world, c) the potential of VR to teach us about the topography of ancient Rome. All classes were held in Accelerate's Makerspace in the new CEIS building (thanks to Tory Lam and Monique Fuchs), which proved to be a dynamic zone for interactive learning.

During the first class, Prof. Gordon presented a lecture that introduced the science and use of VR in teaching and industry. Students were also invited to test out a sandbox of technologies including: the Oculus Go HMD, the HTC Vive HMD, and the Microsoft Hololens (generously loaned by the Schumann Library and set up by Liam Dahler), the latter being one of the most cutting-edge augmented reality devices on the market. Augmented reality (AR) involves the use of a sensory-oriented wearable device (e.g., smart glasses) that takes a user's real vision of the world and adds digital information to it (e.g., an interactive menu) and it has massive potential for use in a range of WIT majors. Students were also introduced to the process of making 360-degree videos by Don Tracia and toured the 3D printing labs with Ryan Bakinowski.

During the second class, students were introduced to 360-3D videos of ancient sites (like the Acropolis), 360 models of ancient statues (like the British Museum's Aphrodite), and VR reconstructions of King Tut's Tomb. The goal was to illustrate how much more we can learn about the world as we move from 2D to 3D digital representations. In the third class, the focus shifted to the study of the design and the emotive sensations elicited from experiencing ancient Rome in all its 3D, CAD-reconstructed, glory through the *Rome Reborn* suite of apps. Students were challenged to experience the Roman Forum, the Colosseum District, the Pantheon, and the Basilica of Maxentius and to think about how immersing themselves in these spaces helped them understand concepts like placemaking, lines of sight, phenomenology, and emotive archaeology. These learning concepts were then followed up with a quiz on VR technology as well as a blog post focused on getting students to respond to their immersive digital experiences.

In Prof. Schultz' course (co-taught with Prof. Jennifer Gaugler, Prof. Christina Lanzl and Prof. Greg Logan), Architecture History and Theory 01 (ARCH-2100), students explored the architecture of ancient Egypt, ancient Greece and ancient Rome in interactive workshops. ARCH-2100 is taught in two formats: weekly lectures with all students that offer an overview of the historic topic in question, and weekly seminars in which groups of 20 students are able to engage in discourse about historic buildings and examine the complex relationships between location, politics, technology and architecture. For the VR workshops, individual sites were used as case studies to provide an overview of the architecture of the ancient world. The workshops used several Oculus Go VR headsets, an easy to handle device that allows an immersive experience of the sites in question. VR in the classroom not only gave students a sense of spatial relationships and scale of the ancient buildings (many of which only exist as ruins) – it also allowed a self-paced exploration and learning.

In order to learn about the sites in question, the students were provided with comprehensive information packages for each site to be used in conjunction with the VR explorations. These packages contained scholarly writings, 2D drawings, 3D renderings and archival photographs to complement the VR apps used in the workshops. With the goal of exposing students to the impact of this new technology, they learned about historic buildings and were challenged to assess different ways of how architecture is represented. Conversations in groups and the entire class revolved around efficient use of representation tools in addition to discussing historic facts and circumstances.

Ancient Egypt was introduced by the VR app "Discovr Egypt: King Tut's Tomb." On the simpler side of VR apps, it allows to experience the sequence of chambers of King Tutankhamun's tomb in the Valley of the Kings in Egypt, their configuration, objects included and decorations dominating wall and sarcophagus. Ancient Greece was exemplified by the sanctuary of Olympia through the app "Olympia in VR" – this app assisted in providing a good sense of the relationships of buildings among each other on the site as well as the consistent formal kit of parts used on facades and interiors. The third and by far most complex app used was the aforementioned *Rome Reborn* suite of apps. With a focus on the architecture of the Pantheon students were able to compare the original urban configuration of the temple to how it presents itself now. They also could experience the interior with its sculptures and original decorations. The three examples selected illustrated a variety of apps of different complexity and pedagogic content. Similar to other teaching materials, they have to be chosen with care.

Overall the feedback from students was enthusiastic – they used the VR headsets with curiosity and interest. An initial evaluation of the use of VR technology in an architecture history class shows that it is a useful addition to many other tools used to research and analyze historic buildings, a tool that will benefit future architects in practice as well.

These positive classroom experiences with VR have also led to a new EPIC grant that was recently awarded to a diverse group of interdisciplinary cross-campus stakeholders led by Prof. Lynette Panarelli (Interior Design). The goal of this grant will be to craft a proposal for a Mixed Reality and Discovery Center lab space that would offer the most innovative VR/AR technology to students and a place for classes like Dr. Gordon's and Schultz' to meet.

Ultimately, this lab would be a destination space for all students on campus to explore VR either through class or on their own. Students do not need to be enrolled in a course to be a part of this technological movement. Many design students on campus are using VR individually in their projects as a means to express and reinforce their design solutions. The lab has the potential to offer co-op opportunities for interested students of all disciplines with the hope that students will discover and create their own interdisciplinary projects.

In sum, integrating VR into our pedagogy has been an enlightening and positive endeavor. Our classroom experiments have illustrated the educational potential for the use of VR in most of Wentworth's major disciplines, and we feel that its use should be supported and expanded for a number of reasons. First, it taps into WIT's experiential and hands-on approach to learning. Second, it breaks down barriers of space and time to let lessons transcend the traditional classroom. Third, these VR experiences are inherently interdisciplinary; they involve technology and the human senses and urge students to think about how science and humanities can unite to improve our world. Fourth, virtual reality learning can be executed in accessible ways; it can involve video or full immersion and can help students learn who are less captivated by traditional passive learning modalities. Finally, by teaching with VR devices, students are exposed to a ground-breaking technology that has incredible potential for economic growth ($120 Billion by 2022) within a range of sectors.

Overall, based on our preliminary experiments with VR in the classroom, we feel that this technology has the potential to provide WIT students with the type of high-value skills and transformative experiences that will shape college education for the next decade. Wentworth can become a leader in this form of education if we are brave

enough to experiment with its myriad pedagogical possibilities and think creatively about its positive socio-economic applications. In our view, the future can be "evenly distributed," if we choose to recognize it and embrace it through the use of VR and AR in our classes and projects.

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