

How ASU is offering hand-on lab experience to remote students.

In February of 2012, President Obama’s Council of Advisors on Science and Technology released a report stating that the nation needs one million new STEM workers (by 2022). To help satisfy that need and the predicted market demands for more qualified health care professionals, Arizona State University envisioned offering a fully-online biology program terminating with a Bachelor of Science award. An advanced degree in STEM, particularly in the sciences, requires access to lab facilities and field sites. This online BS in biology would make it possible for health care degree-seekers to pursue their educational goals, regardless of their physical geography.

“You feel like you’re there. It freed me from distraction. It also reminded me of the magic school bus from when I was a kid.”

— Aaron, ASU Undergraduate Student

After determining that a fully-online biology degree was an essential offering for its institution, ASU set about finding ways to deliver high quality online instruction and replicating the face-to-face lab experiences that would meet the rigorous demands of ASU’s accrediting agency, the Higher Learning Commission (HLC). ASU did a thorough analysis of what instructional content and technologies might be instrumental in delivering robust science lab credits to their fully-online students and its search led them to move forward with an innovative alternative to

School Type:	4-year public research institution, HLC Accredited
VR Project Lead:	Manager, Learning Technologies
Instruction:	Fully-online program
Students:	Pursuing a Biology Degree leading to a B.S. in Biology
Content	Commercially licensed content from Labster, taught in three course sections.
Environment:	<ul style="list-style-type: none"> • LMS/Google • Canvas/Gsuite • VR Headset • Lenovo Mirago Solo with Daydream - Education Edition
Class Sections:	<ul style="list-style-type: none"> • Cell & Molecular Biology • Ecology • Animal Physiology • BIO394 - BIO361 - BIO321
Headsets:	<p>[Pilot] Owned by the institution</p> <p>[Ongoing] Students will purchase headsets, available through the bookstore and most electronic resellers</p>
Number of students:	<p>[Pilot] 96</p> <p>[Ongoing] Expected to reach 1,000</p>
Results: [Pilot]	<p>Most students (82%) thought the simulations were useful in supporting their learning</p> <p>Most students (78%) felt like they were learning in a real science laboratory</p> <p>Most students (55%) thought it was easier to learn with VR compared to traditional methods.</p>

in-class labs: College Level Science labs delivered in virtual reality, with high-quality content and VR headsets simulating a hands-on lab experience. ASU selected Labster as their partner for content and the Lenovo Mirage Solo with Daydream headsets as the delivery platform.

When making its commitment to leverage VR technology for their online Biology students, ASU cited that the VR environment creates a safe environment where students can try, fail, learn, and gain confidence, and enables students to interact with the equipment, perform the experiments, make mistakes and discover (with some guidance from Dr One, an in-lab digital assistant) solutions to problems. In the VR environment, students work through real-life case stories, some of which are difficult or impossible to do in a face-to-face course and they get feedback all along the way through quiz questions and hypothesis testing. For its

VR headset delivery, the Lenovo Mirage Solo offered the ability for students to get started quickly; they used the ASU Gmail account to create a connection to the Google Play store and from there, downloaded the Labster content. When the headsets are in use, learning data is captured through the headset and reported to the institution's Canvas LMS.

After the successful rollout and measurement of the inaugural cohort of students who received headsets from ASU at no cost, ASU will make it possible for students to purchase their own headsets from the bookstore or national resellers. Now that faculty and students are familiar with the ways VR can augment traditional instruction, ASU is expanding its search for applications and pre-packaged software, specifically content in the humanities.

Cochise Community College

The Director of Library Services, John Walsh, is responsible for leading technology innovation and collaborating with faculty to devise and deliver innovative teaching strategies that help Cochise Community College provide compelling, high quality instruction to their students, with an eye towards access. Cochise is constantly seeking ways to offer students the courses that will best position them for success in the workplace or as they transfer and pursue a 4-year degree. Yet, like most community colleges are faced with the reality that offering new courses, specifically new hands-on or science courses requires capital equipment investments at the college. Cochise identified the potential for using virtual reality (VR) simulations as a means of bringing opportunities to their students that would not otherwise be possible on campus.

Cochise Community College is reacting to the need to help graduate more STEM students with a focus on teaching STEM disciplines in the most effective ways. Among the potential pathways that combine access and innovation, using Virtual Reality for instruction in the sciences was identified as an area worth evaluating. Cochise Community college explored the available college level course materials on the market and concluded that Labster content, incorporated as part of a face-to-face class section had the potential to improve student outcomes.

To validate whether or not VR could help Cochise and its students move toward the goal of graduating more STEM-qualified students, Walsh drafted a research proposal and secured funds to purchase VR headsets sufficient to outfit a class section. Walsh

School Type:	Community College, HLC Accredited
VR Project Lead:	Director of Library Services
Instruction:	On-Campus, delivered in a computer lab classroom
Students:	Completing Chemistry Requirement
Content	Commercially licensed content from Labster, taught in a single version of the course
Environmet:	<ul style="list-style-type: none"> • LMS/Google • Canvas / Gsuite • VR Headset • Lenovo Mirago Solo with Daydream - Education Edition
Class Sections:	[Pilot] Biology - BIO181 [Expansion] 13 total Science (SCI) classes, plus Ceramics and 3D Design.
Headsets:	<p>[Pilot] Owned by the institution, 24 headsets secured in a lockable, rolling charging cart.</p> <p>[Expansion] Owned by the institution, second cart of 24 headsets secured in a lockable, rolling, charging cart.</p>
Number of students:	[Pilot] 20 [Expansion] 200
Results:	<p>[Pilot] [Pilot] Students who experienced the VR performed better in the physical labs and did better in the course content and assessments overall.</p> <p>[Expansion] Will measure the percentage of students feeling more engage in VR sessions compared with those in lecture settings.</p>

purchased 24 headsets for a 20-student class, holding a few headsets in reserve for any potential hardware failures or equipment challenges. He also purchased a lockable, rolling, charging cart for storing and charging the headsets.

The research project, “Enhancing Learning Through Immersion”, tests and measures the impact of virtual reality headsets with students learning STEM concepts, specifically the spatial relations taught in Biology 181. Biology is a visually-grounded scientific discipline requiring visualization of very large and very small concepts, and the research seeks to show a positive correlation between the use of Interactive VR instructional simulations and greater achievement of specific Biology 181 course-level learning outcomes. For the inaugural class, Walsh provided VR headsets to 20 students in an “A” section of Biology 181. Students in the “A” section reported to their lab class in a computer lab, where an instructor trained in using the VR modules was available as proctor, and students conducted their lab experiments together as a group, at a dedicated course time throughout the semester. A separate “B” section of students completed the lab assignments through traditional instruction methods, and at the completion of the course term, student outcomes and preferences were planned to be measured and reported for evaluation.

When other innovative campus leaders at Cochise learned about the availability of VR headsets, they sought to learn more about how the Biology 181 course was adopting and evaluating the technology. The library director was frequently asked to give formal and informal presentations, at the individual Cochise Community College Campuses and

across the Maricopa Community College system. Virginia Thompson, Ceramics professor, immediately saw the potential for VR to not only help her students’ understanding of 3D concepts for art and design, but also to use VR’s ability to help people experience things that are not possible in the real world. As part of a Fulbright-Hays GPA Curriculum Development Program, Ms. Thompson saw the potential for using VR to help her students experience first-hand what it would be like to be part of the Silk Road in the 1600s. Her curriculum project is to have her ceramics students recreate the Silk Road in the 1600s, having students draw eight major cities out of a hat and work in pairs to create replicas of ceramic artifacts then give presentations in the order of the Silk Road travels beginning in China and ending in Turkey. With the use of the college’s new Virtual Reality (VR) equipment, students will be able to visit the city stops along the way in 3D VR.

After the successful pilot of the first Biology 181 course and the introduction of VR into the arts curriculum at Cochise Community college, the campus expanded its available inventory of headsets to 48, which would enable two classrooms at the same time or on separate campus locations to take advantage of what VR can offer.