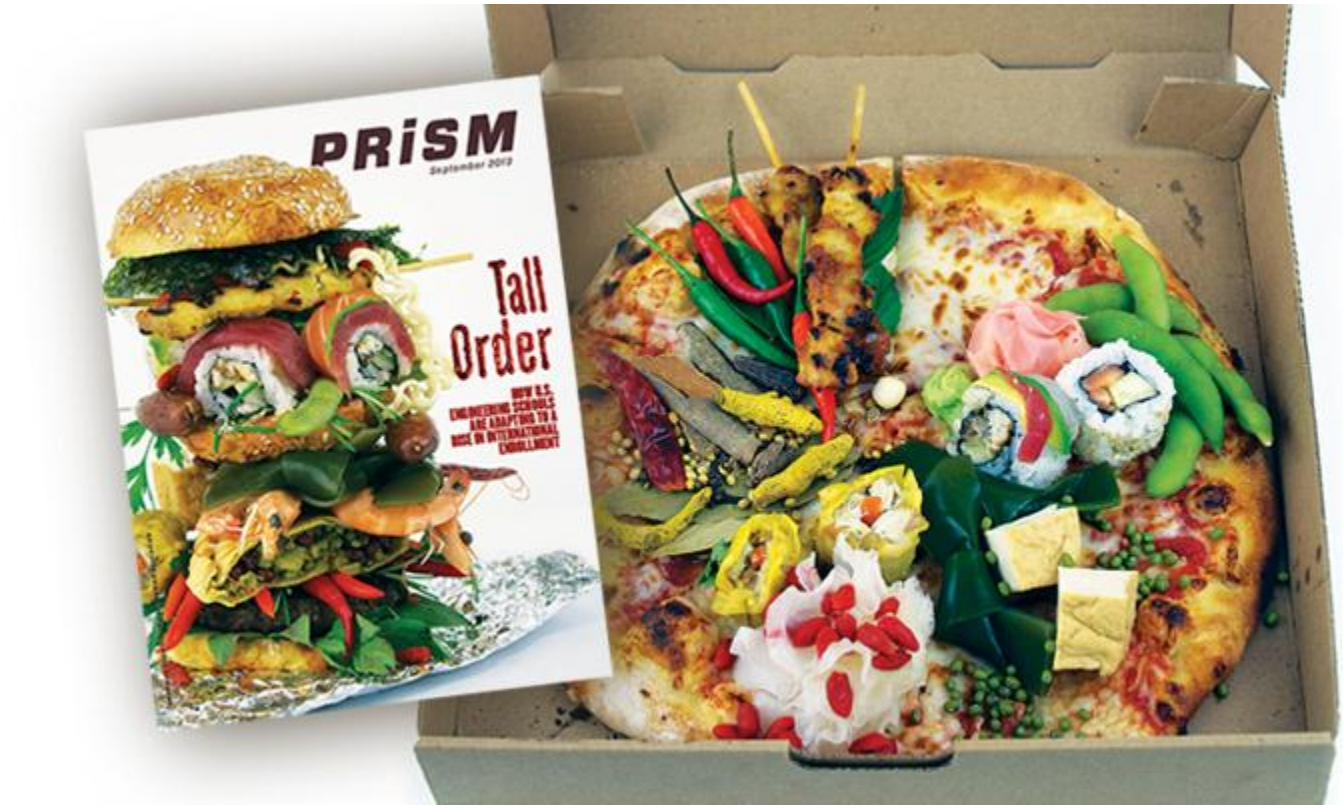
Delivering Diversity

SEPTEMBER 2013



From classroom to cafeteria, rising international enrollments are changing the culture at U.S. engineering schools.

Grilled Korean “kimcheese” sandwiches or burgers? Pizza topped with Thai chicken barbecue or pepperoni? For a sign of rising international enrollments at U.S. engineering schools, look no further than the dining hall options at New York’s Stony Brook University, a flagship state school on Long Island, where stir-fry and curries are as common as ketchup. With international outreach a critical component of the engineering school’s 10-year strategic plan, 13 percent of engineering undergraduates and 75 percent of engineering graduate students hail from abroad. “Research is global, and, more and more, education is global, too,” says Yacov Shamash, dean of the College of Engineering and Applied Sciences and Stony Brook’s vice president for economic development. So, he adds, is the market for engineers, and “having to

interact with [future] colleagues in China and India is a lot easier if you're interacting with student friends." And where better than a lunch table?

From fusion comfort food to interactive admissions sites in Chinese, change is sweeping engineering schools as they draw more international students and grapple with new educational, social, and administrative needs. At some colleges, student support services now feature visa and tax advising. Others, including the Universities of Michigan and Missouri, have launched buddy systems that pair domestic engineering undergraduates with new overseas arrivals. As faculty members discuss whether to make classrooms English-only zones, special orientation sessions underscore the importance of class participation, proper citations, and other potentially unfamiliar academic expectations.

Attracted – and often heavily recruited – by a higher education system that's still the world's gold standard, a record 764,495 foreign students attended U.S. colleges and universities in 2011-12, according to the latest Institute of International Education's Open Doors survey. Though a sliver of the nation's overall enrollment, that total represents a 5.7 percent jump over the previous year, with half the students coming from just three countries: China, India, and South Korea. Engineering, the second most popular field after business, accounted for a disproportionate 18.5 percent share of international enrollment, or 141,285 students. Engineering schools with large international cohorts, like the University of Illinois, can have sections where foreign students – including the graduate teaching assistant – are the majority and conversations might be in Chinese.

Foreign students' presence is most pronounced at the graduate level, training ground for future university faculty and engineering research and development. International students make up 70 percent of all master's and Ph.D. candidates in electrical engineering and more than half of those pursuing advanced degrees in chemical, industrial, materials, and mechanical engineering, according to a new report from the National Foundation for American Policy. Some 77 percent of the engineering Ph.D. graduates in Kansas, for instance, are foreign born. At the University of Bridgeport, international students make up more than 90 percent of the full-time graduate engineering enrollment.

Without international students and faculty, “not only would we not have schools or departments of engineering, we probably would not have national research centers,” says Tarek Sobh, the Egyptian-born dean at Bridgeport’s School of Engineering and vice president for graduate studies and research. Christopher Raphael, chair of computer science at Indiana University, explains in the National Foundation report how much of the research in his department is done by teams led by professors with experiments carried out by graduate students. “This model only works if we can get high-quality Ph.D. students,” he notes, “and we would be hard pressed to get the number we need solely from the United States.”

The importance of international graduate researchers to U.S. competitiveness and economic vitality is one of the drivers in the push for an overhaul of immigration laws. A 2011 report by the Partnership for a New American Economy, for example, determined that immigrants or their children founded 40 percent of all Fortune 500 companies, many of them high-tech giants. Economist Madeline Zavodny of Agnes Scott College calculates that every foreign student who earns an advanced degree and stays to work in a STEM field adds 2.62 jobs to the U.S. economy.

At the undergraduate level, as well, the number of international engineering students has grown – nearly 10 percent between 2009 and 2010, to 31,000 students, according to federal immigration figures. Overall, international undergraduates outnumber graduate students, Open Doors found, with Saudi Arabia displacing India as second highest after China. Purdue University, one of the nation’s top international hosts, has seen international engineering undergraduate enrollments soar from 12 to 17 percent in just a few years; today, a quarter of the freshman engineering class is foreign. Growth hasn’t been universal, however. The proportion of international engineering undergraduates at Stanford University, for example, has hovered around 7 percent for a decade.

The Bottom Line

Far from being huddled masses, most foreign students pay full freight, and roughly two-thirds of them use personal or family funds to do so, according to the latest Open Doors report, which estimates that international students and their families boosted the U.S.

economy by $22.7 billion in tuition, fees, and living expenses last year. Cash-strapped state schools can extract double or triple the tuition from nonresidents. Some engineering schools levy additional fees. The University of Illinois, Urbana-Champaign, which hosts more foreign students than any other public institution, has a $2,000 surcharge for its 1,523 international engineering undergraduates. The university charges all international students another $800.

International engineering students add diverse perspectives that can enrich the design experience. “They bring their culture to the type of problems that we might be thinking about,” says Khaled Elleithy, associate dean for graduate engineering programs and professor of computer science and engineering at the University of Bridgeport, who says he also is learning from the different approaches. For example, a student working on a fire-security project for a major petroleum producer in Saudi Arabia knew to relate it to the harsh conditions of desert oil exploration. A common problem in India may be uncommon in China. Just as with multidimensional teams that mix computer science programmers with electrical engineers, students in Bridgeport’s global classrooms learn that everyone has his or her own strengths. “You improve the quality of education for all,” says Elleithy. “The end result is fantastic.” Indeed, Bridgeport’s engineering students regularly sweep the poster competition hosted by ASEE’s Northeast Division each year.

Foreign undergraduates, who typically arrive with stronger math and science preparation than domestic students, also tend to persist and complete their degrees on time. Data collected from 97 schools for ASEE’s retention survey show international engineering students have much higher retention and graduation rates than their American counterparts. They continue to their second year in engineering at a rate 7 to 9 percent higher than U.S. first-year students. And their four-year graduation rate is 18 to 20 percent greater than for U.S. students, although that gap closes to between 6 and 8 percent for students who graduate within eight years.

Language and Social Adjustments

Yet international students present a variety of challenges, from language barriers to learning how to write a research paper or speak up in class. Consider Shahrum Iqbal’s

journey from Karachi, Pakistan, to Texas A&M and a degree in mechanical engineering this past spring. The son of an eye surgeon, he always wanted to be a pilot and stay back home, but “my mom kind of forced me to go abroad and study,” he explains. “After a whole year of persuasion, she finally won.” While engineering was “a natural choice because I have always had a knack to open things and fix them,” Iqbal opted for Texas A&M over a British university “completely at random.” He found the language and social adjustments a “huge challenge.” When the Corps of Cadets recruited him, he didn’t know what he was getting into – only that he would “get to wear a uniform and look cool.” Though physically demanding – he struggled with the push-ups regimen – the Corps proved his salvation. Seniors tutored him every night. Peers provided moral and emotional support, motivating him to persist and fostering strong bonds of friendship. “All I had to do,” he says, “was believe in myself and be willing to put my best foot forward.” Iqbal, who graduated in May, capped his academic career by winning the first Texas A&M Foundation Trustees’ Outstanding Student Award. He now works as an engineer for Bray International in Houston.

U.S. academic and social norms can be a jolt for international students. In Asia, for instance, questioning an esteemed professor might be considered impolite, not class participation. Plagiarism doesn’t carry the same taboo. The emphasis on projects surprised Lingshuang Wu, a Chinese computer science major who graduated from the University of Missouri’s College of Engineering in May, but she now calls them “the most rewarding part of engineering education here in America.” Why? Because talking with teammates and going online to figure out solutions taught her more about technology – and more English – than any class. For Jinsol Lee, a Purdue sophomore from Korea majoring in electrical engineering, the heavy first-year course load posed a universal challenge. “The amount of homework as well as studying we had to do every night was just… too much!” she recalls. As time went on, however, she figured out a better schedule to complete her work in a timely manner.

English often proves an initial barrier. “To be honest, I was afraid to talk to people at first, because I was not confident with my English,” recalls Bixing Yan, a Purdue mechanical engineering senior. He “forced” himself to talk to at least 10 people per day freshman year until becoming fluent. Now, as president of the Chinese Engineering

Student Council, he organizes rides to fetch new arrivals from the station, group dinners, and other assists.

Students struggle both with academic writing and with ethical expectations. Purdue opened extra sections of two required freshman English courses after a group of international students, having missed a section on plagiarism due to scheduling, earned zero points. “We want them to bring their culture and differences into the classroom, but it’s a fine line,” says Teri Reed, then Purdue’s assistant dean of undergraduate engineering education and now assistant vice chancellor of academic affairs for engineering at Texas A&M. The University of Bridgeport gets international students up to speed first semester by introducing them to six or more different research areas and requiring a report on each. In Computer Science and Electrical Engineering Professor Khaled Elleithy’s class, students must do an in-depth research paper about the topic, a presentation, and a demonstration of the final project, wrapping up with a paper that gets published in a conference proceeding or journal.

Food can be especially tricky. “I don’t like cheese – I couldn’t digest the food,” explains Missouri graduate Wu, who learned to cook for herself. In West Lafayette, Ind., Bixing Yan would spend two hours traveling by bus to Wal-Mart, which caters to Purdue’s burgeoning international student population by stocking several varieties of Asian rice and a wider selection of electric rice cookers. “We see international students facing two main challenges – academic integration and social integration,” says Marie-Christine Brunet, the engineering school’s assistant dean for undergraduate programs at the University of Illinois. Inevitably, this means that some of the extra revenue these students bring in must be spent on helping them – and not just in the classroom. While Illinois earned enough in added tuition to admit more in-state students, it hired two people last year to help international students. Investment takes other forms as well: The engineering college has held a series of events around time management, test anxiety, “healthy academic habits,” and even “The Art of American Small Talk.”

Improving outreach, engineering schools have developed mandatory orientations for international students that cover everything from navigating public transportation to class participation and cheating. Websites are foreign-friendly. The University of Bridgeport provides admissions information in nine languages. International applicants

to the University of Colorado, Boulder can consult a long list to see which countries' coursework and scores meet entrance requirements. Purdue's Facebook-style interactive website, a RenRen, or "people" in Mandarin, answers questions in Chinese.

Buddy to Buddy

Peer mentors play a powerful role in helping international students develop a sense of belonging. More buddies than academic tutors, these domestic students serve as guides to U.S. culture – from football games to Thanksgiving – and provide a relaxed way to practice English. That's a big assist, notes Jill Ford, executive director of student programs at the University of Missouri College of Engineering. She can't forget one Chinese undergraduate's brutally honest feedback on the school's new exchange program. "I don't know why I even came here," the student told her. "I go to class and go back home. I live with people from my country. I could have done that in China."

Lingshuang Wu, who came to Missouri from two years at Shandong University in Jinan, recalls: "At first, I was nervous to start a conversation in English. And engineering students are not very social, so they didn't talk to me." The peer mentoring program introduced her to American and Chinese friends as well as football. Wu went out after class with her peer mentor, a mechanical engineering student who became her best friend. "She introduced me to her friends, and the circle grew." Wu, who now is doing an internship at Microsoft, went on to serve as an officer in the computer science honor society Upsilon Pi Epsilon and volunteer as an engineering tutor.

Few engineering schools have as extensive a support system as Purdue. The university hired its first international engineering undergraduate student adviser a few years ago after a retention study revealed a puzzling decline between freshman and sophomore year. Four-year graduation rates, though still higher than for domestic undergraduates, also began to slip, from 70 percent in the mid-1990s to 40 percent in 2006. "We were all watching the level of international students go up without much change in programs," explains Reed, who documented the decline in a co-authored paper at ASEE's 2012 annual conference. "Everyone said, 'Oh, international students, they're always so successful.' And they are!" But they also are "far away from home . . . many, many countries away. This added level of transition is not taken into account."

Purdue has added 11 new positions to serve its 1,830 undergraduate and 1,474 graduate students from overseas. A virtual summer transition, advising, and registration course primes new international students for fall classes, as does a customized orientation. Two required introductory engineering courses were redesigned to develop students' ability to work in diverse teams, with two international students on every four-person project.

Teamwork

The introductory classes gave rising sophomore Jinsol Lee "the open mind-set to learn about different cultures to find the needs of people all around the world." Collaborative activities and active learning environments are "culturally difficult," explains Teri Reed. Having an equal voice may challenge societal roles for men and women, she notes. Tolerance for uncertainty or risk also varies from country to country.

Having classmates from overseas gives native-born Americans the chance to acquire a multicultural awareness many employers now seek. "How can we say we're effectively training our engineers if we didn't provide them with these opportunities?" asks Ford. "It's good for the U.S. students, and it's good for the international students. We view this as a win-win for everybody."

A number of schools are extending their international reach by forging partnerships with universities abroad. Stony Brook, which enjoys partnerships with 15 Korean universities, recently established a Korean research outpost of the engineering school's Center of Excellence in Wireless Information Technology. Last year, it opened the first U.S. university campus in South Korea. Stony Brook's engineering school has narrowed its Chinese recruiting efforts to 20 top-tier schools. At the University of Bridgeport, engineering faculty and administrators "travel all the time," giving workshops and working with the admissions office to recruit "the best and brightest," says dean Sobh. The school has formal relationships with tens if not hundreds of foreign institutions. Such partnerships may help protect U.S. universities from losing market share in the next phase in the globalization of higher ed: increased competition both from established universities abroad pursuing the lucrative international student market and universities in Asia, Canada, Europe, and the Persian Gulf that are gaining prestige.

Still, it’s an uncertain business. Sobh notes that international enrollment fluctuates with geopolitical upheaval, like the Arab Spring demonstrations or post-September 11 travel bans, and with natural disasters such as the tsunami in Japan. Research collaborations and scholarly exchanges can shrink with the economy. So can graduates’ employment prospects.

Regardless of whether these graduates leave or stay, universities have a chance to broaden their circle of loyal alumni – if they offer a good U.S. experience. “We put in a lot of time, effort, and money to ensure that students, when they come here, have a well-rounded experience,” says Missouri’s Ford. “When they leave us, they are our alumni like any other alumni. They carry that message of what it means to be Mizzou.” Anyone want fries with that sushi?

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