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Tech Trends in STEM Learning Environments

THE IMPACT OF VISUALIZATION TECHNOLOGY ON TEACHING LAB SPACE, LAYOUTS, AND HVAC REQUIREMENTS

It's clear that STEM (science, technology, engineering, and math) learning is crucial for developing critical thinking skills for learners of all ages. STEM areas are foundational to a student's ultimate success in today's technology dense world. To help college, universities and high schools reimagine, cut costs, and optimize their STEM teaching environments, our lab planning teams are employing creative right-sizing strategies that incorporate the latest technology, including cadaver visualization systems and other imaging technology to bring STEM spaces into the lean, virtual future.

In STEM, health, and medical/dental/veterinary student learning facilities, technology is an integral part of a well-conceived and designed learning environment. The space must support multiple learning modalities, using a variety of technological solutions. Systems that interface with displayed images and allow both the learning and educator to manipulate those images is a field of developing technology that can be leveraged to increase the learner's cognition and relieve pressure of stretched academic budgets.

In most learner-centered health and STEM environments, there is a significant amount of simulation-based learning and (as a next step) animal dissection, proceeding to human cadavers for both anatomical knowledge and procedure/technique education. Emerging technologies (like an Anatomage table—an operating-bed sized table that provides highly accurate, 3D visualizations of human and animal anatomy) allow for an immersive, interactive experience and reduce (not eliminate) the need for cadavers. This can significantly reduce space needs as well HVAC/piping requirements.

In K-12, these technologies may completely replace cadaver use, and in higher education, they may replace a significant portion of cadaver use.

> "By leveraging new **technological and VR solutions,** designers can make reductions or reallocations in space, equipment, and budgets."

In a recent project at Michigan Technological University (MTU), HED's lab planning design team was tasked with developing an innovative learning space for an undergraduate anatomy and physiology (A&P) class. The class is envisioned as an entry to A&P and is situated in the university's new H-STEM Complex, providing students a foundational class and the experience of seeing science on display in the chemistry, kinesiology, and biomedical research ongoing in the building and the existing attached Chem Sci facility.

For learners, this room provides several strategies to create a dynamic and productive learning environment, including clear sightlines. The oval air stations pull odors away from the work area, keeping the room more pleasant and views clear and unobstructed for all. The oval table promotes student team collaboration and eases movement through the lab space. During the design process, the use of a new interactive learning tool, two Anatomage tables, was also added to the environment. These tables allow students to view animal and human specimens in a variety of ways; in sliced sectional views, by system (circulatory, endocrine, or digestive, as examples). The information is displayed on a large touch-sensitive flat monitor (which can be positioned in a variety of ways for better viewing). The display can also be mirrored at a large classroom monitor for lecture-style learning.

University of Illinois Urbana-Champaign Chemistry Building
Labs implement oval air stations to keep line of sight clear in the instructional lab.

HED

Michigan Technological University Anatomy & Physiology Learning Lab
This room is placed at the nexus of several paths of travel, taking students on a daily tour of research and science on display in the building. The room is designed to be an open, collaborative environment.

At the MTU learning lab, the tables are placed at the glass corridor wall of the room, placing the science on display. Learning labs in higher education require differing levels of HVAC control, safety considerations, and interactive/AV/IT support. In schools of medicine, and in anatomy and physiology general studies, a cadaver lab is de-rigor for understanding internal human systems; further, in schools of medicine/nursing, the cadaver experience is vital to the educational process. Experience in making an incision, seeing internal structure, and systems relationships is foundational to the learning process.

At the new Exploration Building on Santa Monica High School's campus, a mobile, collaborative environment was also implemented. The building section clearly shows the open and collaboration focused nature of the building. The multifunctional A&P class lab is on the third floor, with allied learning spaces located adjacent. Designed by HED and Moore Ruble Yudell Architects & Planners, the approach for the labs within Exploration was to create a flexible learning environment, allowing faculty to move between various learning modalities, as needed. There is little anticipated preserved specimen use, so exhaust measures at the student work surfaces were not needed. The central tables can be reconfigured, supporting teams of students ranging from four to six people. The class labs are all linked though large overhead doors that create an open collaborative space.

The Anatomage mini lab is visible from both the main lab, and the collaboration commons. This puts science on display, creating an energized space where students can see anatomical systems other students are learning about, and the full lab beyond.

HED's teams work with clients to reduce footprint required for cadaver use in a variety of learning environments. By leveraging technological and VR solutions, reductions of space allocation to cadaver storage, prep areas and learning space footprint are possible. **This represents an important evolution in the learning environment and frees up education dollars that might have been spent on space, and/or equipment (cooling, air handling, plumbing, storage, circulation), disposal, and more. An additional benefit is that this environment also supports remote learning.** There is a use for this technology in clinical environments as well. In developing environments that allow better experience and deeper communication, HED advances clinical environments by envisioning these tools to allow clinicians to share images remotely or in person for patient consultations, in surgical prep, and clinical analysis.

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