

The Environment Is Virtual, The Experience is Real.

A three part practical guide for implementing Virtual Reality in the education space.

Part 3:

Real Suggestions for Implementing Virtual Reality-Based Learning Opportunities



Introduction

This paper is the third of a three-part series that describes the journey and outcomes of implementing virtual reality (VR) technology in a summer program offered by Envision -National Youth Leadership Forum Advanced Medicine. The first paper articulated the planning process, as well as choices made concerning both VR technology and the learning activities themselves. The second paper examined the first year pilot implementation (2017), associated student impact results, and improvement plans for 2018.

This paper will explore what changes that were made to Envision's use of VR in the 2018 program, as well student outcomes based on these changes. This paper will also summarize recommendations for implementing VR in teaching and learning experiences.

Identifying Improvement Opportunities and Consulting Expertise

After the Envision team successfully executed its VR pilot in summer 2017, it was time to reflect on what was successful and what improvements could be made to the program for 2018. To inform this process, we reviewed student satisfaction data and testimonial feedback. We identified trends in these data and examined our assumptions on why these trends exist. After prioritizing the most challenging issues, we set out to solve the top three: 1) design a more integrated VR experience: 2) increase the time spent on VR in our curriculum to ensure all students had a more robust virtual experience; and 3) improve our operational skills to ensure when VR lessons were executed, technical issues were kept to a minimum and resolved quickly.



From the 2017 results, it became very clear that in order for VR to have the deepest impact on student learning, it needed to be as integrated into the learning experience as possible. VR could not be seen as simply a fun, optional, extension activity -- it had to be core to the learning program. In order to improve the integration of VR in the summer program, Envision's design team consulted Dr. Anton Scheepers, founder of the Apprentice Doctor Corporation and Director of the Future Doctors Academy. With more than 30 years experience as a practicing physician, lecturer, and educator, Dr. Scheepers is uniquely qualified for ensuring relevance of medical curricula in an education setting. We discussed with Dr. Scheepers the program objectives, existing components, and the initial VR design scenario highlighted prior (lacerated abdomen).

Based on Dr. Scheepers feedback, the Envision team decided our best course of action was to replicate a physical simulation in the virtual space. In 2017, program workshops included the internal fixation of a fractured long bone using the Apprentice Doctor orthopedics kit. Student satisfaction data on this experience in 2017 was very strong (with more than 90% of the students rating the experience satisfactory or higher). With a description of the experience and a stepwise lesson plan, our VR developers, Arch Virtual, set out to utilize core assets from the 2017 VR scenario (operating room, sights, sounds, equipment, etc.) and created a virtual fracture reduction.

Delivering a VR "2.0" Experience

With version 2.0 of the virtual design build underway, the Envision team focused attention on improving the lesson plan progression through the curriculum and increasing the overall time in the program schedule devoted to virtual reality. Because this particular Envision program is residential, requiring students to check in and live for 10 days in Johns Hopkins University dorm facilities, it was important to strategically position content across the course to avoid front-loading or backending materials. To help generate excitement for the new build, the Envision team rearranged lesson plans and positioned the 2017 [v1.0] VR lesson as an arrival day activity, used to welcome students to campus and quickly expose them to immersive program content. The new [v2.0] build was then inserted into a schedule rotation midway through the course to compliment a field excursion to the University of Maryland Medical Center and R. Adams Cowley Shock Trauma as well as a series of lessons on physical fracture fixation. Because of the likelihood that some students would experience the new VR build before the physical fracture fixation simulation, the build was designed to be asynchronous.

Along with schedule positioning, the Envision team focused attention on resource allocation in planning and event execution to limit technological disruptions experienced in 2017. To overcome internet connectivity concerns, versions of the VR Apps were downloaded to each gaming terminal as backups. Event space that could accommodate the total of the VR setups was secured so the equipment could be setup, tested prior to student arrival, and remain assembled for the duration of the experience, and dedicated personnel assigned to run the virtual reality lessons were trained on equipment and content during portions of the program's field training prior to program launch.

By focusing attention and resources on these VR elements of the camp program, the Envision team felt the total of the experience would improve and student satisfaction scores would increase as a result of pre-program expectations being matched or exceeded by program delivery.

Results

Following the same program evaluation protocol implemented in Summer 2017, the Envision team surveyed students and instructors that participated in the Summer 2018 program. In sum, almost 850 students attended three separate 10 day camps, each a carbon copy of one another and each taking place on Johns Hopkins University Homewood campus. Students came from across the United States, with a small contingent traveling in from outside US borders. As with the 2017 survey, 12 content areas were measured to determine success through students' self-reported satisfaction scores (see Tables 1 and 2). The Envision team reviewed macro trends from the survey results. Overall, program content across the board (inclusive of traditional and VR learning) was better received in 2018 than 2017. Student satisfaction jumped 11 percentage points (13%) and satisfaction with curriculum content 20 points (28.9%). In fact, all nine program components surveyed saw some improvement. Keep in mind that aside from the VR portions of the curriculum, few adjustments were made to curriculum outside of building stronger connections between components to emphasize program connectivity and collective relevance.

The VR portions of the program curriculum, as this paper describes, underwent significant investment and redesign for 2018. And the response was also very positive. VR satisfaction increased nine percentage points and was the only program component not rated above the 90% threshold in 2017 to achieve that distinction in 2018. On the surface, these gains many not seem as impressive as some of the other jumps; however achieving measurable gains becomes harder as base scores are higher. We feel that the focused redesign of VR and connectivity with other program elements was the proverbial rising tide that lifted all ships. And the overall trends are a direct reflection of the specific investments made in VR.

In addition to the satisfaction data, we received testimonial feedback from staff, students, and other stakeholders like Dr. Scheepers, who product-tested both VR Apps during the staff training program. Dr. Sheepers was amazed at the realism of the experience and commented on the life-like nature of the actions required to complete the procedures. "From the point of view of the reality simulation – like the real background or sounds and the bleeding on incision for instance," he commented. "The step-by-step mentoring/ guiding was also a plus. In short, apart from the initial learning curve, I think it is a well done and amazing piece of work and technology, and supplements the orthopedic theory and apprentice simulation workshop amazingly well!" Staff who delivered the program content were equally impressed, often staying after training lessons concluded to gain some extra time in the VR scenario.

When we looked at student reactions, in their freeform responses to a question on what component had the most impact on them, a handful mentioned VR specifically, with one student going as far as to say: [what was my favorite part of the program?] '*The diagnosing of the patient from the initial check-up to the oral presentation and the suturing/surgery/VR.*' Note how the comment closely aligns items in the program, highlighting the connectivity between elements - it's feedback that supports the benefits of well designed, linked curriculum in both the physical and virtual spaces.

Lessons Learned and Recommendations

Over the past 24 months, the Envison team learned a lot as we embraced the power of VR as a tool to enhance realism and student engagement in our immersive summer program. As we've highlighted throughout the documentation of our experiences, VR can be a powerful ally or fickle, potentially expensive, adversary in the battle for student attention. Investments that advance both VR content and delivery mechanisms are needed to further widespread adoption of VR across the K-20 landscape. Thus we recommend the following five tips for practitioners looking to onboard this tool in their lessons:

→ Integrate - Use VR as a complement to existing curriculum, not as a stand-alone element lacking cohesion. Challenge notions of VR's place in the curriculum and build lesson around VR rather than adding VR at the end or beginning.

→ **Resource** - Make sure proper resource allocations are made at the beginning of your lesson plan development. As we've noted, equipment, facilities space, and personnel should all be allocated properly to ensure the learner experience is optimized. "Gut check" your resource planning with a VR designer.

→ Learn - Don't go into VR with an expectation that you can just 'figure it out' on the fly. Ensure that you (or your technicians) are well versed on how to setup/run and troubleshoot the VR experience (equipment and app) before launching with any student group

→ **Frame** - Tell students what they are going to do, tell them what they are doing, and tell them what they did. We found that VR can be a powerful tool, but unless it's used appropriately (in a way that students see as relevant), it's potential for engaging students will suffer.

→ Excite - Usage of VR, or any new technology for that matter, is exciting! But students will take a queue from their instructor(s) - if you don't 'show' them that you're engaged and excited about the prospects and potential of what VR represents, they'll lose interest

VR's Bleeding Edge

The Center for Excellence in Enterprise Technology at Villanova University has constructed The Cave - 'An 18-ft wide by 10-ft deep by 7.5-ft high enclosure within which viewers can interact with a virtual world.' This basically represents a VR classroom designed to transport a small class size to wherever the instructor chooses (assuming a developer has had an opportunity to build out the virtual framework for that instructor's vision). This does little to solve for one of the other challenges we've noted - the startup equipment costs to make VR viable. This, too, is seemingly being addressed in real-time. Oculus has announced the advent of Quest - a replacement for the *Rift that eliminates the requirement* to purchase a costly gaming PC terminal. Set to debut in the spring of 2019 and cost similar to the *Rift (\$399), this advancement will* increase the scalability of VR almost overnight, dropping the total cost for one complete set of equipment by 80 %.

Advancements in technology and integration of VR in teaching and learning represent a very exciting time for education. Through our journey, we've become learners and builders ourselves. And we're excited about the future of teaching and learning in both the physical and virtual classroom. We hope our shared experience might assist you, the earlier adopters, successfully launch or improve your own VR initiatives.
 Table 1. Year-over-Year Comparison of Student Satisfaction Data

	Overall 2018	Overall 2017
# Surveys	720	586
Overall Satisfaction	95%	84%
Program Impact	97%	89%
Overall Advisor	98%	92%
Overall Curriculum	89%	69%
Standardized Patient Encounter	96%	95%
Apprentice Doctor	94%	92%
Shock Trauma / UMD Visit	93%	90%
VR	93%	84%
Overall Program Speakers	86%	61%
Hot Topics in Med	80%	65%
Physical Exam Skills Training	79%	79%
Public Awareness	71%	55%
Career Compass Portal	68%	64%

Table 1. Year-over-Year Comparison of Student Satisfaction Data

	Descriptor
Standardized Patient Encounter	Students take the medical history of a patient actor portraying an Envision authored patient case; takes place at the Hopkins School of Medicine Simulation Center
Apprentice Doctor	Hands-on workshops that focus on medical skills: aseptic technique; suturing and culminating in external and internal fixation of a long bone
Shock Trauma / UMD Visit	Students visit the university of maryland medical campus including gross anatomy lab, R Adams Cowley shock trauma center, and a working trauma ward
VR	Initial design/build involving a patient with a lacerated abdomen and full modelling of a fracture fixation similar to the apprentice doctor workshop
Overall Program Speakers	All speakers
Hot Topics in Med	Discussions on topics that are in the news/ relevant to medical education
Physical Exam Skills Training	Members of the teaching team at the JH Medical School Simulation Center teach students how to perform a basic physical exam
Public Awareness	Design a public awareness campaign based on their experiences at UMD medical center
Career Compass Portal	Envision's career compass App and navigation portal

About Envision

Envision is a nation-wide youth development organization devoted to improving student academic success and career readiness through experiential programming. Envision hosts college-accredited, academic- and career-focused programs for youth. Each Envision program employs a variety of instructional approaches – ranging from distinguished faculty-led lectures, to engaging small group activities, to real-world simulations, and subject-specific field excursions. Programs cater to 21st century skills development which are critical across all current and future careers. With a rich history dating back more than thirty years, Envision takes care in program design, development, and delivery in order to execute its mission – to ensure each student leaves having made progress on their career and life aspirations.