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## Putting the Coronavirus to Work: Developing a Global Engineering Program during a Pandemic

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### Cover Page Footnote

I would like to thank my colleague in Engineering, Todd Hamrick, for his enthusiasm and support of this joint project. Thank you also to Andrew Benedicktus for his insights regarding the needs of engineering students.

## ***PERSPECTIVE***

# **Putting COVID to Work: Developing a Global Engineering Program During a Pandemic**

Cynthia S. Chalupa, West Virginia University

## **Introduction**

After the COVID-19 pandemic led to campus shutdowns across the United States in the spring of 2020, tuition revenues and fiscal reserves of public and private institutions alike suffered a shocking impact (Kelchen, 2020). With the ongoing uncertainty of the pandemic and the continuous shifts it has caused in the business of the university, students and their families have called into question the lofty price tag of an on-campus experience. Conversations in both social and traditional media indicate public doubt regarding the ability of universities to deliver a high-quality educational experience given the effect of the pandemic on face-to-face instruction and the campus experience overall (McMurtrie, 2020). To counteract the immediate and long-term repercussions of the shutdowns, which have diminished student motivation, faculty morale, and university resources, higher-education administrators have emphasized the need to create programs that heighten the attractiveness of the university and on-campus experiences through their ingenuity and ability to prepare students directly for a future career. In the wake of the pandemic, Gordon Gee, president of West Virginia University, called on the university community to “differentiate and lead” (WVU, 2020) in an effort to reestablish the appeal of a four-year, on-campus education through program innovation. Other administrators have stressed the importance of academic offerings that “tap into a particular market niche,” and include “new degree programs” and “certificates” whose uniqueness may ultimately draw more students to campus (Aoun, 2020). These programs will prepare students for a wide variety of professional opportunities that are shaped by post-pandemic conceptions of the workplace and a projected increase in higher-wage positions on the global labor market.

Despite the dire situation the pandemic has created for universities across the country, the need to think outside of the box in order to attract and retain students has created an opportunity for developing innovative programs and cross-campus collaborations.

One such example is an interdisciplinary program in engineering and world languages. At a time when financial austerity measures and program elimination seem to be initial go-to solutions, a Global Engineering Program (GEP) can offer interdisciplinary and intercultural experiences to which students have access only by enrolling at the four-year institution that houses the program. As such, a GEP has the ability to attract students to study at a university they may not otherwise have considered. Additionally, if the program is designed to make the most of current resources, little additional financial investment is required in terms of faculty or infrastructure. Finally, a GEP can prepare students in engineering for a job market that now, more than ever before, calls for excellent communication and social and emotional skills.

This article highlights how the COVID-19 pandemic has created an environment that is favorable to the creation of a dual program in global engineering (encompassing a B.S. in engineering and a B.A. in world languages) based on the initial program-building steps taken at a large state university, West Virginia University (WVU), a public land-grant research university with its main campus in Morgantown, West Virginia. Beginning a GEP may be easier than prior to the pandemic based on the following three factors: 1) a variety of new technologies that promote communication across campus, with industry and trade offices, and with international partners; 2) the critical call for programmatic innovation to attract more students amidst falling enrollments; and 3) a newfound flexibility and vision regarding work descriptions and settings. In the following, I describe the fiscal impact of the pandemic and the manner in which a GEP can be helpful to both engineering and world language programs by internationalizing the curriculum, preparing students for the global workplace, and raising enrollments. Second, I describe both the strategies for and ongoing challenges of building such a program that I have experienced at our large, state institution. Finally, I highlight our first steps in establishing a GEP amidst ongoing financial stressors driven by the pandemic. While the evolution of our program will continue, the initial iteration of a dual degree program in engineering and world languages offers our future engineering graduates important job skills and instills in them core humanistic values of cultural understanding and intercultural competence that are key to co-existing in a global society.

## **GEPs: Benefits and Challenges**

### ***The Post-COVID Job Market***

In its report titled *The Future of Work after COVID-19*, McKinsey Global Institute (2021) examined post-pandemic labor trends and the job skills needed in eight countries that make up almost half the global population and 62% of the GDP: China, France, Germany, India, Japan, Spain, the United Kingdom, and the United States. The report, covering projections into the year 2030, highlighted how the labor market has

been indelibly changed by COVID-19 and described expectations for the future make-up and workplace environment of the global workforce. Several points highlighted in the report are poignant for the current discussion. First, the share of STEM occupations in the United States is expected to rise by nearly 3 percentage points, indicating an increased emphasis on technological innovation in the post-pandemic world (McKinsey Global Institute, 2021). Indeed, the U.S. Bureau of Labor Statistics more specifically projects that the fields of architecture and engineering will see 6% growth from 2020 to 2030, with the majority of added jobs in the field of engineering (U.S. Bureau of Labor Statistics, 2022). Second, almost all growth in labor demand is expected to occur in high-wage jobs, suggesting that young people looking for work will need a college education or specialized skills in order to find a job. Finally, the time spent using social and emotional skills at the workplace is projected to increase by 3.2 percentage points (McKinsey Global Institute, 2021), thereby underscoring the importance of these competencies for people entering the workforce.

### ***Future Labor Projections and Opportunities for Engineers***

For students in the field of engineering, the report's predictions bode well for future employment opportunities. At the same time, the report also suggested that job seekers in STEM areas need to move beyond technical know-how and be able to demonstrate greater social and emotional competence and better communication skills. In an opinion editorial for the American Society of Mechanical Engineers (ASME), Thilmany (2020) argued that, after the pandemic, the discipline of engineering will “change in another, key way. It boils down to one word: communication” (Strong Communication section, para. 1). Even well before the COVID-19 pandemic and its associated impacts on jobs and working conditions, voices from the field suggested that engineering departments must move beyond traditional views of training through highly structured curricula and incorporate a greater focus on communication and other professional skills that provide students with an edge on the job market. For example, Alan Lightman (2000) spearheaded the effort to establish a communication requirement at MIT, calling the targeted training in speaking and writing “part of a vision of the scientist and engineer of tomorrow” (para. 6). More recently, ABET, Inc. (2017) reinforced the idea that technical skills needed to be supported by an equally important set of non-technical skills that are important for the workplace, such as the ability to communicate, the ability to recognize ethical and professional responsibilities in a variety of contexts, and a capacity to function in a team setting.

Research has shown that language learning can support the development of these general types of skills, in addition to reinforcing the characteristics of cultural awareness and openness with which language learning is typically associated. For example, numerous scholars have demonstrated the link between proficiency in a second language and improved communication and social and emotional skills (Bialystok, 2015;

Buchweitz & Prat, 2013; Hernandez, 2013; Jones, 2018; McCabe et al., 2013). As Hernandez (2013) stated, “People who speak two or more languages have significantly better cognitive abilities, both academically and emotionally, than those who speak one” (p. 373). Buchweitz and Prat (2013) linked language learning to improved executive function, and Jones (2018) explained that language learning enables people to better empathize with others, thus suggesting that it also provides a useful skill set for engaging in team interactions. Mikhnenko & Absaliamova (2018) underscored the importance of language learning specifically for engineering students, stating that the integration of language education in the engineering curriculum provides a way of “improving professional competence and personality development” (p. 34). Using the general term personality development suggests the link between language learning and attributes such as the ability to interact in socially appropriate ways, set goals, and make decisions, which are all aspects of social and emotional learning. These same authors further argued that as students acquire the ability to communicate in two languages, they also develop their intellectual aptitude, as well as a “systematical perception of thoughts and actions, tolerance, and [the] willingness to take risks” (Mikhnenko & Absaliamova, 2018, p. 37). It is clear that learning a language can improve students’ communication skills and also contribute to the development of a variety of professional faculties, including the ability to problem-solve, listen to others, and deal appropriately with a variety of professional situations.

In addition to citing the cultivation of strong communication and problem-solving skills, ABET (2017) lists as important criteria the ability of engineers to “apply engineering design” and to make judgements that “consider the impact of engineering solutions” in relation to a global context, among others (Criterion 3: Student Outcomes 2 and 4). These directives place emphasis on the cultivation of skills necessary for interacting with colleagues from around the globe. The call for preparing engineers for an international context is not new. Kalonji (2005) emphasized the importance of developing global awareness in *Educating the engineer of 2020: Adapting engineering education to the new century*, concluding: “Considering the rapid pace of change and the internationalization of technical labor, there simply will not be jobs for our students unless we begin to think more creatively about the kinds of skills and personal development they will need to be competitive” (p. 147). Such skills include the ability to communicate effectively and work in a team, but also refer to a readiness to engage with other cultures and their perspectives. Kalonji further argued that, in order to cultivate these characteristics, a “multidisciplinary, multisectoral, multicultural, and multinational” approach to educating engineering students is necessary (2005, p. 147). In the article titled “The rationale for developing global competence,” Parkinson (2009) laid out parameters for providing this training, naming thirteen dimensions of global competence that could be used to guide engineering education. In addition to language skills that support both conversation and technical presentations in a world language,

Parkinson emphasized the need for cultural understanding that enables one to “communicate across cultures” and work in or direct “a team of ethnic and cultural diversity” (2009, p. 10). Additional studies have focused on the importance of developing globally competent engineering students and the role of language and culture learning in doing so (Allert et al., 2007; Ferrante Perrone, 2017; Grandin, 2006; Grandin & Hirleman, 2009; Grudzinski-Hall et al., 2006; Johnson & Demaris, 2007; Jesiek et al., 2014; Jesiek, 2018; Katehi, 2005; Lohmann, Rollins, & Hoey, 2006; Parkinson, 2009). Taken together, this body of scholarship demonstrates that engineers must be prepared for a global context because that is where their work increasingly takes place. Graduates entering the field must be prepared to demonstrate global competence in order to interact with professionals whose opinions and approaches differ greatly based on their cultural backgrounds.

### ***GEPs and the World Language Department***

In choosing their majors and educational experiences, students in the 21<sup>st</sup> century often seek direct connections between their studies and future career paths.<sup>1</sup> Kirchner (2000) alluded to this pragmatic perspective in the decision to study a language and culture:

The current student generation no longer studies a foreign language and literature for purely humanistic reasons and in order to gain a well-rounded education, as was the case historically. [...] More than anything, future employment opportunities and perceived market value seem to have a strong impact on what today’s student will choose to study (p. 227).

When a language is linked to national security efforts or a successful international economy, students tend to perceive a natural application of their skills. Being able to communicate in other languages and navigate another culture are clearly assets on the global job market. Yet, as world economies have become increasingly globalized and English has become the lingua franca for interactions that take place in businesses and politics as well as on social media, students have questioned the purpose of studying an additional language, believing they will not use it in the future.

This view has no doubt contributed to the near steady decline in enrollments of language programs over the past decade.<sup>2</sup> Already in 2000, Kecht and Hammerstein’s (2000) volume *Languages across the curriculum: Interdisciplinary structures and*

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<sup>1</sup> Certainly not all students are drawn to the study of a world language based on the direct application of their language skills in a future career. Many students see value in the study of languages, cultures, and literatures because of the broader knowledge they impart and their link to intellectual inquiry. Nevertheless, being able to show how they might use their skills to advisors in other areas of study as well as to parents often has an impact on whether students decide to major or minor in a language.

<sup>2</sup> According to the 2016 MLA report on enrollments in languages other than English (Looney & Lusin, 2019), the drop between 2013 and 2016 was particularly striking, when enrollments “declined by 9.2%” (p. 1).

*internationalized education* suggested the threat of such a decline and stressed the ways in which administrators and faculty could re-think their programs to draw more students to language study and prepare them for the demands of a globalized society. In an effort to cultivate a “globally competent graduate,” faculty identified ways to break out of traditional, discipline-focused structures and develop relationships across disciplines and campuses (Kecht & von Hammerstein, 2000, p. xi). Based on new conceptions of language and culture studies in the higher education curriculum, world languages departments worked with public health programs and departments in business and STEM disciplines to attract new students. At the same time, international or global engineering programs began to emerge. These programs typically featured language study, a semester or year abroad, and work experience in the target culture, and enjoyed success at a number of universities.

The educational innovation undertaken by GEPs (or IEPs, EIPs, GIPs, etc.) created during those years helped world languages departments weather the storm of cuts and closures a decade later, when, according to the 2016 report of the Modern Languages Association (MLA), a shocking record decline of 651 language programs occurred (Looney & Lusin, 2019).<sup>3</sup> Despite this concerning news, the authors noted that interdisciplinary collaborations, such as those with engineering departments, represented the type of curricular innovations that students found attractive and therefore maintained enrollments. They observed that programs oriented toward career-readiness “appeal to students (and their parents) who want to be assured that a job will be waiting upon graduation” (Looney & Lusin, 2019, p.17). They also noted that curricula promoting vocational opportunities and career options appeal to students, arguing: “We need to remind our students that the liberal arts major is not the same thing as a career, but we should point out that a degree in languages can offer interesting vocational possibilities” (p. 10). In sum, a joint program between world languages and engineering offers many positive aspects to constituents on campus. First, it provides language programs with a connection to students outside of the liberal arts college; second, it suggests greater viability of language study via the link to what is dubbed a more pragmatic discipline; and third, it is attractive as a global program that improves student marketability. Ultimately, this type of career-ready educational pathway provides students with essential tools for their future, stimulates program enrollments, and can potentially stave off elimination of academic programs in the face of stringent budget cuts.

More recently, the academic world was turned on its head by the arrival of COVID-19. June and Elias (2021) highlighted the losses that universities and colleges have suffered since the start of the pandemic, including \$120 billion in expenses incurred and revenue

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<sup>3</sup> Other publications that analyze the state of world language programs in the United States include MLA Ad Hoc Committee on Foreign Languages (2007) and McGinnis (2018).



lost, in addition to the \$24 billion in new expenses related to COVID-19 safety measures and technology for virtual instruction. Exacerbating these hits to institutional budgets is the approximate 3.6% decrease in undergraduate enrollments in the fall of 2020. Even if enrollments rebound and the economy of higher education stabilizes, the losses caused by the pandemic will reverberate for years. As Marcus (2019) explained even prior to the pandemic, in response to enrollment declines and financial challenges, institutions of higher education must implement solutions that respond to current demands in the workforce and provide links to employment after college. Having survived the initial emergency response to the pandemic, administrators and the bodies that govern them have in turn called for rethinking the business of the university. In this situation, the climate for creating new programs that link to marketable areas of study and prepare students for unique employment opportunities is more favorable than ever before. As in the past, faculty in world language departments in particular must employ “entrepreneurial thinking” to draw students to the study of languages (Rarick, 2009, p. 114). These entrepreneurial programs, among them GEPs, will fill the current demand for curricular ingenuity, in particular as global employment opportunities become ever more available through virtual work environments.

While the importance of global engineering programs from the perspectives of both engineering and the languages is clear, establishing such a program continues to be a challenge in the second decade of the millennium. The difficulties are linked to several key factors: 1) the challenge of making connections to faculty in other disciplines; 2) a lack of time to establish an interdisciplinary program; 3) convincing administrators in both units of the marketability of the program; and 4) making connections to stakeholders beyond the university. In the following, I describe the challenges and successes I faced while trying to establish such a program at WVU both before and during the COVID-19 pandemic, and the setbacks that ensued based on budgeting issues.

## **Program-Building During the COVID-19 Pandemic**

### ***Overview***

When establishing a joint project between disciplines that are not typically seen as being linked, the first steps are often taken by a single faculty member who must find and convince faculty collaborators of the justifiability of such a program. In the case of GEPs, often that person is a member of a world languages department because of both the desire and need to introduce the language major to a broader audience. For years I had wanted to create a global engineering program (starting with German), knowing the positive impact it could have on students at the university as well as in our program, and based on the close connection I had with colleagues at a technical university in Germany. Our program, which is housed in the Department of World Languages, had

maintained stable numbers over the years, but they were considerably lower than those of the Spanish section, which was held up as the measuring stick by college deans. We were encouraged to create opportunities that would increase the number of students enrolled in German and double the number of majors. While I knew that connecting the German curriculum to engineering studies could create opportunities for students to work abroad given the labor shortage in Germany, it was also clear to me that reaching out to an untapped group of students was crucial for the survival of our program.

As part of my preparation, I viewed a presentation by faculty members in German from a variety of private and public universities who reported about their experiences in establishing new dual degrees in global engineering. Following their advice, I sought an advocate in the engineering program who would share my vision of cultivating culturally adept and linguistically proficient students who could ultimately work for a German-speaking company. I was very fortunate not only to find an ally, but a German-speaking colleague who, as a college student, pursued degrees in engineering and German out of interest. During his career, he worked in industry and returned to the university to serve as a professor and first-year faculty advisor to students in all fields of engineering. Shortly after his arrival, he established an exploratory spring break program in Munich to introduce students to life and work in Germany and consistently rallied groups to attend.

While our initial conversations about a global engineering program occurred in 2017, we did not begin investigating in earnest how to go about establishing it until almost a year later, in late 2018. Our planning continued throughout the spring and fall of 2019, when we began offering dedicated sections of introductory German with a STEM focus on the engineering college campus in an effort to draw in more students and gauge their interest in learning German. We believed that if it were easier for students to get to the location where the German class was being held, they would be more likely to choose to study the language, which turned out to be true. The enrollments in those sections were robust, meeting the capacity limit of 25 students per section largely through the addition of engineering students to whom the courses had been specifically marketed. Understanding that flexibility in the tight schedule of engineering students is paramount, we planned to follow the on-campus courses with a series of asynchronous online courses that students could complete within their own time schedules. While these courses were open to all students, we believed they would be particularly attractive to engineering students who often forego pursuing a major or minor in German because they lack time for it in their schedules.

During the preparatory phase, we reached out to colleagues with successful global engineering programs for their recommendations and began strategizing about which engineering departments we would target first to pilot the program. We established

connections with deans at partner universities in Germany and requested copies of their syllabi and curricular maps to search for overlap with the engineering courses offered at our university. Even as we took preliminary steps to move the program forward, we encountered the second major hurdle in establishing the program, and that was a need for adequate time to address program development. In the early stages of planning a program such as this, the involved faculty must do viability studies and curriculum development. They must work together to convince administrators, who are frequently cautious because of potential costs (in resources and personnel) associated with running such a program, of its marketability and value. Finally, they must spearhead recruitment efforts that will introduce the program to students and convince them to enroll.

Thus, finding time to commit to the necessary steps was always an issue given that we were completing development work on top of our normal teaching and service loads, including leading study abroad programs. The demands of teaching, program direction, advising, and research made meeting together and cultivating the program more difficult, and, as is often the case in program development, our efforts were stalled due to other demands on our time. Given departmental budgeting constraints and the need for faculty course offerings, attaining a course release to develop a program was not a viable option. Finally, we were having difficulty bringing all of the stakeholders to the table to have a discussion about the program. For administrators whose schedules are packed with meetings, making a trek across or between campuses – which at our university can take up to forty-five minutes – to discuss a hypothetical program is often deemed less pressing than the current demands of existing programs. Despite several efforts to set up an in-person meeting to pitch our program and attain the necessary buy-in from the deans of both colleges, we failed to come together as a group to move our idea to the development stage.

We had taken a semester-long hiatus in planning when COVID-19 hit. Time pressures were exacerbated by the pandemic, as all faculty, including us, became overextended in an effort to learn and teach in new modalities while conducting research, recruiting students, and ensuring program viability. Nevertheless, oddly and to our surprise, the pandemic breathed new life into our endeavor. Several factors induced by the shutdown made the previously stymied attempts at program building more successful. The first aspect was increased communication between the key constituents based on the new technologies that prevailed and the willingness to meet virtually. When college instruction moved online nearly overnight in the spring of 2020, most educators were unprepared for teaching in multiple modalities using new video-conferencing, presentation, and file-delivery software that the virtual modality demanded. Zoom fatigue and hybrid instruction have, to date, become commonly recognized terms describing the daily reality of teachers at all educational levels and in a variety of institutional contexts. Yet these technological advancements, which initially caused

stressful re-training initiatives among faculty members, also served as the basis for facilitating conversations across disciplines that otherwise had not occurred in our earlier attempts at program creation.

Having the ability to connect via Zoom made it possible to clear the first hurdle, namely a meeting of all involved chairs and deans. While the task of bringing important constituents to the same table to discuss a future program may seem trivial, my attempts to do so previously met with little success. Shortly before the pandemic, in the fall of 2019, I had attempted to bring together deans of the engineering and arts and sciences programs with little success because of conflicting schedules. With the advent of Zoom and work from home, the scheduling of a meeting that had only a few months earlier been nearly impossible was managed in a matter of a few emails. For the first time we were able to convene administrators from different colleges and campuses to look for sources of commonality. We delivered a formal presentation via Zoom, which our stakeholders watched from the comfort of their homes, and entertained questions regarding potential challenges and solutions for the future. The unexpected enthusiasm of the dean of the College of Engineering for international study and the support of the dean in the College of Arts and Sciences, who was originally a language professor, provided the key elements for the establishment of the program. While Zoom was certainly not the reason for attaining the administrators' buy-in, it made possible the necessary conversations for it to occur.

The second key factor for program building during the pandemic was the prescribed need for innovation at the department and college levels. The administration, from the deans to the provost and president, began a strategic transformation that required the restructuring of some departments and the elimination of others. As faculty members, our charge was to rethink our programs or create new ones that would better prepare our students for the future while also attracting new students to study at our institution. In this regard, we felt a GEP would stand out. It was clear that collaborative programs between world language departments and STEM disciplines would be helpful in demonstrating the importance of language and culture study at a time when many language programs were being threatened. As Natow (2021) pointed out, "the academy is becoming a more frugal employer, a more virtual entity, and less of a home to the traditional liberal arts" (para. 22). It was therefore imperative to demonstrate how our world language department could play an important role in preparing students for the local and global job market.

In addition to internationalizing the curriculum, we felt we could make a case for contributing to a key mission of the university: the promotion of first-generation college-goers. Our university, with an enrollment of 26,839, is the largest public institution in one of the poorest states in the country. Of an undergraduate enrollment

of 20,000, roughly 4,000 identify as first-generation students (Farmer, 2021). These students often come from families throughout Appalachia where world language study is not necessarily understood or prized. A GEP can help fulfill the goal of our university with regard to first-generation students by introducing them to an intercultural curriculum and providing intensive support at all stages of study. While we knew the program would not be aimed only at first-generation students, ultimately the curricular structure we had to adopt (as described below) would require close monitoring of students throughout the curriculum, which can be particularly helpful to first-generation students who often experience difficulty navigating the higher-education system (Farmer, 2021, para. 4). In addition, for students coming from remote and isolated areas, the opportunity to examine diverse cultures through academic study allows them to become more aware of both the insularity and diversity of their own local communities, as well as their own cultural identity and that of the populations most familiar to them.

### ***Leveraging Local Business Organizations***

The interest we experienced regarding a global engineering program at the university also extended to the state's trade office. Given that a key feature of most existing global engineering programs is the link to a local headquarters of an international concern, we reached out to the trade office to locate German-speaking companies doing business in the state. Immediately we received a response lauding the timeliness of our proposed program; in short, members of the trade office believed that such a collaboration could also support and benefit from the increasing number of international investors in the state. Not only did the trade office express support for our proposed program, they also facilitated contact with German-speaking businesses. As a result, we met with the CEO of the closest company to our university (around 45 minutes away) to discuss the possibility of sending interns abroad when travel re-opened and integrating them into the company's workforce upon their return. In doing so, the company would have linguistically and technically well-trained candidates, and the state would benefit from a young and talented workforce remaining local.

The trade office has had a demonstrated history of supporting international companies in the state and had sent interns abroad to market the state as an ideal setting for an international business site. Nevertheless, the global character of the pandemic and the economic stresses it has caused worldwide certainly underscores the importance of bringing more business, including international companies, to the state as the economy recovers. Moreover, a program focusing on developing technically skilled and bilingual students that would ideally enter the local or regional workforce upon graduation also suggests a way of combating the brain drain which has confronted the state for decades.

In addition to increased communication through new technologies and the need for program innovation, the third factor that made program initiation during the pandemic viable was the newfound flexibility regarding the design and execution of work experiences despite the initial disruptions it caused to the global workplace. Even as businesses were required to shutter their doors and change their way of meeting customer needs, world languages and engineering programs experienced a break between pre- and post-pandemic education after the immediate switch to online instruction. The transition to remote learning was particularly challenging for engineering programs given the key role of lab courses in the curriculum, which could not always be easily adapted to an online format (Park et al., 2020). In addition, co-op opportunities were limited, postponed, or canceled altogether as engineering firms and businesses sought to enforce health guidelines, social distancing, and work-at-home orders to protect their current employees in an ever-changing situation (Alanson et al., 2020). Nearly a quarter of employers in the United States are known to have canceled summer internships (Feldman, 2021), leaving many students for whom work-integrated learning is a fundamental aspect of the curriculum without options for completing their training. A year after the pandemic began, the number of co-ops in some companies was still low due to insufficient marketing at online career fairs. Because of the reduction in opportunities to meet face-to-face, employers and students had greater difficulty finding each other.

In response to the potential crisis regarding the training of students whose curricula require work-integrated learning, a wide range of remote work opportunities were created both domestically and internationally to accommodate the needs of both students and employers during the pandemic (Pittenger, 2021). Virtual work had been on the rise prior to the pandemic based on globalization and new technologies that support collaboration (Pittenger, 2021). Nevertheless, before 2020, virtual internships and work experiences for students lagged behind remote work practices based on issues surrounding mentorship, confidentiality, security, and equipment accessibility (Pittenger, 2021). Once the pandemic hit, companies needed to restructure their internship and co-op experiences despite never having offered such positions in a remote setting before.

Although the new online work environment was unknown territory for companies and students alike, virtual co-op and internship experiences ultimately opened a door of opportunity by bridging geographical distance and improving accessibility (Pittenger, 2021). As a result of the adaptation of traditional work spaces and job descriptions, students with limitations on mobility or with family or other obligations are now better able to engage in integrated work programs (Feldman, 2021). In particular, international work experiences offered virtually can promote participation of students who otherwise could not afford to travel outside the United States. Given that many of

the students at our university are first-generation college-goers, they often find funding a trip abroad difficult; nevertheless, a study and work abroad component is a foundational aspect of a global engineering program. We have therefore sought ways to use the new flexibility created by the pandemic to offer internship solutions for students who could not afford to work abroad for a semester, not only during the shutdown but also in a post-pandemic world. As the workforce begins to normalize, many internships will return to a face-to-face format; nevertheless, virtual internships, as they are available, will serve as a key component in developing intercultural competence for those students who cannot travel to another country due to financial restrictions.

In reaching out to organizations that facilitate placements in international firms, we were pleased to learn that companies abroad were also accepting interns for virtual work. Such internships were designed to expose students to work-life in another culture and were designed to pay a small stipend similar to face-to-face internships. Ultimately, none of our students completed a virtual internship, although the opportunity existed. As travel restrictions are lifted, we will encourage our students to complete a stay abroad in the culture, but the option for virtual participation will still be available to students who, based on any number of reasons, feel they cannot travel out of the country. A virtual work abroad component may be controversial because the “abroad” aspect of the experience has been eliminated; research has shown, however, that remote internships are successful primarily in the area of communication. For example, Jeske & Axtell (2014) noted prior to the pandemic that “e-internships have been praised for providing excellent opportunities for practicing and enhancing communication skills” (p. 462). For global engineering students, a key component of working in a company in the target culture is developing linguistic skills and intercultural competence, both of which are built through communication with native speakers. Ultimately, the benefits of a virtual international work experience, such as enhanced communication skills and increased accessibility, make it a viable option for a global engineering program both during the pandemic and beyond. One can argue that much is lost in virtual experiences, especially as compared to face-to-face interactions. At the same time, the virtual platform has already become a normal part of doing work across a variety of sectors, and it is incumbent upon businesses and universities to make the most of the format to improve equity and inclusion as well as communication.

### ***Challenges and Successes***

While the pandemic afforded initial opportunities for program innovation at the university, subsequent budget constraints have led to the stark scrutiny of both existing and newly proposed programs. In our case, the administration began requiring that dual degree programs with shared credit hours submit a plan for sharing operational costs, but without providing a budgetary framework for doing so. Consequently, in an effort to keep our interdisciplinary collaboration going, we have chosen a dual degree model with

two independent degrees that requires accelerated language study, intensified advising, and a six to nine-credit internship program that is applied toward world language study.

In order for the joint curricular plans to succeed, students must have a language level of “intermediate low” prior to beginning their first year at the university. They can achieve these credits through AP or IB exams or by taking intensive, asynchronous online classes as high school students through a tuition-reduced program the university offers to juniors and seniors. They also have the option to take intensive asynchronous online classes the summer before they begin as first-year students in the fall. By taking some language classes early, students can accommodate world language study in the credit-heavy engineering curriculum. The internship forms a second key component of language study and a crucial link to the student’s engineering discipline. Through the completion of an internship, either in-person or virtual, students can receive six to nine credits of language coursework depending on duration (3 or 6 months) and important work experience in their discipline. The program affords flexibility in terms of how each engineering department chooses to evaluate the internship experience. Students may also use their internship as a basis for their capstone research projects, which is a university graduation requirement in every major, in one or both disciplines.

The key to success in the program as it is currently structured is recruitment and early advising. Students must begin taking languages prior to official program coursework or be placed in more advanced language courses in order to fulfill criteria for both programs in a timely manner. In order to reach students early, we have begun a variety of recruitment efforts. Visits to schools and online language events serve to inform high school students and their parents of the college language courses available to them at the secondary level. We have compiled a list of language programs in the state and have begun reaching out to high school teachers to identify students who may be interested in pursuing dual degrees in engineering and world languages in order to guide them into and through the curricula. We have created programs of study documents so that students can see how it is possible to complete both degrees in a timely manner and made them available on the department website. Finally, in an effort to help students who are already enrolled at the university, we have sought out engineering students in lower-level language courses to help them determine ways to complete dual degrees through additional study abroad programs, credit by exam, or independent study projects.

While completing the 158 credit hours needed for both degrees is extremely challenging, the dual degree program structure has allowed for students in multiple languages to pursue studies in engineering and world languages. Given that all of the languages consist of the same number of credit hours in the major and have similar course requirements, the program can be duplicated across languages. Currently nine students



in four languages in our department (5 Spanish, 2 German Studies, 1 Russian Studies, 1 Chinese Studies) are pursuing dual degrees with engineering; they all have varying levels of international experience. The next phase of our program implementation is to ensure that every student participates in a global internship prior to graduation based on our collaboration with an internship placement organization. Although the process of linking these disciplines proposes ongoing challenges, stressing the importance of working with our counterparts in engineering to prepare linguistically, interculturally, and technically competent members of the workforce has shown initial stages of success.

## **Conclusion**

The COVID-19 pandemic has upturned the world of higher education in many ways, most of which are negative; the full extent of the impact will continue to be felt as academic transformation efforts occur on campuses across the country. Nevertheless, the innovation and adaptability that arose in response to the pandemic have created opportunities that will surely outlive the virus and become a part of the “new normal” way of life and doing business on college campuses. In the environment created by COVID-19, where flexibility and openness to new ideas have become a requirement of survival, program innovation and new alliances, such as those embodied by a global engineering program, are imperative to the sustainability of individual programs and the university itself. Despite the many positive aspects of collaborations across campus, interdisciplinary program-building is often a messy process with many starts and stops. Even as new opportunities arise, uncertain conditions lead to constraints that temper those opportunities and require the ability to think even further outside the box. Challenges notwithstanding, the development of such programs must continue because they provide an important foundation for future curricular innovation. As we look forward to seeing the outcomes of our fledgling GEP, we will use opportunities afforded by the pandemic and its aftermath to streamline our programs of study and market them to both in-state and out-of-state students. We will make use of new technologies to improve accessibility of international experiences and also promote in-person study and work abroad experiences in an effort to provide students with the tools, skills, and knowledge that will help prepare them for their future professional lives. Above all, we will use the lessons learned through COVID-19 to underscore the importance of the core principles of our disciplines and to continue cultivating globally competent students in diverse and innovative ways.

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