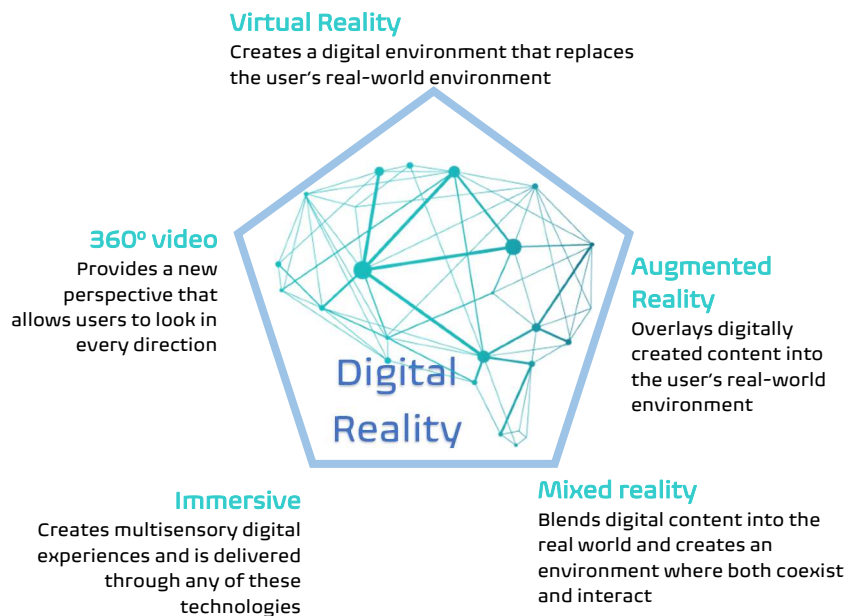


Virtual Reality in Education and Its Application in Nanotechnology

a. Improving the Quality and Level



As seen in this chart, digital reality, such as virtual reality can provide quality educational content which a traditional learning environment would be unable to provide. As this chart states, virtual reality can replace the real-world environment with a digital environment where students can experience new environments and events that students may never be able to encounter in real life. Virtual Reality has a unique capability to “allow students to visualize abstract

concepts, to observe events at atomic or planetary scales, and to visit environments and interact with events that distance, time, or safety factors make unavailable”. One example is an app created by Google called *Google Expeditions*. This app provides students to take trips to the bottom of the ocean or Mars within their own classrooms or homes and all they need to accomplish this is a mobile phone.

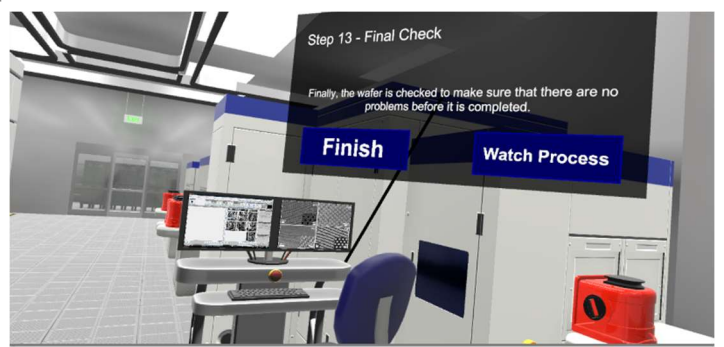
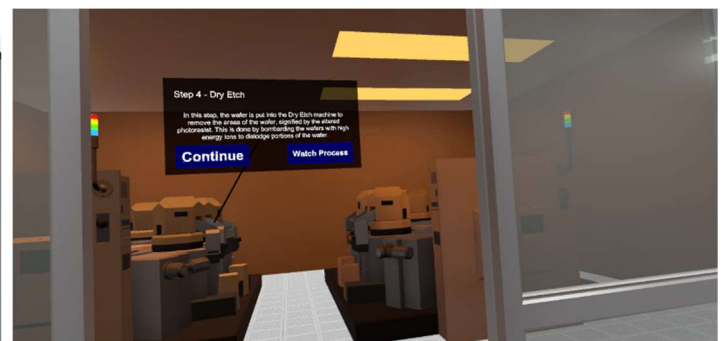
Since virtual reality creates a world where students are able to have hands on experiences which may have been too costly or dangerous to have been done within a traditional learning environment. This training can provide students with a chance to learn skills in areas pertinent to their career choice. Virtual reality could even provide life-saving skills which would otherwise go untaught. An example of the life-saving properties which virtual reality can have, comes from a Walmart in El Paso, Texas, where they experienced the ability for virtual reality to provide employees with life-saving skills. On August 3 of this year, the El Paso Walmart had twenty-two people fall victim to a mass shooting, but McMillon, Walmart CEO, says that, because of the VR training which the Walmart management team has gone through, they were able to “[act] so fast and [engage] other associates and [execute] the plan” and because they were able to act so quickly under a stressful situation they are “very confident that lives were saved and seconds were gained”. In a traditional lecture education, this training would have been done most likely through some simple exercises and videos, but with the virtual reality, the employees were able to experience and learn what is needed to be done when there is a mass shooting in a store. Virtual reality was able to provide the skills these Walmart employees needed to react quickly and get the situation underhand before even more people were killed.

Utah Valley University’s Nanotechnology program has created an environment where students can perform experiments simulating the process of fabrication for a

Silicon wafer chip. These simulations increase the quality and level of education by providing students virtual machines, which would normally cost thousands of dollars, to go through the process of creating these Silicon wafers on their own without any risk of breaking a wafer or the machines. A single mistake for this process could cost a school or person hundreds to thousands of dollars, and virtual reality reduces the risk of this happening.

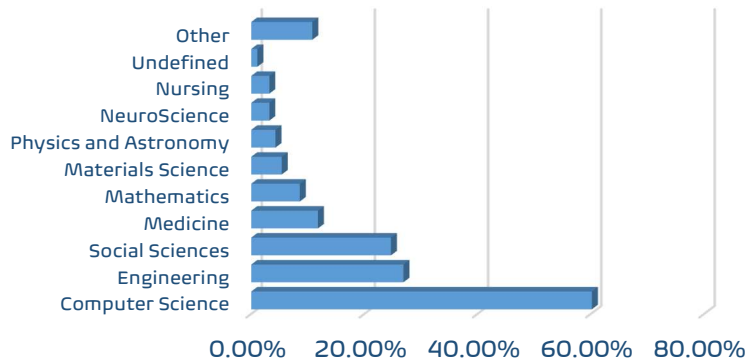
Another environment this project implements is a fully automated clean room, similar to IMFlash's in Lehi, Utah. IMFlash's clean room is 100 times cleaner than a hospital room, with less than 100 particles per cubic foot. To keep this room so clean all employees are required to wear bunny suits. IMFlash almost never gives tours of their fabrication clean rooms, and therefore, students interested in this line of fabrication don't have the opportunity to see just how it works. This is where Utah Valley University's line of fabrication simulation comes in handy. This simulation allows students to explore a clean room and follow a wafer through its process of fabrication without having to visit one for themselves. This virtual reality creates a private environment, generally not open to the public, that students can explore and learn in.

Within this fully automated fabrication room, students can follow a series of prompts leading them through the process which a single wafer would go through in order to create a memory chip. Each step of the process has a written explanation of what is happening in the step, as well as a simple animation showing what is happening to the wafer within each machine. By the end of this simulation a student will have run through all the steps to create a wafer, a process that usually takes more than one month to complete, within less than half an hour. Along with follow the fabrication process, students also have the chance to simply explore a clean room, taking in all the sights and sounds of the room, experiencing what it would be like to actually be in a fabrication clean room.



b. Making Hands-on Simulations Available for Education

Virtual Reality Papers Per Subject



Virtual reality, as explained above, provides opportunities for students to have hands on experiences where otherwise would be impossible. This can be used in many disciplines as shown by this chart. Virtual reality is even being used by primary schools to teach children how to code at a young age, in a fun, immersive manner by “put[ting] the power of the

developer directly in students’ hands”, allowing them to create their own virtual environments as they are learning to code.

Utah Valley University has several different virtual reality projects happening at this moment, including Nanotechnology project. These projects cover disciplines in Nanotechnology, Automotive, Aviation and Nursing. These projects are being created to provide hands-on experiences for students, so they can develop the skills within their career area and potentially receive higher quality jobs, or be better prepared for their jobs. For example, one of UVU’s virtual reality projects is to simulate what it is like to be a flight attendant, since there is a paradox where airlines want flight attendants who have the experience of being a flight attendant, but in order to receive the experience one must be a flight attendant and therefore airlines are hiring people who have any kind of customer service experience, and the newly hired realize that there is a lot more to being a flight attendant than what was first expected. This is a major reason as to why the majority of flight attendants leave their jobs within 3 years of starting. UVU’s virtual reality aviation project is attempting to create a simulation which can provide potential flight attendants with the knowledge and experience of what it is truly like to be a flight attendant.

There are many other universities using virtual reality simulations to further the education of their students. University of Utah is developing “the world’s first full-service dental-practice simulation” to train new dentists and have taken this simulation to India to teach over a hundred students procedures they would never have been able to practice without the use of virtual reality. Oxford University is using virtual reality simulations for their medical students to help cement their conventional lectures with hands on experiences within VR.

c. Engaging

In an age where “92% of teens are online daily, playing games, livestreaming memorable experiences, sharing ephemeral moments on Snapchat, or posting pictures of exciting daily occurrences on Instagram” it is often difficult for teachers and professors to

keep the interest of their students using their traditional lecture based teaching methods. Traditional methods of teaching can, and most likely will, lead to disengaged, disinterested students, but the hands-on, immersive and interactive environments and experiences of Virtual Reality can provide an opportunity to boost student engagement and draw the attention of students to subjects which they may have found disinteresting or boring otherwise. Virtual Reality increases engagement through “a strong sense of presence and immersion compared to traditional learning environments”. Where traditional learning environments would simply provide a lecture, movie or where possible a lab here or there, Virtual Reality offers “tridimensional computer environments with advanced forms of interaction that can provide more motivation to the learning process” by placing the students in environments where they are allowed to interact with objects how they want.

Another way that virtual reality can increase the engagement of students, is by placing the students in the driver’s seat. Students are able to “construct their own knowledge from meaningful experiences”. VR allows students to learn at their own pace and in their own way. VR is a platform for education which can allow room for the imagination of the student, and create experiences which they would not gain in a traditional classroom setting.

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