



Teamwork: We work together in support of our mission. Our individual contributions are amplified by the synergistic effect of cooperative effort focused towards a common purpose. We value the individual as an integral member of the team. We treat each other with respect and dignity.

Part of the Values at Work Series

From the Class Room to the Mechanical Room: How Architectural Engineering Students Benefit from a Partnership Between the University’s Faculty and Facilities Engineers

Learning Comes to Life

When it comes to teaching architectural engineering students how to design and understand the large and highly technical building systems in institutions, professors often look for opportunities for their students to see the systems where they come “alive” in order to better comprehend how they work. A facility must function well to serve its purpose to its occupants. Like a breathing organism, the electrical, mechanical and heating, ventilation and air conditioning (HVAC) systems pulsing throughout the facility must remain operational. If the systems go down, the facility cannot support its purpose. One of the best ways to help teach this is the definitive “show and tell” where the class room is replaced with the mechanical room.



*Associate Professor Ying Xu
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This is the story of how a professor at The University of Texas at Austin helped make abstract concepts concrete in a partnership with the facilities professionals responsible for the university’s building operations. Twice a semester, she takes her students to a tour of two buildings: one that is newer and one that is older in order to compare and contrast the facilities in operation. How does our story begin? How do the tours impact the students?

Origins

Associate Professor Ying Xu from the Department of [Civil, Architectural and Environmental Engineering \(CAEE\)](#) came to UT Austin in 2009. Her responsibilities include teaching a fundamental course required for CAEE students: Building

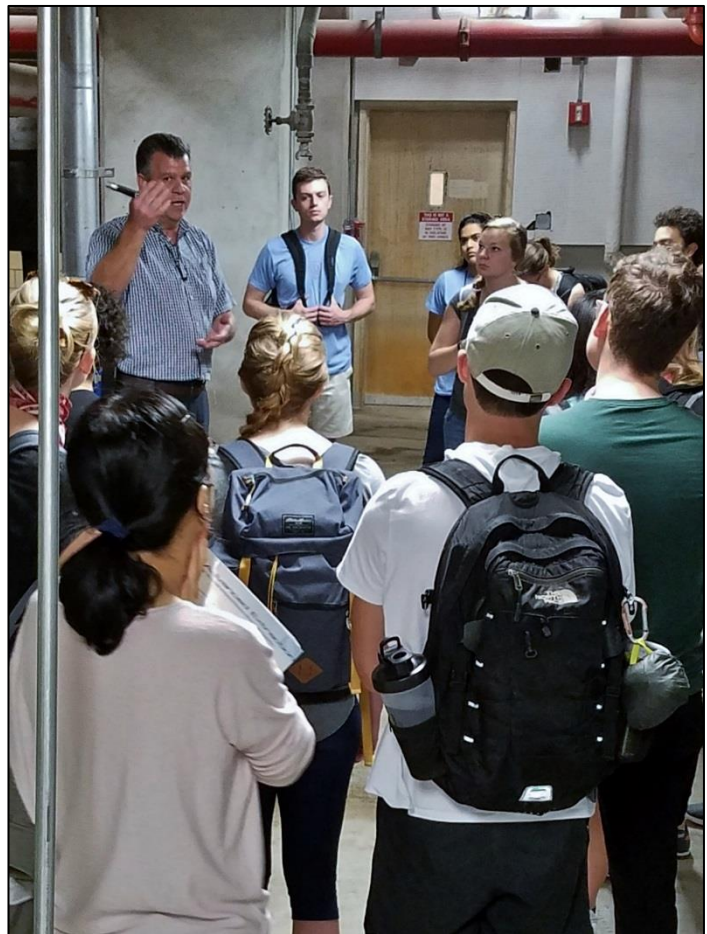
Environmental Systems. The course provides architectural engineering students with the basic principles and knowledge they need for their future profession.

Professor Xu starts the semester discussing some of the concepts integral to architecture and engineering theory. Describing the associated building systems in the classroom is augmented with images and videos, but the scale of the systems and their actual operations are hard to grasp without experiencing their functioning within the buildings, as Professor Xu explains. That is why she, as did her predecessors, sought out a facilities-based tour to complement the curriculum.

Forging a Partnership

Initially, the building tour for the semester took place within the Ernest Cockrell Jr. Hall (ECJ), part of The Cockrell School of Engineering. As the curriculum developed, Xu sought out support from Facilities Services to facilitate tours at two research buildings on campus to better demonstrate the differences that decades can make in the way the two building systems are configured and operate. For example, building codes evolve over time so the design and layout of the building systems change—something which trained and experienced facilities managers know all too well.

Support for the student tours came readily at the capable hands of Randy Hooper, manager of the [Engineering & Technical Support \(ETS\)](#) group within Facilities Services. For their part, the group was more than happy to form an academic alliance with Professor Xu. Now in its fifth year, ETS views the partnership as an important opportunity to work in concert with the university's faculty. Twice per semester, for a total of four tours a year, the alliance has strengthened the connection between academics and operations on campus. As Brian Stokes, mechanical engineer, sees it, "How often do staff engineers



Randy Hooper, manager of Facilities Services' Engineering & Technical Support group, shares his facilities operations experience with CAEE students in a behind-the-scenes tour on the UT Austin campus.

get to participate in the university's educational mission and interact with the students in this way?" The ETS group believes the tours help students see building systems from an operational perspective, what Stokes referred to as "the building's heart and lungs."

A Tour of Two Buildings, Part 1: Newer Building

Early in the semester, Professor Xu discusses concepts such as understanding moist air properties, calculating building heating and cooling load, the function of air handler units (AHUs), and how air and water are distributed throughout the building via the HVAC systems. To demonstrate how this applies to an industrial-sized research facility in operation, the students are guided through the Neural and Molecular Science Building (NMS), which was completed in 2005.



Brian Stokes, mechanical engineer with Facilities Services, discusses building systems with CAEE students during a tour of the Neural and Molecular Science Building (NMS). The tour helps student see the systems they learn about in class.

This first tour leaves many of the budding designers amazed at the sheer size of the AHUs required to meet the operational needs of the building. As they explore the inner workings of the facility, the students are able to reach out and touch the massive units as they "breathe". Outside air is conditioned and delivered into the space, while expelled air and harmful chemicals are ventilated out of the space. Again and again, in a careful rhythm.

“The NMS tour includes a discussion around the building codes for the major building systems—electrical, mechanical and fire—as required for labs,” explains Hooper. The ETS team guides the group behind the scenes of the facility to point out all the essential components and how they work together to accomplish their intended purpose. And that is one of the major points expressed to the students: Building operations *are* intentional. They are calculated, and the result of applying applicable engineering principles and building codes in real life for the intended purpose of the spaces involved. As the NMS tour evolves, the students begin to see how theories become proofs in the hands of the university’s facilities staff.

“My students can ask the engineering staff operational questions while we tour the facility. It gives them an idea of what systems are like; they can visualize all they’ve been taught,” shares Professor Xu, who reinforces her lessons throughout the tour.

Darnell Mack, an electrical engineer with ETS, has been serving as the liaison between faculty and facilities for the length of the partnership. “It’s great to provide an opportunity for our students to get ‘hands-on’ experience with the system components to better equip them with the knowledge they need in their field,” she says. Mack and her team cover multiple touch points during the one-hour tour, including heat wheels, energy conservation measures, control theories, and the role of building automation systems. She and her ETS colleagues look forward to seeing the future designers again for the second tour.



Randy Hooper shows CAEE students the inner workings of the building systems at Robert Lee Moore Hall (RLM).

A Tour of Two Buildings, Part 2: Older Building

Later in the semester, Professor Xu focuses on electrical systems and talks about conductors, feeders, transformers, and panels. Students incorporate important concepts, such as how transformers function to lower voltage to a safer level, how electricity comes into the building, redundancy, maintenance access, and how building codes affect the design. This part of the semester is also when the second tour takes place.

In contrast to the initial field trip at NMS, the second tour was developed to demonstrate building systems within an older research facility, Robert Lee Moore

Hall (RLM), which was completed in 1972. “We want to give the students a sense of the life cycle of a building,” explains Hooper. “How do you ‘own’ a building for 40 to 50 years?” In fact, as Hooper states, “The operational costs far exceed the original construction costs.” This is a fundamental concept that facilities managers must take into consideration, and a valuable lesson Hooper hopes the students remember when they begin to design new buildings for the “real world”. For example, a freight elevator with access to the roof might be “value-engineered” out of the design to reduce initial construction costs. While up-front savings might sound good at first, it doesn’t account for the owner’s costs down the road. How would facilities staff maintain and replace an AHU without elevator roof access? The designer must be aware of the impact and future costs of this decision for the 40- to 50-year life of the building and maintenance or replacement of the rooftop AHUs.

Speaking of rooftops, the RLM tour takes the students to the roof of RLM to see the exhaust system, the lightning protection system, and the type of roof. The basement is also part of the tour. Wherever they go, Hooper and the ETS team take the opportunity to point out the evolution of building codes and how that has affected the building systems—another important take-away, according to Hooper.

Student Impact

When asked about how the tours benefit her class, Professor Xu is quick to say that her students “have more motivation in the classroom” than prior to the field trip. “I see how it helps them to build a career in this direction.” Perhaps this is a case where seeing is believing.

Professor Xu states that most of her students are very interested in what they get to see firsthand, and they learn a lot during the field trips. They appreciate the opportunity to gain knowledge by talking with the technical staff. She tells the story of one student whose excitement and interest stood out. She recalls that he was “very curious and enthusiastic about the tour, asking many questions.” She believes the tour, coupled with his high level of interest, helped him receive a scholarship from the American Society of Heating, Refrigerating and Air-Conditioning Engineers.

The University of Texas at Austin’s [values](#) of learning and discovery are alive and well in this partnership between Professor Xu and Facilities Services. Putting students first means helping them



CAEE students get up-close view of UT Austin building systems in operation during facilities tours to support what they learn in class.

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to learn wherever on campus they can gain the most—whether it's in the class room, or in this case, in the mechanical room.

For more information about this ongoing partnership, contact Associate Professor Ying Xu from the [Department of Civil, Architectural and Environmental Engineering](#) at xuying@mail.utexas.edu or contact Facilities Services' Randy Hooper, manager of [Engineering and Technical Support](#), at randall.hooper@austin.utexas.edu.