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May 2025 Edition

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UNMC℠ | iEXCEL

Improving Human Performance & Effectiveness in Health Professions Education

iEXCEL in the Davis Global Center
University of Nebraska Medical Center, Omaha, NE

AR/VR HEALTH CARE CONTENT CREATION

- World-class creation team
- Precision, accuracy & realism
- 3D assets & modules for all platforms

REMOTE & DISTRIBUTED LEARNING

- Statewide & global connectivity
- Real-time collaboration
- Rural & remote outreach

CUTTING-EDGE SIMULATION TECHNOLOGIES

- Augmented & Virtual Reality (AR/VR)
- 3D & holographic imaging
- Interactive digital walls

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Advancing the Adoption of Technology in Health Professions Education: An iEXCEL Emerging Technologies Lab

Introduction

The iEXCEL vision, Improving Human Performance and Effectiveness in Health Care, requires a robust and resilient system that can measure the impact of interprofessional, experiential and immersive education upon training and patient care. Achieving this vision requires an intelligent infrastructure that captures, analyzes and reports the ROI for iEXCEL and the Davis Global Center. Remaining on the forefront of health professions education requires consistent evaluation of relevant emerging technologies, as well as ensuring up-to-date skillsets and technological expertise. The focus for the iEXCEL Emerging Technologies Lab is upon continuous innovation in Extended Reality (XR), visualization, data mining and capture, hardware, and software and processes that improve the outcomes of training. To be considered for adoption, emerging tools and software must be tested in a secure environment and assessed by the potential users for reliability, ease of use and relevance. The stakeholders are the iEXCEL simulation staff, University of Nebraska Medical Center (UNMC) faculty and students and Nebraska Medicine clinicians, with the primary stakeholders being the recipients of the medical care provided.

Learner using head-mounted display (HMD) to explore skull anatomy through XR

An Emerging Technologies Lab

"*Living on the forefront of technology innovation in health professions education takes purposeful strategy combined with a growth mind set.*" – *Pamela J. Boyers, PhD, 2025*

An iEXCEL Lab for Emerging Technologies

As iEXCEL at the University of Nebraska Medical Center moves into the 6th year of operations in the Davis Global Center in Omaha, Nebraska, this advanced interprofessional, experiential simulation training center is undergoing a thorough internal review of where it stands in meeting vision and missions. While the initial vision of Improving Human Performance and Effectiveness in Health Care remains unchanged, this assessment is resulting in redefined goals that will determine a 2025–2030 road map for iEXCEL. With advanced health professions simulation training that includes the adoption of XR and holographic technologies, there is also a strong effort to ensure that 3D imagery and data can be securely transmitted across this 500-mile-wide state in real time. This means being able to provide statewide training sites, emergency medical responders, critical access hospitals and rural clinics, as well as those who receive their care, with up-to-date knowledge and training on an as-needed basis. Being able to offer tele-simulation, tele-mentoring and tele-care by clinical subject matter experts can greatly reduce the need to transfer patients to tertiary care hospitals, as well as save lives.

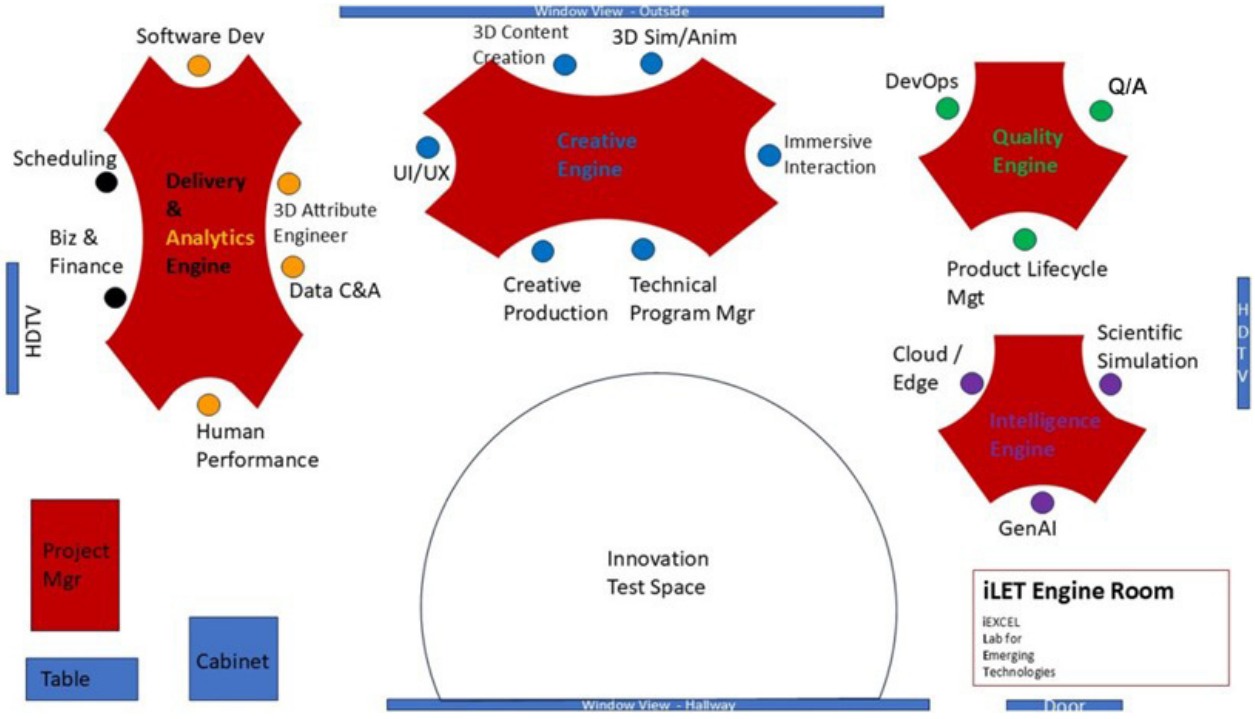
These goals require the creation of an iEXCEL Emerging Technologies Lab that functions as the “engine” of the iEXCEL “ship!” The overarching goal is to identify and evaluate emerging technologies that foster efficiencies and effectiveness in health care by continuously monitoring advancements in XR, AI, spatial computing, holographic displays, user interaction techniques (NLP, haptics) local/remote collaboration tools, cloud and edge computing and networking technologies. Feasibility studies will be conducted to determine the potential application of these technologies within iEXCEL to improve the outcomes of training and patient care.

iEXCEL Emerging Technologies Lab Goals:

- **Leverage Generative AI for Automation & 3D Content Creation – Utilize AI-driven tools to accelerate content creation for medical simulations, including automated 3D model generation, text to image rendering and AI-powered content creation.**
- **Prototype and Test New Solutions – Rapidly develop and test proof of concept applications to assess usability and effectiveness and partner with researchers, industry leaders and internal teams to pilot innovative solutions.**
- **Enhance Data-Driven Decision Making – Advance the iEXCEL Data Capture System and implement analytic tools to capture data from the usage of content on different platforms including web, holographic, VR headsets, iWalls, CAD Walls and CAVE, and generate reports.**
- **Create Intelligent Digital Twins – Develop scientific digital twins based on a platform where outcomes are both data-driven and experiential and provide real-time interaction with data from multiple sources (MIoT, metadata and geometric data). Embed GenAI in the digital twin to predict and analyze both operation and function, with bidirectional interaction between physical and digital data in a collaborative environment.**

Emerging Technologies Lab Operations

Housed in the Davis Global Center in Omaha, NE, the lab functions as the “engine” room for iEXCEL by supporting current operations and ensuring future growth.



This space mirrors the immersive experiences in the Davis Global Center by using technology that simulates CAD Walls, HMDs and motion tracking, with clustered computers that simulate edge computing, real-time AI-based inference engines, and real-time ray/path tracing. Additionally, the Emerging Technoligies Lab creates an isolated environment in which to test hardware and software for the development of advanced simulation capabilities. Industry-first scientific accuracy, embedded intelligence and visual fidelity are important criteria for the selection process.

The Lab is comprised of distinct “specialty areas” which contain specialists in data analytics, scientific content creation / creative productions / AI / human performance and effectiveness in healthcare, interaction and immersive environments and embracing Network/Cloud architecture. The layout of the lab is comprised of distinct specialty areas, to be physically clustered in 4 “engines”:

Performance – Quality – Intelligence – Experience

- Performance Engine: Responsible for analyzing the performance of all experiences within iEXCEL, including post-experience follow-up to assess outcomes
- Quality Engine: Collaboration of team for software quality assurance and to streamline delivery through regular, reliable updates and peer review of products
- Intelligence Engine: Ensure application and integration of artificial intelligence at all levels of data used within/for iEXCEL applications
- Experience Engine: Creation of immersive experiences for iEXCEL technologies, containing accurate and compelling scientific simulations and intuitive interaction techniques

These Engines mobilize: iEXCEL NOW – Data capture and analytics program; Gen AI, immersive interactions and cloud edge computing; Testing station continuous improvement and continuous development (CI/CD); Content creation for scientific simulations (ranging through all modalities) including: Human Performance and Effectiveness Outcomes Research; Business integration (including scheduling) and web development (internal/external).

Emerging Technologies Lab Processes

Formal processes for evaluating emerging tools will streamline efforts, as well as help advance the iEXCEL vision: Improving Human Performance and Effectiveness in Health Care. New applications in medical simulation which employ many types of artificial intelligence, scientific mathematically defined visualization data, enhanced rendering techniques, leading immersive XR interaction techniques, cloud and edge and more must be developed. Confirming the capabilities tested, if deployed, will promote iEXCEL's mission and vision:

- Allow the "art of the possible" to freely ideate and create
- Focus on key problems and/or challenges related to medical training, education and research
- Amplify the current immersive hardware capabilities in iEXCEL through software innovations
- Ensure technology selection serves UNMC community and is aligned for the intended users; identify key partners and collaborators
- Data capture and intelligence will be considered an essential output of any technology system developed to measure human performance and effectiveness in the simulation environments, and measure the long-term effectiveness in outcomes
- Focus on next-generation content creation pipeline and build capabilities into a new iEXCEL intelligent immersive platform based on a holistic digital twin
- Identify a distribution model that protects iEXCEL IP
- Create a model for revenue generation that fosters our growth and reputation
- Maintain and obtain world-class talent in essential, plus emerging technologies for continuous advancement in immersive simulation
- Democratize access to immersive reality, making it accessible and available statewide
- Use immersive reality with CAVE for groups and head-mounted displays for knowledge and skill-based assessment in continuing education settings across the full spectrum of health professions
- Provide remote and distributed "just-in-time" training for tele-simulation, tele-proctoring and telemedicine.

Expected Outcomes and Impact

The intent of establishing the iEXCEL Emerging Technologies Lab is to ensure iEXCEL can impact the outcomes of care through the adoption of interprofessional, experiential learning using advanced simulation technologies. Can the development and application of emerging immersive and holographic technologies improve training, offer remote and distributed training, and ensure the delivery of safer patient care? Demonstrating this outcome will require an "intelligent" data capture system capable of assessing multiple aspects of human performance, including stress levels and skills proficiency, while considering confounding variables such as the effect of fatigue and illness on performance. In addition, democratizing access to simulation through distributed capabilities is of vital importance to those providing care in rural and remote settings. Using Extended Reality as a trusted method for knowledge and skill-based assessment in continuing education across the entire spectrum of health professions will greatly assist in closing the gap between urban and rural training care sites. Providing remote and distributed "just-in-time" training for tele-simulation, tele-proctoring and telemedicine statewide and across the nation remains an unrealized vision. However, the overarching goal is to ensure UNMC continues to lead in adopting emerging technologies, including creating intelligent, scientific twins of human organs and medical equipment, through XR and holographic content development as well as the technologies required to disseminate vital information in real time across distance.

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Special Acknowledgements:
Laurel Ybarra, Graphic/Digital Design Specialist, iEXCEL, University of Nebraska Medical Center
Elizabeth Baron, Senior Advisor, Intelligent Immersive Simulation