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VR in Education: Product  
EDTC 6240

**Product: VR Headset**
As I previously had built a class set of Google Cardboard, and none of them survived the school year, I opted to use our other VR headset. Although much cheaper, Google Cardboard proved challenging to focus and not very durable. For this project, I used the DESTEK V5 VR Headset. It was a far more pleasant experience as the focus was sharp, and the straps were comfortable.

**VR Apps Explored:**

**InCell VR**
InCell was designed as a racing game that combines strategy and bio-science. I initially thought that this was an instructional educational app as it was from the same company that provided in InMind VR. Although it did offer some basic educational contexts, the educational value was low. It would be well suited for elementary school students starting on their journey into virtual reality. It taught some fundamental concepts like viruses are bad, and proteins are the building blocks of life. This app had the unfortunate side effect of giving me motion sickness that lasted for several hours after the experience. I think this was because the game controlled the motion forward, but my head movements controlled the rotation of the racer.

**Aquarium VR**
Aquarium VR was a pleasant surprise. Although I would have preferred if it were a filmed experience, the quality of the 3d animations were sufficient to provide a sufficiently real
experience. By focusing on a fish, you could learn more about it, and some fish would interact as if you had pushed them. I had my two-year-old daughter use this app to examine her experience. I wasn’t sure if it would be adequately focused for her, but she instantly cried out, “I see Nemo, I’m underwater!”.

Within

The Within app is a collection of Virtual movies and documentaries. I tested Restless Hong Kong. It was a very realistic experience. The creators used a static 360 camera, so I wasn’t able to navigate the streets, but I was able to look around. Watching the time-lapse video in virtual reality was a unique experience, and in a few minutes, I had a feeling for what life in Hong Kong was like. The high definition video made the experience exciting despite not being able to move around. During my viewing of the experience, I tripped and fell over our coffee table as I had lost track of my position in reality.

VR Rollercoaster

I mostly got this app for my two-year-old daughter to test. She loves dinosaurs, and they had a dinosaur rollercoaster ride. She wasn’t able to focus on the word “Start,” so I had to get the device working for her. After testing to make sure it was safe for children, I handed it over to my daughter. She took a few moments to look around, but then all of a sudden, she started to shout, “I see a triceratops!” She kept moving her body at every turn. When she oriented herself towards the forward motion of the rollercoaster, she started shouting, “Look Mommy! I’m flying! I’m flying!” Then all of a sudden, she pulled off the headset and said “It’s broken!.” An ad for a war game had started playing. After “fixing it” she played again. She was so immersed that her jaw was slack and her breathing was heavy.
Three-Dimensional Virtual Reality as a Substitute for Introductory Laboratory Activities

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EDTC 6240: VR In Education

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Three-Dimensional Virtual Reality as a Substitute for Introductory Laboratory Activities

Three-dimensional virtual reality (VR) can increase knowledge retention, intensify engagement, enhance safety, and lower costs, but it should not be used as an exclusive replacement for in-person laboratory activities. Despite the promising results from recent studies, substituting hands-on learning with exclusive virtual reality alternatives does not provide equal benefit to all sexes, and post-introductory experiences and experiments are limited to the situations and scenarios programmed into the system. By leveraging the strengths of VR and physical experiences, we can obtain the benefits from each system while limiting the disadvantages from each as well.

**Benefits of VR in Laboratory Activities**

With restrictive budgets squeezing schools, technology quickly becoming obsolete, and costs of expendable materials rising, there is little surprise that leaders are looking to virtual reality as a solution to provide cutting edge experience to our students without the associated costs of the traditional laboratory. Combined with the increase in engagement and learner satisfaction (Bogusevschi, Muntean, & Muntean, 2020), virtual labs offer students practice and training opportunities that are free of risk and material related costs (Chen, 2020).

With such promising benefits, leaping to replace entire laboratory experiments with virtual reality experiences may seem like an obvious choice. However, not all students benefit from virtual reality equally.

**Women retain less than Men in virtual reality laboratories**

While both males and females can learn in virtual environments, the way they process spatial information is statistically different (McDonald, 2016). A study that explored student’s
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short and long term knowledge retention in a virtual lab versus a traditional cadaver lab showed that men who learned with the 3D-VR tool had significantly higher short and long term knowledge retention scores than the control group who were taught using traditional methods. In contrast, women in the control group had significantly higher short term scores than those who learned in the virtual environment (Alharbi, Alraddadi, Al-Saffar, Garman, & Alraddadi, 2020). There is also a growing body of information to suggest that women are more than twice as likely as men to experience simulator (motion) sickness (McDonald, 2016).

One might argue that since the average scores of students increase by enhancing learning with virtual reality, it would make sense to replace traditional a full lab experience with the equivalent virtual experience. The weakness in this argument lies in the evidence that providing a combination of both VR and traditional laboratory experiences would benefit both sexes. It could also result in an even higher average of knowledge retention scores since both groups would have opportunities to learn in a way that lead to an optimal result. Offering both methods could be offset the increased cost by using virtual reality during the costly introductory phases of learning where errors, accidents, and waste are far more likely to occur.

**Current technology limits the infinite variability present in physical laboratories**

In real life, there are infinite variabilities in a lab. Bottles get mislabeled, an artery or organ is not in the same place in every cadaver, the power goes out, a student spills some acid on the table, a sneeze contaminates the petri dish, the temperature at the back of the room is warmer than the front, and the list goes on. When it comes to introductory virtual laboratory experiences, virtual reality’s chief weakness is one of its greatest strengths – variability in virtual reality is limited to only the programmed situations. By contrast, virtual reality has diminishing returns as
students move from introductory experiences and trainings to more advanced skills and techniques that require more innovation with fewer anticipated results. Proponents of using virtual reality to replace a traditional lab in its entirety cite the advantage of controlling all variables to increase student’s ability to follow the expected path in the experiment. The argument is valid, but it misses a critical point – the purpose of a school laboratory is not to prepare students to perform virtual experiments in a computer-controlled environment, but instead to prepare students to deal with and interpret experimental uncertainties in real-world conditions.

By leveraging virtual reality in the early stages of learning, students can inexpensively learn the fundamentals in a safe and controlled environment that builds their confidence (Blascovich & Bailenson, 2012) and grows their skills for applying their new knowledge in reality.

**Conclusion**

Virtual labs can be an effective way to intensify engagement, enhance safety, provide controlled introductory experiences, help keep lab costs down, and boost knowledge retention in men. In contrast, traditional laboratory practice provides the real-world variabilities that students need to prepare themselves for the future while limiting the disadvantages that some women experience in virtual environments. By using virtual labs for introductory material and transitioning to traditional labs as students gain experience, we can reap the benefits that both methods have to offer without accepting the limitations from either system.
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References


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