



# HEALTH CARE IN 3-D

by Karen Burbach

Technology has come a long way since Princess Leia's holographic image appeared before Obi-Wan Kenobi in the original "Star Wars" movie. And, science fiction that seemed fantastical in the 1977 blockbuster is now reality. Today, in high definition, you can travel through the chamber of an oversized 3-D heart to better understand, and correct, genetic defects. You can visualize abnormalities of the brain using a medical hologram, which, unlike a static CT scan, allows you to walk around the organ – that appears to be suspended in space – for a truly realistic-looking image.

Augmented and virtual reality are among the fastest growing sectors of the economy – moving well beyond gaming and entertainment worlds and into business and education.

Now, UNMC intends to be a leader in the revolution of health care education.

Already, through its iEXCEL<sup>SM</sup> initiative, UNMC faculty and students use mind-boggling technology to create new educational content and improve human performance and patient outcomes.

And, as aviation simulation changed the flight industry, iEXCEL has the potential to propel the training of doctors, nurses and allied health professionals into the next generation with emerging virtual and augmented reality. Learning opportunities will further grow when, in 2019, the iEXCEL initiative moves into a new high-tech facility – the Dr. Edwin G. and Dorothy Balbach Davis Global Center.

There, students will travel between floors to master their clinical and surgical skills using sophisticated simulators, lifelike holographic images and immersive environments.

In the meantime, UNMC is forging ahead in a prototype visualization hub, where faculty, staff and students create and apply high-quality medical visualization content to the education and training of health care professionals – in formats ranging from augmented and virtual reality to holographic imagery. Meet a few iEXCEL champions now.

Paul Dye, a graphic arts visualization specialist on the iEXCEL team helps bring health care education content to life. “We’re limited only by the academic’s imagination. There’s not a lot we say ‘no’ to – it’s more about the amount of work that goes into it, but nothing is too fantastical.

“What excites me? Well, we have access to technology you don’t have anywhere else, at least in Nebraska. We work on content for the virtual reality headset and holographic theater – where else can you do that?”

Robert Norgren, Ph.D., sees parallels in iEXCEL and ‘programmed learning’ – once popular for its self-paced, self-administered instruction, which was presented in logical sequence with repetition of concepts. It was, in fact, programmed learning in the 70s that piqued Dr. Norgren’s interest in neurosciences and neuroanatomy.

“People thought it was a better way to learn and now we can do it, digitally, in a more elegant way.” As a result, Dr. Norgren, a professor in the UNMC Department of Genetics, Cell Biology & Anatomy, is working with the iEXCEL team to create an interactive bundle of digital neurosciences resources.

“I’m most excited about letting students interact with the material. Students, today, like to test and work through things themselves. They’re really comfortable interacting with digital media on their own time.

“I’ve been using 3-D animation since the early 1990s, but it was 90s technology and the resolution was really poor – it’s something people laughed at. iEXCEL uses better animation and resolution and is more elegant. It’s something I’ve been waiting for so I’m glad it’s available.

## Augmented reality vs. virtual Reality

In augmented reality, technology generates images or information that can be layered on top of real-world objects – think Pokeman Go. It differs from virtual reality, which creates a completely immersive, artificial scene - think simulating a skydiving experience while standing in your living room.





## Uniquely Nebraska

As the new headquarters for iEXCEL, the Davis Global Center will provide almost 200,000 square feet of clinical simulation, surgical skills training and advanced visualization space. And, it will mark its opening with the:

- First-in-the-world, five-sided, laser-based immersive environment (iEXCEL Laser CAVE-5).
- First holographic theater in an academic setting.
- 13 realistic clinical environments within clinical simulation, including ambulatory, emergency department, trauma, intensive care, labor/delivery, pediatrics.
- 21 operating room environments within surgical skills simulation.
- First 200-degree digital touch environment (iEXCEL Helix).
- The National Center for Health Security and Biopreparedness. Funded by the U.S. Department of Health & Human Services, the center will enable UNMC to teach federal health care personnel procedures in diagnosing and treating highly infectious diseases.
- Continued outreach of four Simulation-in-Motion Nebraska trucks used to teach lifesaving skills to rural emergency medical service providers and providers at critical access hospitals throughout the state. Since the summer of 2017, SIM-NE has held more than 200 training events and trained more than 3,600 providers across the state.

The EON Reality VR Innovation Academy. Housed on the UNMC campus in Omaha, and in partnership with EON Reality, this workforce development program gives students the opportunity to learn the fundamentals of AR/VR, 3-D modeling, animation, mobile applications, project management and more. The first cohort of students entered in June 2018 and will graduate in May 2019.

“Professors bring the expertise and content knowledge, which can’t be replaced by anyone else. I’m not a graphic artist or an animator. I don’t know the technology. You need both the content side and technical side so that it becomes a partnership with the iEXCEL team to turn the curriculum into an interactive experience.”

Across the state, UNMC nursing students can learn to give insulin injections via the iWall, said Beth Culross, Ph.D. The iEXCEL team is developing syringe imagery to show on the iWall so students can see what it looks like to draw up 10 units of insulin. They also have to pick the correct syringe – insulin syringes are in units and flu shot syringes are in milliliters – and the correct needle because it’s different for intramuscular and subcutaneous injections.

“Another example of this technology is to have that visual first and then have the students practice with real needles, go to the simulation lab and practice on mannequins, and then do a flu shot clinic,” said Dr. Culross, assistant professor in the College of Nursing and director of the Learning Resource Center.

Faculty have embraced the iWall technology and appreciate how it connects nursing students in Scottsbluff, Kearney, Lincoln, Omaha and Norfolk, as well as dental hygiene students in Scottsbluff and Lincoln and College of Allied Health Professions students in Kearney and Omaha.

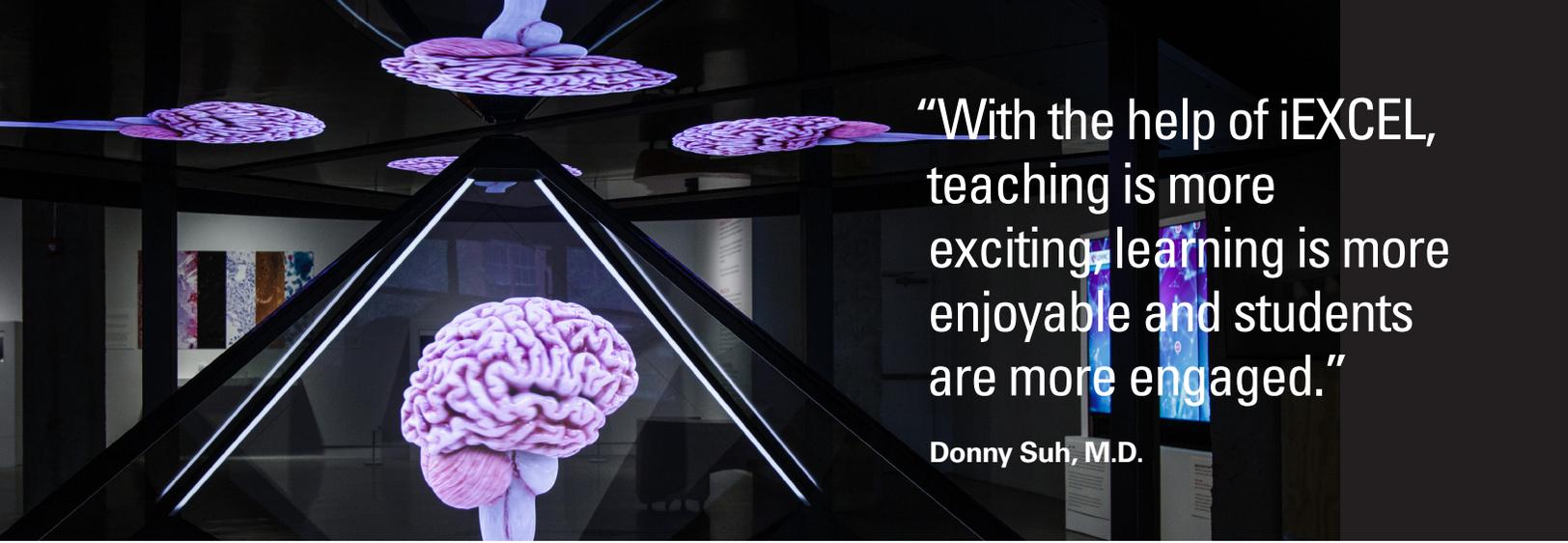
“We’re just scratching the surface of what we can do with the technology...I’m a kind of gadget girl and this technology provides us with a lot of ways to help students be comfortable with their skills – and confident with the knowledge that before they walk into a live patient room they already have an idea of what they’re doing.”

Dr. Culross already envisions increased opportunities for interprofessional education collaborations. “If nursing is doing cross-campus projects with injections and medications, we also could involve pharmacy, allied health and medical students. It’s exciting to think of what we can create to move forward and really help our students work together.”

As a former UNMC faculty member, Edwin Malashock, M.D., understands the role technology plays in teaching and clinical practice.

“Technology has contributed to the rapid advances in surgical techniques and the actual practice of medicine today,” he said. “This was an opportunity to take part in that rapid development by supporting iEXCEL.”

Dr. Malashock is referring to the gift that he, and his wife, Sally, made for the construction of the Davis Global Center – and out of respect for his former urology professor and private practice colleague, Dr. Edwin Davis, Sr., who serves as the building’s namesake.



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**Donny Suh, M.D.**

“He was always seeking ways to improve teaching, surgical techniques and in finding new drugs to combat urinary infection,” Dr. Malashock said.

In fact, Dr. Davis taught him how to perform a critical surgical technique – the perineal prostatectomy – which Dr. Malashock used to treat prostate cancer patients throughout his career.

A clinical professor of surgery at UNMC for 24 years, Dr. Malashock graduated from UNMC’s medical school in 1946 alongside Dr. Davis’ son, Edwin Davis Jr. In 1953, he joined the senior Dr. Davis in his Omaha medical practice.

With the use of virtual reality and 3-D virtual animated images, Donny Suh, M.D., plans to better educate health care professionals, high school students and the public on the dangers of shaken baby syndrome.

“They can wear the virtual reality headset and see the damage live as though one is shaking the child. They’ll see the retinal hemorrhages and how delicate the babies are as we better educate to prevent shaken baby syndrome.”

Dr. Suh, a clinical faculty member in the UNMC Department of Ophthalmology and Visual Sciences, was an early champion of iEXCEL, and has since created a module that enhances his ability to explain how the eyes function. “It’s a complex organ, but with the help of iEXCEL, teaching is more exciting, learning is more enjoyable and students are more engaged.”

Dennis Ross, M.D., of Wichita, Kan., and his wife were wowed by their initial visit to the iEXCEL Visualization Hub and Sorrell Clinical Simulation Lab. “Ann and I were so impressed with how advanced the simulation center was,” said Dr. Ross, a practicing nephrologist for 40 years.

Such advanced simulation enables students to master procedures using mannequins and virtual reality devices – long before seeing patients, he said. “Instead of watching a doctor do a procedure on a patient, you can do it on the mannequin until you’re skilled at it.”

The couple – he, a 1973 UNMC College of Medicine graduate from Aurora, Neb., and she, a 1971 UNMC College of Nursing graduate from Wayne, Neb. – have worked with the NU Foundation to monetarily support iEXCEL programming.

The benefits of simulation are many, Dr. Ross said, including a faster learning pace; greater perspective; enhanced engagement and communication between teams, including to rural areas and community hospitals; and improved patient care.

He said he’s excited to see iEXCEL blend basic science and clinical work: “When you begin to connect basic science information to clinical outcomes it makes more sense in the learning process.”

Visitors to the Davis Global Center are sure to be awestruck by the high-tech equipment, but Pamela Boyers, Ph.D., associate vice chancellor for iEXCEL, reminds us that the technology is simply a tool to enhance health care education. “Disruptive technologies are key to helping transform the way health professionals are prepared for their current and future patient care responsibilities,” she said.

Inside the Davis Global Center, one such example will be the “first-in-the-world” five-sided, laser-based, immersive environment. “The iEXCEL Laser CAVE-5 will allow learners to fly through the human body to learn how the heart or lungs look from the inside out,” she said. “It also is possible to fully immerse learners in different health care environments, such as an operating room, or even provide care in a virtual village in a third world country. The ability to incorporate unique smells that represent different health care settings also will increase the immersive experience for the learners, making scenarios as close to realistic as possible.”



The iEXCEL Holographic Theater will bring holographic professors, subject matter experts and subject-related images to life – and mark another “first” in an academic setting, Dr. Boyers said. “In addition, telepresence allows a live person from across the globe to present and interact with our learners and other audiences. Both opportunities provide the impression of the real presenter actually being in our theater.”

Collectively, these tools will augment student learning and improve human performance, she said. “Clinical simulation technologies allow the opportunity to ‘practice until perfect’ and show great promise for enhancing health care education – as well as offering new and cutting-edge research opportunities.”

Sachin Kedar, M.D., sees patients with abnormal pupils, the dark apertures in the iris of the eye, which allows light to strike the retina. This includes physiologic anisocoria, a benign condition, and Horner’s syndrome – an uncommon, but potentially life-threatening condition. Now, student trainees and residents can practice eye exams and become familiar with the common and uncommon conditions of the pupil, using a new virtual reality application – the EyeSim Advanced Pupil Simulator (APS).

In the past, trainees would rely on textbook images, videos or happenstance to master testing and identifying such ophthalmologic dysfunctions. “Now, they can do testing on the computer simulator as many times as they want, as long as they want, and the patient won’t complain,” Dr. Kedar said. Pupil examination is a basic skill that is practiced by all health care providers- physicians, nurse practitioners, nursing and allied health professionals, such as optometry and EMT. The results of pupil examination depend on the use of correct technique.

An associate professor in the UNMC Department of Neurological Sciences and director of the neurology residency program, Dr. Kedar developed the EyeSim APS – now licensed with EON Reality Inc. and on the market - with

Deepta Ghate, M.D., assistant professor, UNMC Department of Ophthalmology and Visual Sciences; A Nu Reality; and UNeMed, the technology transfer and commercialization office for UNMC and UNO.

EyeSim APS simulates how medication and lighting levels affect dysfunctions involving the pupil of the eye. Trainees can add eye drops to the pupil simulation and improve the specificity of their diagnosis and identify serious conditions.

Dr. Kedar has seen the benefits of virtual reality amongst trainees: enhanced understanding of the concepts, increased retention of knowledge, improved confidence prior to seeing actual patients.

“I never had access to such technology in training,” he said. “The first time I encountered a patient was a frightful experience. Now, students and residents come to clinic and are comfortable doing the examination and know all the steps without being afraid.”

UNMC student Charlotte Starling values hands-on learning, whether it’s in the gross anatomy lab or collaborating on the iWALL. Each, she says, benefits visual learners, such as herself.

The Los Angeles native, who is pursuing a master’s in medical anatomy in the Graduate College at UNMC, said it’s invaluable to “experience what we might experience in the real world before we actually do.”

And, for that reason, her stint as a volunteer emergency medical technician during her undergraduate years at Loyola Marymount University was an ideal precursor to the master’s program. “As a participant, you get that preview aspect, which shadowing can’t provide when you’re simply an observer. The experience validated my desire to pursue medicine.”

AR/VR tools, she said, will “give us the opportunity to preview something before we go and do it.”

It’s what science fiction has done for years.