



Engineering is Global at the University of Mount Union

by Cynthia Mwenja, PhD

Hans Tritico, Assistant Professor of Civil Engineering at the University of Mount Union, is a water resources engineer who studies the impacts of dams and fish passages to guide regulatory decisions regarding these structures. He also teaches the innovative Global Engineering class at Mount Union, in which students design and build a project in another country using civil engineering approaches informed by active orientation to the country's culture and language.

Mount Union established its engineering program twelve years ago, with a vision for developing students who could offer unique strengths to the field. The five engineering degree programs continue to rest on the four pillars used for the school's development, each working in concert with the others to contribute complementary assets to this distinctive curriculum. One pillar, "Building Effective Leaders and Communicators," relies on the school's core curriculum of a broad-based liberal arts education. Mount Union Civil Engineering 2016 graduate Taylor Cline—now a Lead Project Engineer at CESO—says that she did not appreciate this aspect of the course of study until much later. At the time, she says, she thought, "This is dumb; I don't need these classes," but now she is thankful for required to take courses in a variety of disciplines. She says that she often consciously draws on the liberal arts values expressed in Mount Union's mission of preparing students for "fulfilling lives, meaningful work, and responsible citizenship."

Another of the engineering program's pillars, "Integrating Engineering Knowledge with Essential Business Skills," is expressed in two ways. First, the School of Engineering

shares a building with the School of Business, so interactions with that program are facilitated by proximity. Additionally, two classes integrate engineering and business content: first-year engineering and a product design course. These classes give Mount Union engineering students a broader base of preparation than just applied sciences. The next pillar, "Providing Extensive Hands-on, Real World Engineering," requires that all classes in the school include a lab or design project. Lastly, the pillar of "Requiring International Engineering Field Experience" relates to Mount Union's existing strong study abroad program, and the Global Engineering class is a required part of the course of study for every engineering student.

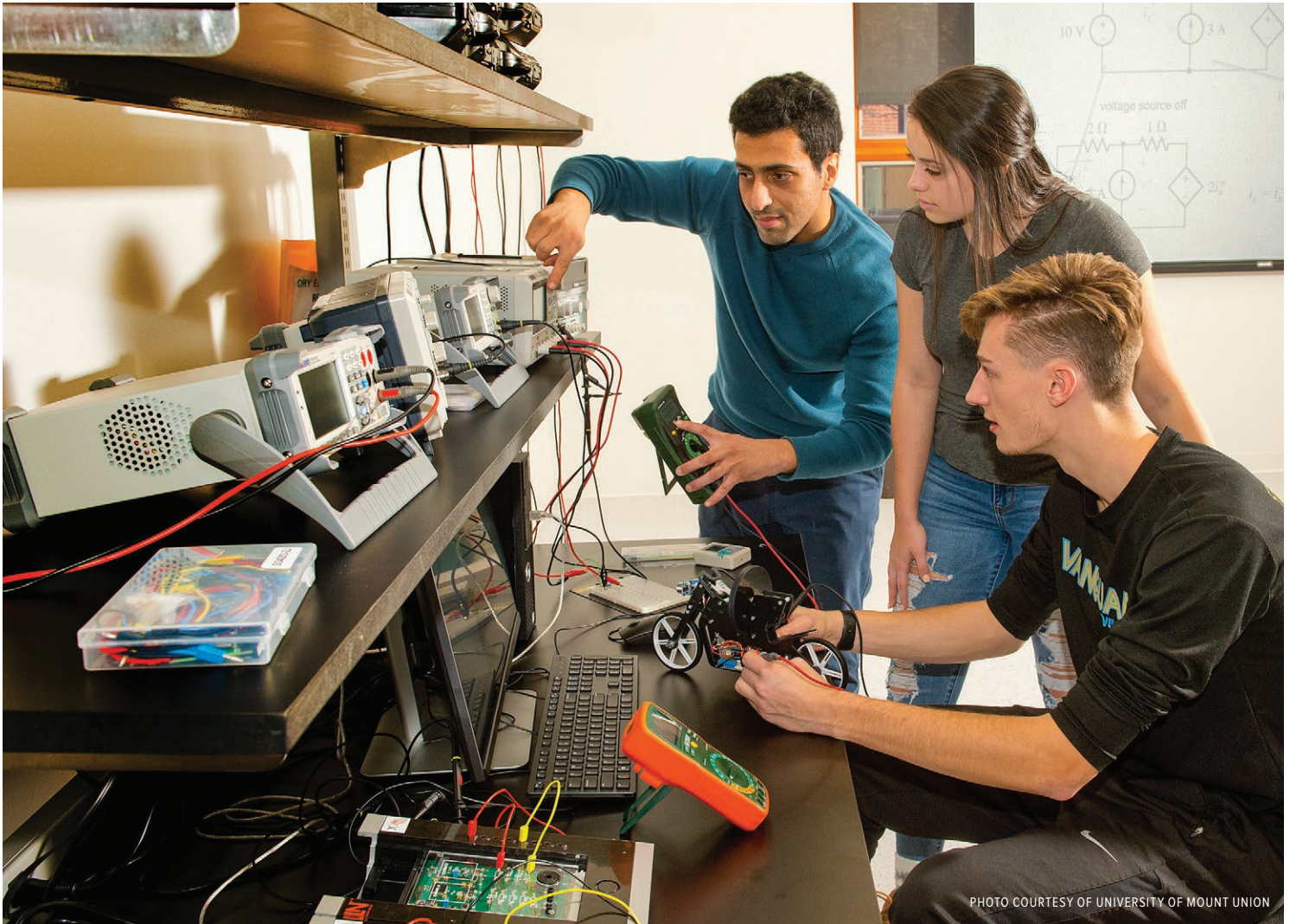
Global Engineering Class

Tritico has taught Mount Union's Global Engineering Class for five years; a co-teacher has joined him for the past three. Lecture topics in the class include subjects such as global ethics, international trade, cultural attitudes, and attention to the availability of materials and design components in specific locations. Tritico says that the course continues to be refined year after year, but the

current iteration includes one class day each week focused on lecture and hands-on work, while another class day centers on studying the culture and language of the country the class will visit that term. Tritico says that he certainly never envisioned teaching language and culture as an engineering professor, but the subject matter is exciting and different. He adds that this aspect of the class demonstrates a practical reality of the professional field: engineers who get contracts or jobs in different countries must learn local communication skills and cultural norms in order to effectively complete their work. Students earn three credit hours for the on-campus portion of the class; an additional credit hour is earned for the international part of the course. While previous classes have gone to Belize, students in this year's class will go to either Brazil or Nigeria, and the school has future plans for a group to go to Abu Dhabi in the United Arab Emirates.

Class Projects

The required Global Engineering class, with its international travel component, centers on a design/ build project. This class is generally taken in the junior year, and until the Covid



pandemic began, every graduate had worked internationally, due to this class. The Spring 2020 class had to cancel its planned trip; they pivoted to an international speaker series in which alums and other engineers shared experiences of working across five continents. The program again had to make contingency plans for Spring 2021. Instead of students traveling to Brazil, representatives from the Juara Foundation joined students at a camp not far from campus for twenty-four days. After the students built the prototype, the Juara Foundation representatives learned how to build the structure, then went to Brazil and tried to build a replica.

This spring's class has been approved for travel. Tritico will take two groups on separate ten-day trips to work with Juara in Brazil, while another professor will take a group to Nigeria to complete a similar project. This year's Global Engineering students have built on the work of the Spring

2021 group to further improve the design of a self-contained solar-powered remote-sensing station. Tritico describes the building as a "picnic structure with a roof and a box for the electronics." The current class is now trying to design a more mobile structure that can be loaded in a pickup truck for easier transport along the rough rural roads.

The design includes a weather station, microphones to identify animals, and a seismograph, so it draws on multiple types of engineering specialties. The station also connects with the internet over a distance of about a mile—and across a lake. This connection allows the collected data to easily be made available online, where it will be stored in a password-accessible website. Because the station is designed to perform many tasks simultaneously, this year's students are trying to decrease the size of the structure to minimize power usage, as well.

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Juara Foundation

Established in 2014, the Juara Foundation is a non-profit based in the Pantanal—the world’s largest wetlands—which connects Brazilian citizens with international scientists. Juara’s Board President, Ethan Shirley, coordinates projects with several universities as part of his job responsibilities. Tritico did sabbatical work in the Brazilian city where Juara is based, and a mutual colleague introduced him to Shirley. Once Tritico heard about Juara’s projects, he became interested in developing a collaboration between Juara and Mount Union.

Shirley says that international engineering generally—and Juara’s work specifically—comes down to one word: “multi-disciplinarity.” Juara’s projects draw on expertise of engineers, scientists, biologists, and even musicians. The music program grew out of visit to a Brazilian orphanage that had a room full of unused musical instruments. Some people involved with Juara happened to be musicians, so they started a music program that has grown to serve over a hundred kids and has sparked the creation of other youth music programs, as well.

Shirley points to multiple connections between music and environmental science. Juara has had hydrologists who work with the sound of water flow, and other scientists who have taught the student musicians about the science of sound.



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Additionally, he points out that the best way to find animals in the wild is often through hearing them first. The remote-sensing station project that Tritico is overseeing relates to these ideas by recording bio-acoustics through time, at levels both within and below the human hearing range.

Shirley appreciates working with the Mount Union students because of the breadth of their preparation, both in the liberal arts and in the School of Engineering. Every real-world project needs a different skill set, he says, and those skills need to extend further than issues of design and re-design. Successful engineers need to be able to mockup their designs and consider the material and cultural contexts of the project. In these ways, Shirley says, “Multi-disciplinarity is crucial to being a successful engineer.”

Additionally, Shirley appreciates the attention Tritico gives to the cultural aspects of engineering. With increasing globalization, he points out, even local jobs become international by default—people may now be based in one country but work with colleagues all over the world. Engineers need to be ready to work productively with people from different cultures rather than trying to impose a singular set of cultural norms on others. These considerations extend to building designs and materials, too; effective choices in one location may not be practical in another. Since Mount Union’s students have the opportunity to learn these realities while still in school, they will be better prepared for their careers.

Intersections of Liberal Arts and Engineering

While the Global Engineering class was the biggest factor in Cline’s decision to attend Mount Union, she now realizes that she benefitted from many aspects of the liberal arts model, particularly the small class sizes and ability to really get to know her professors. Cline says that, as her advisor, Tritico was “always there, always helpful, and always cared about stuff outside of school.” Tritico talked with Cline many times to help her figure out which engineering specialization would be right for her. Her Global Engineering class project was an aquaponics design for a school in Belize; she took part in

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designing the storage tanks. She says that getting to travel and both design and build a project was fantastic experience that let her see all the aspects of the field—"how it actually works," as she says.

Crucially, she and her team learned one of their biggest lessons on the first day in the country: civil engineers must be flexible and able to re-think their designs on the fly. In this case, the team had to scratch the entire plan they had worked on all semester because the materials they needed were not available. They ended up cutting and shaping rain barrels that were locally available, and the new plan ended up being cheaper and more practical.

While Cline now specializes in traffic engineering—so her current professional work is quite different from the work she completed in Belize—she still draws on mindsets she learned from Tritico and the other Mount Union engineering professors. Cline appreciates the way Tritico challenges students to consider solutions from multiple angles and to think in ways that may be unconventional or uncomfortable. Cline

has also sought out other opportunities to travel internationally for engineering work; she traveled to Calcutta to participate in various aspects of designing a child development center, including cost estimation, site preparation, and designing the water and sanitary systems.

In the Global Engineering class, Tritico provides a rich, multi-faceted—and ultimately highly practical—experience that his students can draw on as they begin their own careers. While every engineering project is unique, each one relies on widely applicable skills of flexible thinking and considering cultural context when choosing materials and designs. With his thoughtful and ambitious course design, Tritico holds the space for his students to not just learn these skills intellectually but to embody them in working at Mount Union and beyond.

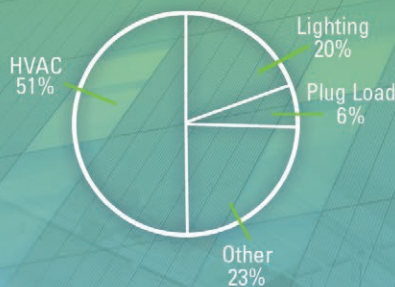


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