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Cultivating Global Leadership in Engineering: Insights from a Gateway Course

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Abstract

This paper investigates a strategy for cultivating global leadership skills among engineering students through co-curricular programs. It focuses on a required gateway course in the Global Engineering Fellows program at the Pennsylvania State University, designed for undergraduates who have participated in international experiences. The program aligns with institutional goals of fostering diversity, equity, inclusion, and cultural competency, aiming to produce engineers with global leadership capabilities. Participants develop cross-cultural awareness, communication, and leadership skills, further enhanced by a one-credit gateway course. This paper reviews the course content and discusses continuous improvements informed by student feedback and global leadership development with cultural perspectives. Evaluation data highlights student gains in cultural and professional competencies, shaping their academic and career trajectories. The findings underscore the value of integrating global leadership training into engineering education and offer insights into program improvements and best practices for future implementation.

Introduction

In the field of global engineering education, there is an essential question: How can engineering students' global leadership skills be most effectively cultivated through co-curricular programs? Curricular and co-curricular global engineering opportunities such as a study, research, or internship experience abroad are high impact practices, well-documented for providing enriching experiences to complement the academic curriculum. The College of Engineering at the Pennsylvania State University offers a co-curricular Global Engineering Fellows program for engineering undergraduate students who have completed a University international experience. This program reaches across the boundaries of teaching, research, service, student and scholar mobility, and intercultural learning within a framework that encourages cultural competency.

The co-curricular program aligns with the College and University's Strategic Plan by reinforcing the goals of enhancing student success and fostering diversity, equity, inclusion, and belonging. The College vision includes producing engineers who lead globally, and global competence is an educational and professional imperative. One goal of this offering is to provide an opportunity for technically grounded, globally engaged students to build leadership skills from these experiences. The Global Engineering Fellows program prepares participants to enter the workforce with cross-cultural awareness and communication skills, poising them to become global leaders. In addition, these students serve the College as peer advisors, international education advocates, and liaisons for incoming international students. They make presentations to current and prospective students, as well as promote global programs at University events. Participants in the Global Engineering Fellows program earn a digital micro-credential upon completing an approved global experience, a required gateway course, and one semester of service in study abroad promotion and peer advising.

Students in the program are afforded professional development opportunities and mentoring. Participants attend several meetings throughout the semester and become eligible for a

scholarship by taking on leadership roles such as team lead, new participant chair, peer advising chair, or international student liaison chair. They are also invited to showcase their experiences in a global experience poster session and recognition ceremony. Outstanding graduating participants may be considered for the College's Global Impact Award, typically awarded to one student each year.

Prior to entering the Global Engineering Fellows program, training is delivered through a one-credit gateway course, which was first offered in 2017. Each year, modifications have been made in an effort to improve the course. In this paper, the authors discuss the most recent evolution of the gateway course's content and use student feedback to assess the course learning objectives for continuous improvement of the course and program. The summative teaching evaluations show students gained new cultural and leadership perspectives and the program integrated different cultures into the curriculum. Students also recognized the course and program in the larger context of their engineering major. The short-term benefits continued and evolved to shape student choices concerning additional intercultural and international experiences and career opportunities. Overall, the evaluation and assessment of the course invites an exploration of how to improve the student learning, future course directions, and best practices in the field of global leadership development for engineering students.

Defining a global leader

Prior to delving into the gateway course content, as the scope of the program is to develop global leaders, it is relevant to contextualize this term. In Osland et al.'s, review of the literature, they proposed that a global leader is "An individual who inspires a group of people to willingly pursue a positive vision in an effectively organized fashion while fostering individual and collective growth in a context characterized by significant levels of complexity, flow and presence [1]." However, in corporate operations, the phrase "global" refers to more than just geographic reach. It also covers the idea of intellectual scope in the formation of a global mentality and cultural reach in terms of people. It encompasses a global mindset, which is the capacity to create and evaluate performance standards for individuals and businesses that are not influenced by the presumptions of a particular nation, culture, or setting; and to apply such standards suitably in other nations, cultures, and situations [2]. Among the attributes that an engineer should possess to be successful in a global context, Warnick's list included global mindset, an appreciation of cultural differences, an ability to demonstrate worldly knowledge, cross-cultural communication skills, foreign language abilities, an understanding of international technical issues, professional experience in an international engineering environment, and a background with a global team [3]. Furthermore, engineering global leaders should possess global competencies which can be defined as "global awareness, global understanding, and the ability to effectively apply intercultural knowledge [4]."

In the context of engineering education, it is crucial to recognize the role of academic programs in cultivating leadership skills that go beyond technical expertise. The importance of global leadership competencies in engineering education has been increasingly recognized in literature, reflecting the growing need for engineers to operate effectively in multicultural and international environments. Studies emphasized the necessity of integrating global competencies into engineering curricula to better prepare students for the complex challenges of a globalized

workforce. Taylor and Green highlighted the significant role that student perspectives on global competencies play in shaping the future of engineering education, advocating for curricula that foster cultural awareness and intercultural communication skills to enhance global leadership effectiveness [5]. Majewska, meanwhile, discussed the new paradigm of a globalized society, a fact that corporations understand. Furthermore, institutions of higher education should assess global competence teaching and revise the curriculum accordingly [6].

Gateway course overview

The intention of the gateway course was to build upon the above-described global leadership skills as students prepare to enter the co-curricular Global Engineering Fellows program. Prior to enrollment in the gateway course, students must have completed a global experience abroad which may include an approved study abroad program, international research, internship, or service program while a student at the University. Per Kolb's Experiential Learning Theory, a Concrete Experience (CE) is necessary for Reflective Observation (RO) and subsequently serves the basis to create meaning and knowledge through re-learning [7]. Thus, a student's experiential global foundation was considered an essential pre-requisite to enrollment. From this basis, students in the gateway course created meaning as they revisited their experiences, classified learnings, and accessed their knowledge to complete the course assignments.

Regarding course logistics, it is worth noting that the gateway course did not fulfill degree requirements and targeted a subset of motivated students. For practical purposes, it was scheduled once a week at a time that generally does not interfere with students' schedules, 8-8:50 am. In 2024, 26 students enrolled in the gateway course.

Learning objectives

The course syllabus described several objectives. At the conclusion of the course, students were expected to be able to:

- Articulate the values of international experiences to their peers, faculty, and potential employers, in both group and individual settings.
- Make a compelling (clearly argued, articulated, inspiring, and well prepared) presentation about how their international experiences are relevant and beneficial to becoming a successful engineer.
- Anticipate the cultural demands that may accompany international business travel and formulate a plan to compensate for such needs, including identifying appropriate resources to investigate how one can professionally engage with the target culture.
- Reflect and build upon intercultural learning experiences and consider ways to apply their knowledge, skills, and perspectives through campus and community engagement and in preparation for professional pursuits and life after College.
- Discover opportunities for international internships, study abroad, careers, and fellowships.
- Assess their own cultural lens and interpret how it influences their worldview and develop a plan to expand their cultural competence.

Course content and assignments

The gateway course employed a variety of assignments, and content, including guest speakers, designed to foster student engagement with global perspectives, leadership development, cultural intelligence, and professional skills. The curriculum was conceived to encourage active participation, reflection, and actionable insights into the value of global engineering experiences and leadership development. These assignments collectively emphasized self-reflection, professional development, global awareness, and actionable learning. They were carefully designed to prepare students for impactful careers in global engineering by equipping them with the skills, insights, and confidence needed to excel in diverse cultural and professional settings. Deliverables included written assignments, reflections, recorded videos, as well as individual and group presentations. The following sections summarize the most significant aspects.

Global skills articulation

To help students translate their global experiences into professional assets, students developed resumes that highlighted these experiences. Students identified three key skills gained abroad, such as flexibility, intercultural communication, or problem-solving, and provided brief explanations of how these skills were demonstrated during their experiences. This assignment ensured students could effectively showcase their global competencies to potential employers with supporting examples from their programs. A guest speaker from the career office discussed how to highlight global experience on cover letters and resumes.

Global leadership guest speaker series and reflections

Guest speakers selected for their professional experiences in global leadership broadened student perspectives. Students were prompted to consider gaps in their own preparation for working in a global context and submitted reflections analyzing key takeaways and their applicability to future global endeavors. The topics presented by the global leadership speaker series guests are summarized below:

- cultural perceptions, history, and leadership principles in Afghanistan, distilled from the speaker's experience as a U.S. Army officer in the Trans-Atlantic Division of the Army Corps of Engineers, assisting in the reconstruction effort in Iraq and Afghanistan (Speaker 1);
- frameworks for leadership presented by a former head of global leadership development at Royal Dutch Shell (Speaker 2);
- developing global career competencies presented by recent alumnus of the Global Engineering Fellows program, currently working for United Airlines Alliance Operations (Speaker 3).

Developing Cultural Intelligence (CQ)

Students used the Cultural Intelligence (CQ) assessment [8], a research-based instrument and developmental tool that provides insights into an individual's or group's ability to understand, adapt to, and work effectively across cultures. The CQ assessment relies on self-reported data

and compares an individual's responses to worldwide norms. While the authors believe it offers valuable insights, users could, either knowingly or unknowingly, misrepresent their capabilities. Nevertheless, it remains a useful tool for introducing the concept of intercultural skills and how to enhance them. The assessment measures CQ as a multidimensional capability that can be developed and applied in various cultural settings, including international business, education, or multicultural teams.

The assessment included the CQ Cultural Values Group Profile, which helps foster cultural awareness and competence within teams. After completing the assessment, students were debriefed on the results, including the cultural values of their group. Following this, they developed a CQ Action Plan to improve their intercultural competencies. They reflected on past intercultural challenges and assessed their CQ across four dimensions: Drive, Knowledge, Strategy, and Action. Focusing on two sub-dimensions, students created a detailed action plan with activities, timelines, and goals for improvement. This exercise was designed to encourage intentional growth in cultural awareness and to enhance the ability to navigate diverse perspectives effectively.

Presentation development

To develop storytelling and communication skills, students were instructed in the Presentation Zen style, by a guest speaker with expertise in this domain, to create an inspiring PowerPoint presentation to highlight their global experiences. The ability to inspire is consistent with Osland et al.'s definition a global leader as one "…who inspires a group of people…[1]" The Presentation Zen format emphasizes full-page visuals and minimal text to convey key messages effectively. Student presentations included an introduction and main messages (e.g., personal growth, academic enrichment). Their examples were required to align with the SUCCESS principles for effective communication [9], which provide a framework for crafting memorable and impactful messages. Slides followed a standardized format used by the Global Engineering Fellows program. They were bookended by introduction and conclusion slides, with a call to action for peers to pursue global learning abroad. This assignment challenged students to distill complex ideas into compelling visuals and focused narratives, showcasing skills gained abroad, such as adaptability and intercultural communication. The craft of creating a presentation was an iterative process as course concepts were scaffolded. For example, the class learned to identify tangible leadership skills from their international experiences and explored best practices for articulating them by watching and discussing selected TED Talks, such as *Celebrate What's Right in the World* [10], which emphasized positive reframing of narratives. Additionally, students participated in presentation workshops. In the weeks preceding the final submission, they provided revised versions of slides and recorded a 1-minute "entry point" video to fine tune their presentations' openings. The final product, due in the latter portion of the semester, was a 5-minute recorded presentation, submitted on a digital learning platform where students provided constructive peer feedback.

International business travel planning presentation

Students were provided with an overview of resources and how to approach preparation for an international business trip. Then, they were asked to synthesize this information with course

learnings from guest speakers, the Cultural Intelligence (CQ) module, and best practices in effective communication to create a group presentation for a country on which they had limited prior knowledge. Columbia, Botswana, Hungary, Latvia, Indonesia, and Malaysia were selected for the 2024 class. In teams, students researched and presented on conducting business in their assigned country. Presentations focused on cultural values, business practices, and opportunities for engineers in the country, providing practical advice for a business trip to this location. Students also addressed potential challenges and estimated costs for conducting business in the country. Slides were professionally formatted and cited sources. This assignment combined research, collaboration, and presentation skills to prepare students for global business environments.

Further enrichment opportunities

In addition to required assignments, there were several non-obligatory enrichment activities offered for extra credit to promote global leadership. Students were invited to a workshop to explore competitive fellowships (such as Gilman, Fulbright, Boren, Goldwater, Astronaut, Rhodes, Marshall, NSF GRFP Fulbright. etc.) and reflect on which fellowships aligned with their academic and career goals, fostering awareness of pathways for continued global engagement.

Additionally, an optional off campus high ropes leadership retreat for the Global Engineering Fellows program was held. Gateway course students were invited to join current Global Engineering Fellows program participants in an experiential learning opportunity designed to develop teamwork and leadership skills. Participants were divided into teams and completed aerial challenges by working together with a trained facilitator. By tackling physical and strategic challenges in a collaborative setting, students enhanced their communication, problem-solving abilities, and confidence in leadership roles. The retreat helped foster group cohesion and complemented other course activities by emphasizing the practical application of leadership concepts.

Grading percentages

Course assignments and their values are summarized in Table 1 below.

Table 1: Course Grading Scheme

Assignment categories	Percentage
Attendance and Participation	15%
Global Experience Presentation	20%
CQ Assignments	10%
Written Assignments	45%
International Business Travel Presentation	10%

Course assessment methodology

The course assessment methodology is divided into phases that are part of a strategic a long-term assessment and improvement plan. It includes an operational phase to develop a longitudinal

survey and tactical actions (discussed in this paper) that collect, review, and provide accessible data that can be used for real time modifications. The data collected through the tactical actions will be built upon as it will be recollected in subsequent iterations of the course.

As part of the operational phase (incipient) interviews on the program impact are in progress with 10 alumni. All interview participants are in the engineering workforce, except for one who is a PhD student. The interviewees were identified as having professional roles with a significant global scope. These interviews will further the strategic goal to create a survey that can be distributed to more than 100 program alumni, providing rich longitudinal data that can be utilized in the course improvement process.

The initial phase of the course assessment (detailed below) involved collecting actionable data from multiple sources 1) a course survey 2) the University official course evaluations 3) information students provided in reflections/ guest speaker feedback. The below figure represents the methodology for the course assessment and improvement process.
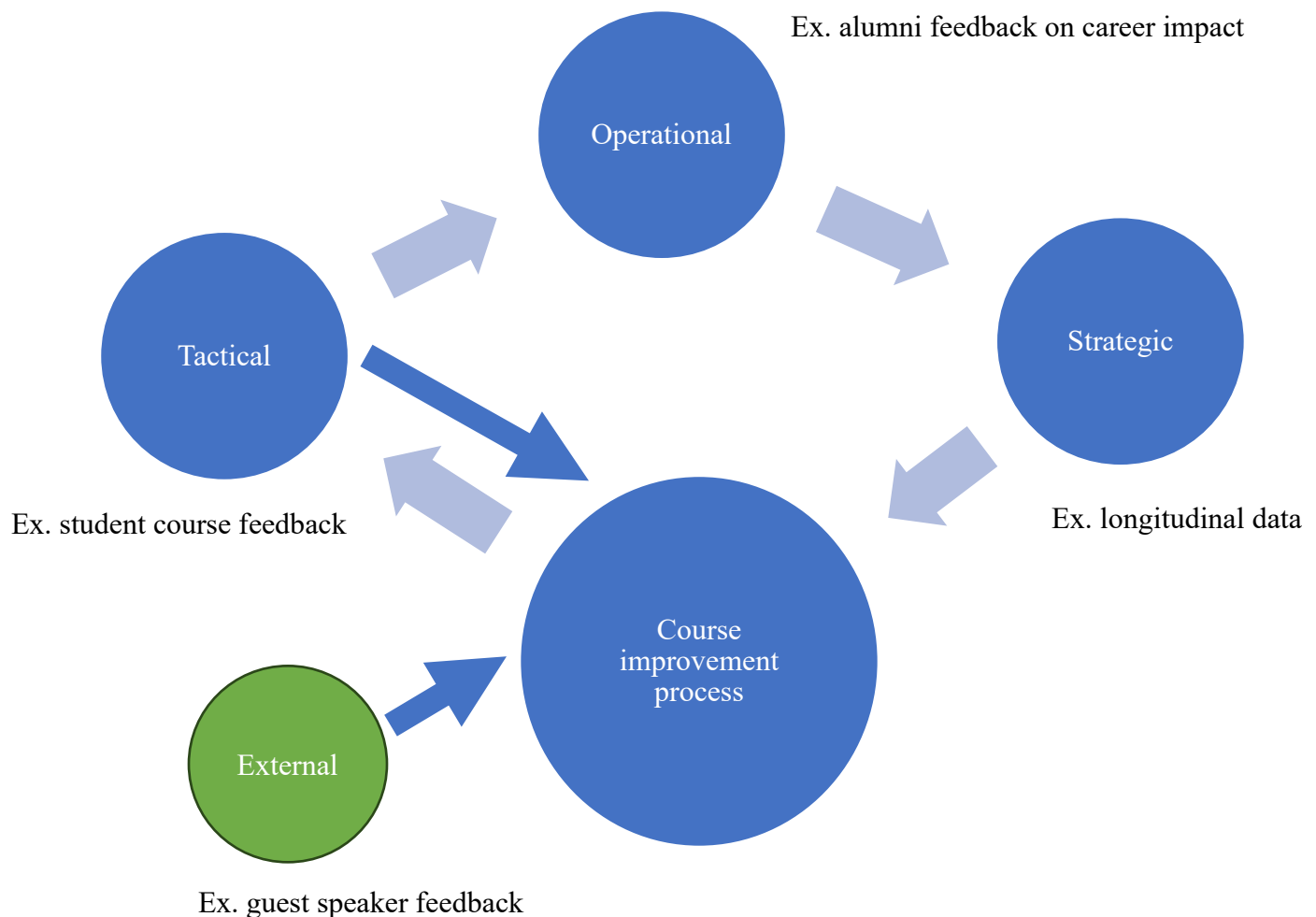

Figure 1: Course improvement process

Course survey

A survey to assess student competencies as mapped to the course objectives was conducted at two points in the semester, after one month of class and at the end of the semester. Anonymous and optional, the surveys were administered via Qualtrics and students were provided a week-long timeframe to complete them. The same survey was administered at both points in the semester as the intention was to understand where students rated themselves and whether any changes in their self-assessments would be recorded at the end of the semester. Administering the survey for the first time several weeks into the course, rather than at the beginning, may have been helpful in assessing this population. As students self-select into the gateway course after having had an international experience, they may arrive confident in their global leadership skillset, which could skew the data. However, after several weeks in the course, students will have been presented with course content that may allow them to assess gaps in their knowledge, skills, and abilities.

The below questions were provided in the survey:

1) I can describe the values of international experiences to peers, faculty, and potential employers, in both group and individual settings.
2) I can create a compelling (clearly argued, articulated, inspiring, and well prepared) presentation about how international experiences are relevant and beneficial to becoming a successful engineer.
3) I can analyze the cultural demands that may accompany international business travel and formulate a plan to compensate for such needs, including identifying appropriate resources to investigate how one can professionally engage with the target culture.
4) I can interpret and build upon intercultural learning experiences and consider ways to apply knowledge, skills, and perspectives through campus and community engagement and in preparation for professional pursuits and life after College.
5) I can identify opportunities for international internships, study abroad, careers, and fellowships.
6) I can assess my own cultural lens and interpret how it influences my worldview and develop a plan to expand cultural competence.

Questions were assessed using a Likert scale and descriptions with the corresponding values as follows, "Strongly disagree" = 1, "Disagree" = 2, "Neither agree nor disagree" = 3, "Agree" = 4, "Strongly agree" = 5. Out of 26 enrolled students, 19 (73%) completed the mid-course survey and 12 (46%) completed the post survey. On average, students exhibited confidence in these abilities during both points of the assessment. At the end of the semester, there were increases in all 6 categories assessed. The average across all 6 abilities reported was 3.75 for the mid-course survey and 4.6 for the post course survey, representing a 23% increase in the aggregate of the reported abilities. There was variability in the individual capabilities assessed with less significant increases in Q1) related the ability to describe the values of international experiences (12% increase) and Q4) related to the ability to assess one's own cultural lens (12% increase). The greatest increases reported were in Q2) relating to presentation creation ability (33% increase) Q3) related to the ability to prepare for international business travel (38% increase). To

understand whether the course leveled the students' abilities relative to their peers, the Coefficient of Variation was examined. This statistic demonstrated whether the dataset became more or less consistent relative to the mean, indicating improvements or inconsistencies. The Coefficient of Variation on average, across all categories, decreased from 21% to 11%, demonstrating that students' self-assessments became more in line with their peers throughout the course. The most significant improvement in the Coefficient of Variation was seen in Q3 from 32% to 11%, indicating that by the end of the course there was less variation (21% decrease) among students, as they more consistently felt confident in their abilities to anticipate the cultural demands for international travel. However, the Coefficient of Variation increased modestly in one category Q1), students' abilities to describe the values of international experiences (to peers, faculty, and potential employers), from 8% to 11%. These results are summarized in Tables 2-3.

Table 2: Mid Semester Course Assessment Summary Statistics

Mid Semester Statistics	Q1	Q2	Q3	Q4	Q5	Q6
Average	4.11	3.58	3.32	3.84	3.74	3.95
Standard Deviation	0.32	0.61	1.06	0.90	0.93	0.78
Coefficient of Variation (CV)	8%	17%	32%	23%	25%	20%

Table 3: End of Semester Course Assessment Summary Statistics

End of Semester Statistics	Q1	Q2	Q3	Q4	Q5	Q6
Average	4.58	4.75	4.58	4.67	4.67	4.42
% Change from Mid Semester	12%	33%	38%	21%	25%	12%
Standard Deviation	0.51	0.45	0.51	0.49	0.49	0.67
Coefficient of Variation	11%	9%	11%	10%	10%	14%
Coefficient of Variation Change from Mid Semester	3%	-8%	-21%	-13%	-15%	-5%

University official course evaluation

The University official course evaluation provided another opportunity for course assessment, although it should be noted that the completion rate was 19%. The course received positive feedback, emphasizing its impact on student learning and engagement. Quantitative results from the report showed 100% of respondents rated both the course structure and the instructor's inclusivity as either "Agree" or "Strongly Agree," with a mode and median score of 5/5. Students highlighted the course's effectiveness in preparing them for the Global Engineering Fellows program, particularly through its emphasis on communication and reflection. One student noted, "The combination of learning how to communicate and reflect on global experiences is very useful. It does a great job of preparing people for [the Global Engineering Fellows program]." Additionally, the inclusion of guest speakers and group activities was appreciated, with

comments such as, "Love how the class is set up, I get so excited to hear the guest speakers as well as do group work!"

The most significant learning outcome was the ability to reflect on global experiences and apply those insights to personal and professional contexts. Students consistently referenced this skill, stating, "How to reflect on my experience and make changes to my life based on them," and "About how my global experience can be applied to everything and in every part of my life." According to the evaluations, the course fostered a welcoming, low-stress environment that encouraged meaningful engagement, as evidenced by remarks about the instructor's passion and approachability. Furthermore, the evaluations did not provide suggestions for improvement, with one student summing up the overall sentiment: "I wouldn't change anything about it – super manageable and very meaningful!" These results underscore the course's success in achieving its learning objectives and creating a positive student experience.

Student reflections/ feedback on the global leadership guest speaker series

An additional opportunity to capture pedagogical effectiveness was found in student reflections from assignments and optional feedback on the global leadership guest speaker series. According to the submissions, several themes were identified. Students learned lessons on cultural adaptability, leadership, and personal growth from the guest presentations. Key takeaways included the importance of understanding and adapting to cultural differences and the role of storytelling in conveying leadership principles. The speakers emphasized the significance of professional skills like adaptability and active listening in cross-cultural settings, as well as the value of international experience in shaping both personal and professional development. Additionally, students were inspired to embrace unconventional career paths, trust their intuition, and explore opportunities that might not follow a traditional trajectory. The presentations also highlighted the benefits of language learning and cultural immersion in broadening perspectives and fostering meaningful connections in global environments.

Summary of student feedback on guest speakers

Speaker 1 provided students with valuable insights into cultural adaptability, leadership, and navigating international environments. His experiences in Afghanistan illustrated how preparation and flexibility are essential when working in diverse cultural settings. Many students highlighted how his stories emphasized the importance of understanding and adapting to cultural and societal differences, with one noting, "I think (Speaker 1's) presentation did a great job of showing us how he was able to prepare for and navigate the cultural/societal differences, as well as being able to adapt to the different customs overseas." They noted that his ability to work collaboratively with Afghan individuals to achieve common goals offered practical lessons in leadership and cross-cultural engagement.

Students also appreciated Speaker 1's engaging storytelling, which helped connect abstract leadership principles to real-world applications. They mentioned that his talk demonstrated how global engineers can contribute beyond technical expertise, emphasizing adaptability and cultural awareness. As one student remarked, "It gave us firsthand insight into what it is like to literally

be a global engineer." Overall, the lecture aligned well with the course objectives and provided students with meaningful lessons for their development as global leaders.

Speaker 2's presentation had key takeaways that included the value of leadership fundamentals, the importance of preparation, and strategies for becoming effective leaders, speakers, and communicators. Students highlighted his use of authentic storytelling, drawing on personal experiences and real-world examples, to illustrate his points. They discussed the utility of the speaker's including specific frameworks, such as his "five pillars of leadership," which were effectively presented through examples and stories. This framework helped them understand not just what leadership requires but also why these elements are essential. In terms of practical application of leadership, feedback indicated the speaker emphasized actionable ideas for becoming more effective leaders and communicators, focusing on how students could apply these lessons to their lives and future roles. As one student noted, "He didn't focus on what he has done but rather taught us what he has learned and how we can use those ideas."

Speaker 3's guest presentation provided students with insights on the importance of embracing uncertainty, pursuing unconventional career paths, and developing cross-cultural competencies. A key theme was the role of language learning in cultural immersion, which Speaker 3 emphasized to "immerse yourself in another culture, but also view your own through another lens." His story of teaching English in Taiwan and learning Mandarin resonated deeply with students, inspiring them to embrace diverse experiences that could enhance both personal and professional growth. One student reflected, "Hearing how he went from a biomedical engineering student to a career in the airline industry was reassuring," reinforcing the idea that career paths don't need to be linear.

Also highlighting the value of professional skills, Speaker 3 discussed adaptability and active listening, in cross-cultural settings. Students reported that his experiences abroad helped him build these skills, which later contributed to his success at United Airlines. As one student noted, "The experience he gained from that was probably more valuable than any internship or other experience he could have otherwise had." The speaker's candor about his nontraditional journey encouraged students to trust their intuition, explore unexpected opportunities, and embrace the possibility that seemingly unrelated experiences could lead to meaningful outcomes. Overall, his presentation underscored the power of taking risks and following passions, leaving students inspired to pursue their own unique paths.

Discussion and future directions

Interpretation of the course assessment

The findings indicated that the curriculum was effective and well-received by students. The authors believe that this positive assessment may be a result of several factors 1) student motivation to self-select into a non-required course 2) the course curriculum has been refined over nearly a decade.

Based on information gleaned from the assessment, students exhibited gains in the competencies the course aimed to foster. Noteworthy increases were documented in student confidence in their

abilities to create compelling presentations about their international experiences and to analyze the cultural demands/ plan for international business travel. These increases were 33% and 38%, respectively. As presentations were a major course theme, with numerous assignments to inform student learning, evidence of students' increased confidence in these presentations was expected. The largest increase in students' perceived abilities was the international business travel category. While there was only one assignment on this topic, the rating increase may demonstrate the accumulation of global leadership knowledge throughout the course, converging Cultural Intelligence (CQ), effective communication, and takeaways from the course's global leadership guest speaker series.

At the end of the course, two areas were slightly lower than other categories that the students rated, their abilities to describe the values of international experiences (to peers, faculty, and potential employers) and to assess/ interpret their own cultural lens. Regarding the ability to describe the value of their experiences, this may indicate a need to provide students with enhanced training on how to articulate them to faculty and employers, as the course had a disproportionate emphasis on creating presentations for peers. Additionally, the concept of a cultural lens may have been nebulous. Greater effort to explain this concept and the inclusion of a related assignment could prove useful. Modifications should be considered with additional student feedback, which might be collected via a focus group.

As the review of the global leadership series guest speakers and student course evaluations were both highly positive, it seems the course identified effective practices that should be continued. It is worth noting that the speakers' backgrounds were diverse and spanned military, engineering, and global business backgrounds. This aspect may have enhanced the impact of the speaker series with unique perspectives on global leadership. The inclusion of a younger speaker, who was an alumnus of the Global Engineering Fellows program, appeared to generate excitement and the feeling of a personal connection. Regarding the University official course evaluation, responses were limited and provided neither evidence of issues in the course broadly nor constructive feedback.

Challenges and future implications

Despite the encouraging findings, there are challenges with the approach to the course. It is not ideal to offer a course at 8 am, as it had the tendency to be unappealing to undergraduate students. During this time slot, several students regularly arrived late or provided an excuse for missing class. Furthermore, a 50-minute class once per week was at times insufficient to fully present concepts and deeply explore them in class. Consequently, a flipped approach was employed when possible, where students completed pre-work for discussion. Furthermore, due to the shorter class sessions, guest speakers were encouraged to provide space during their talks for questions, rather than waiting until the end of class.

Given the once weekly class touch point, the creation of a student community was more difficult than it may have been if there were more frequent meetings. To help foster familiarity among classmates, students were distributed double-sided name tents to display in class and submitted introduction videos for peer viewing. While helpful, the establishment of a class community remains an obstacle to overcome. The high ropes leadership retreat, which was well-attended,

furthered this goal. However, this retreat was optional, thus the entire cohort did not benefit. At the end of the semester, the instructor probed the gateway course students as to whether additional class meetings or longer classes would be useful. The overwhelming opinion of the informal class poll indicated this would be unmanageable in their schedules and would impact enrollments. Lastly, the gateway course does not fulfill degree requirements. While it is likely that a justification could be made for the course to fulfill general education credits, because the course is only one credit, it would not offer much value in a student's degree audit. One future direction under consideration is incorporating the gateway course into the College's international engineering minor. This inclusion may enhance the appeal of the course. Another initiative that has been suggested is to develop a digital badge or micro-credential where the course is one of the requirements. The digital badge would have the metadata to show the skills and competencies of the earner to potential employers or those perhaps unfamiliar with global leadership.

As evidenced in this paper, the strategy discussed to cultivate global leadership skills among engineering students via the Global Engineering Fellows program's gateway course was effective. This is consistent with scholarly assertions that there is a role for curricula that foster cultural awareness and intercultural communication skills to improve global leadership abilities [5, 6]. The participants exhibited gains in their skills along with enthusiasm and motivation to undertake further global engagement. To a practitioner in the field of global engineering education, this is exciting. However, gateway course students are a subset of a significantly larger population of global experience alumni (at the Pennsylvania State University's College of Engineering and across peer engineering colleges). Thus, a question remains: *How can the enthusiasm of global experience participants be harnessed into scalable, sustained momentum to forge global leaders?*

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