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Advancing Global Engineering Competency through Alumni and Student Perspectives

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Abstract

This paper contributes to an ongoing assessment on how including global leadership training in the engineering curriculum can support professional success. Specifically, alumni of the Global Engineering Fellows program at the Pennsylvania State University are surveyed. Many of the alumni have professional experience in international contexts. The goal was to identify and rank the global competencies most critical to their careers. Respondents also reported their years of experience and regions of employment, as well as perceptions of program differentiators, enabling analysis of potential trends across experience levels, geographic regions, and program structures.

To compare views across stages of professional development, current students in the Global Engineering Fellows program, who have participated in university supported global experiences were also surveyed to rank the anticipated importance of global skills in their future careers. Comparing alumni and student perspectives provides insight into whether global competency development evolves over time and its connection to professional growth.

To define a set of global skills relevant to engineering students, this paper drew upon three established frameworks, the OECD Global Competence Framework, the AAC&U VALUE Global Learning and Intercultural rubrics, and ABET student outcomes. These frameworks were integrated to generate a competency list for respondent evaluation. This paper contributes to continuous improvement efforts in the Global Engineering Fellows program and is part of a broader longitudinal assessment into the impact of global learning experiences in engineering education.

Introduction

High impact, experiential learning is a university level priority that is complemented by the College's vision of producing engineers who possess the abilities to lead globally. Professional skills, such as global competence are essential in today's interconnected context. In an increasingly interconnected engineering workforce, graduates are expected to communicate effectively across cultures, collaborate in global teams, and adapt to diverse professional environments. For nearly a decade, a global leadership training program at the Pennsylvania State University's College of Engineering has encouraged generating momentum in the development of global competencies that were initiated in engineering students during their international experiences, spanning study, research, or internships abroad. The Global Engineering Fellows program in which these internationally mobile students participate is designed to build upon their global skills. This program, which is for returnees from international experiences, includes a required entry course which has been discussed extensively in a previous ASEE paper [1]. As part of the present assessment, the College sought to incorporate real world perspectives from alumni to provide a thoughtful rationale to the skills developed through the program's curriculum. It answers the question, is content being taught that meets the need? To that end, a survey, including a global competencies ranking list, was distributed to alumni and

students. The results of this survey and its relevance to the global engineering program are discussed in this paper.

Although prior work has defined global competencies conceptually, this study contributes empirical insight into how engineering alumni and students prioritize these competencies relative to one another within a structured program context.

While improving teaching methods, honing one's craft, and pivoting as student feedback is internalized, in a continuous improvement process, it is equally important to periodically verify the curricular heading, and when necessary, make course corrections. For as any navigator understands, being even a few degrees off course can lead to an unintended destination. Thus, this exercise was to determine whether the College is on course and whether a heading correction should be considered.

Consistent with the abovementioned objective, in this assessment, global competencies were identified and ranked in terms of their importance for careers by both students and alumni who participated in the College's Global Engineering Fellows program. Although this paper provides a snapshot from one College, the methods employed and results discussed may be of interest to any engineering program that prioritizes the development of global competencies in their students.

Evaluation of global competencies

Identification of global competencies for ranking criteria

The first step in evaluating which global competencies are ranked most highly by alumni and students, and subsequently how such a ranking compares between alumni and students, was to define a list to rank. Global competencies and related terms have been defined by practitioners and researchers in the field of international education in many ways, although they have not always been narrowed to a few words suitable for a ranking. Deardorff ,whose work relates to global competencies, conducted a seminal study, cited by nearly 8,000 scholars. One of its goals was to determine a definition of intercultural competence. It incorporated extensive input from international scholars and administrators and concluded "there is no real agreement among administrators on the terminology to use in referring to intercultural competence" [2]. Focusing on global leadership competencies, Jokinen's article, which has also been highly referenced (800+ at the time of this writing), discussed *Global leadership competencies: a review and discussion*. Jokinen synthesized the concept by saying, "global leadership competencies are seen as those universal qualities that enable individuals to perform their job outside their own national as well as organizational culture, no matter what their educational or ethnical background is, what functional area their job description represents, or what organization they come from" [3]. Shifting the emphasis to the workforce, Cumberland et al., in their review of literature to assess the development of global leadership competencies in the workplace concluded that there is a gap in the literature pointing to "the need for a more coherent understanding of what global leadership competencies are needed in different contexts" [4]. While this background is a valuable foundation from which one can view global competencies broadly, this paper sought to gather practical perspectives from recent industry-facing engineering alumni. This objective

necessitated the creation of global competency constructs that could be easily understood and ranked, yet rooted in a credible framework that merged academic, engineering, and workforce perspectives.

Competency list for respondent evaluation

To arrive at a simple, yet reliable list, the OECD Global Competence Framework, the AAC&U VALUE Global Learning (GL) and Intercultural Knowledge and Competence (IKC) rubrics, and ABET student outcomes were used to define a set of global skills relevant to engineering students. These four frameworks provide credibility as they are authoritative, widely adopted, evidence-informed, and aligned with higher-education and engineering accreditation practice. Together, they provide complementary perspectives: policy-level, pedagogical, and accreditation-driven for defining global skills relevant to engineering students. The OECD Global Competence Framework was developed by an international, intergovernmental organization with extensive experience in education benchmarking [5]. According to OECD, "Global Competence is a multi-dimensional construct that requires a combination of knowledge, skills, attitudes and values successfully applied to global issues or intercultural situations" [6]. The AAC&U VALUE rubrics were developed through a national, faculty-driven consensus process and are widely used for learning outcomes assessment in U.S. higher education [7, 8]. Finally, ABET Student Outcomes represent the formal accreditation standard for engineering programs in the United States and many other countries, ensuring disciplinary relevance and alignment with professional expectations [9]. These frameworks were examined for overlap in global skill constructs, and each construct was mapped to a labeled survey skill using language consistent with that found in the source documents. Construct labels were derived inductively through comparison of language used across the OECD, AAC&U, and ABET frameworks, with labels selected to reflect the most consistent and representative terminology across sources.

Table 1. Crosswalk of Global Engineering Competencies Across OECD, AAC&U, and ABET Frameworks

Survey Skill	**OECD Framework (2018) [6]**	**AAC&U VALUE Rubrics' Dimensions [7, 8]**	**ABET Student Outcomes (2025–26) [9]**
Cross-cultural communication	"appreciation for respectful dialogue, desire to understand the other"	Intercultural Communication, Empathy (IKC rubric)	"Communicate effectively with a range of audiences"
Intercultural sensitivity/ humility	"Understand and appreciate perspectives/ worldviews of others"	Global Self-Awareness, Openness, Curiosity (GL rubric)	Ethical/professional responsibility in global context
Adaptability/ flexibility	"they can flexibly adapt their behaviour;" "readiness to respond	"flexibly to unfamiliar ways of being" (IKC rubric)	"having no obvious solution, addressing problems not encompassed by current

	to a given local, global or intercultural issue or situation")		standards and codes" (complex engineering problems)
Teamwork in multicultural/ global teams	"Take action for collective well-being and sustainable development;" "interact with people from different cultures"	Empathy; "meaningfully engage those others" (IKC rubric)	"function effectively on a team"
Global/ contextual knowledge	"Examine issues of local, global, and cultural significance"	"Understanding Global Systems" (GL rubric)	"analyze and interpret data, and use engineering judgment to draw conclusions"
Cross-cultural leadership & negotiation	"Engage in interactions across cultures Engage in open, appropriate and effective interactions across cultures"	Perspective Taking, Engagement (GL rubric)	"provide leadership, create a collaborative environment"
Global engineering practices & standards	"higher-order thinking skills, such as selecting and weighing appropriate evidence to reason about global development"	"application of an integrated and systemic understanding" (GL rubric)	Apply engineering design with consideration of global factors
Project management across borders	"build a more just, peaceful, inclusive and environmentally sustainable world"	Personal and Social Responsibility; engagement (GL rubric)	Function effectively on a team; project planning & management
Stakeholder engagement & networking	"relationships in which all participants demonstrate sensitivity towards, curiosity about and willingness to engage with others and their perspectives"	Global Engagement; Civic responsibility (GL rubric)	Communication; recognizing societal context
Problem solving in resource-constrained or novel contexts	"create opportunities to take informed, reflective action"	Knowledge of Global Systems; Application (GL rubric)	Apply engineering design considering global/ economic/ environmental/ societal contexts

Survey distribution

As this study was conducted as part of a program assessment, a survey ranking the 10 global competency items was administered only to alumni of the Global Engineering Fellows program who were currently working in industry and to students who had completed the program's gateway course. The gateway course is designed to develop global leadership skills and serves as the feeder for students entering the Global Engineering Fellows program.

The survey was distributed anonymously to students and alumni via email and was administered using Microsoft Forms. The survey was sent to more than 100 program alumni, of whom 20 completed the survey. In addition, the survey was distributed to approximately 30 students who had completed the gateway course, with 15 students responding.

While these sample sizes are insufficient for broad generalization or inferential research claims, they are appropriate for program-level and course-level assessment purposes, and results are therefore interpreted descriptively.

Survey results

Alumni and students were asked to complete a survey that ranked global competencies. Alumni were asked to rank the competencies from most to least important based on their relevance to the global or international dimensions of their current professional work. Students were asked to rank the same set of global competencies according to how important they believed each would be to their future careers. In both cases, respondents were required to rank all competencies, thereby forcing a comparative judgment from highest to lowest importance. A forced-ranking approach was selected to require respondents to make trade-offs among competencies, rather than rating all skills as similarly important.

Across both alumni and student responses, the top five competencies accounted for more than 60% of the weighted rankings. To analyze the data, the Borda method [10] was used, with rankings assigned weights based on their position in the hierarchy. The highest-ranked competency was assigned a weight of 1.0, with each subsequent rank decreasing by 0.1. Because there were 10 total competencies, the lowest-ranked item received a weight of 0.1. Weighted rankings were then aggregated across respondents to determine final scores. The top five competencies identified for alumni and students are presented in Tables 2, 3.

Notably, 80% of the top-ranked global competencies overlapped between current students and program alumni, with the top three competencies identical across both groups: Adaptability / flexibility, Cross-cultural communication, and Teamwork in multicultural / global teams. (See Tables 2, 3) While both groups prioritized similar competencies, differences in relative ranking were observed. Students ranked cross-cultural communication more highly, whereas alumni placed greater emphasis on adaptability and flexibility.

One possible explanation for these differences is the immediacy of communication challenges experienced by students during international travel or coursework, where interaction across cultures is unavoidable and highly visible. In contrast, adaptability and flexibility may be less immediately apparent to students but become more salient in professional practice. Importantly,

both students and alumni demonstrate substantial alignment in their assessment of competencies relevant to career success. This alignment may reflect the benefits of global experiences in engineering education, the influence of the gateway course, or a combination of both.

Table 2. Top Ten Student Ranked Global Competencies

Current Students	Weighted Sum	Weighted %
1. Cross-cultural communication	12.3	15%
2. Teamwork in multicultural / global teams	11	14%
3. Adaptability / flexibility	10.2	13%
4. Cross-cultural leadership & negotiation	9.9	12%
5. Problem solving in resource-constrained or novel contexts	7.4	9%
6. Global engineering practices & standards	6.9	9%
7. Intercultural sensitivity / humility	6.2	8%
8. Stakeholder engagement & networking	6.2	8%
9. Global / contextual knowledge	5.5	7%
10. Project management across borders	4.5	6%

Table 3. Top Ten Alumni Ranked Global Competencies

Program Alumni	Sum of Weighting	% of Weighting
1. Adaptability / flexibility	17.5	16%
2. Teamwork in multicultural / global teams	15.6	14%
3. Cross-cultural communication	14.9	14%
4. Problem solving in resource-constrained or novel contexts	10	9%
5. Intercultural sensitivity / humility	9.5	9%
6. Global / contextual knowledge	9.3	9%
7. Stakeholder engagement & networking	9	8%
8. Cross-cultural leadership & negotiation	8.9	8%
9. Project management across borders	7.6	7%
10. Global engineering practices & standards	5.8	5%

To ensure that the identified global competencies used in the ranking did not overlook relevant skills, respondents were given the opportunity to indicate additional global competencies they felt were missing from the list. One minor theme emerged, with approximately 15% of alumni

identifying foreign language proficiency or language humility as an additional global competency.

The survey also recorded the geographic regions in which respondents gained global experience. (See Table 4) For students, this referred to the location of academic research, internships, or study abroad experiences. For alumni, this reflected regions in which they had professional global work experience. Twelve alumni selected "other," indicating that their primary experience had taken place within the United States. Respondents in both groups were permitted to select multiple regions, as individuals could have experience across more than one geographic area. Numerous participants selected multiple locations in their responses, indicating that they had experience in more than one geographic area. Given the small number of participants and the overlap in locations, it was not possible to analyze potential differences in destinations on the global competencies selected. Beyond the global competency ranking, no other observable trends were uncovered in the survey.

These data were also used to explore whether alumni with more extensive global professional experience responded differently from those with more limited global work exposure. The number of respondents in each subgroup was small and no noteworthy differences in competency rankings were observed.

Table 4. Regions of Experience

Region of experience	**Current Students (academic experiences)**	**Program Alumni (work experiences)**
Europe	9	7
Australia & NZ	4	2
Latin America & Caribbean	7	5
Sub-Saharan Africa	0	1
North Africa & Middle East	0	2
South Asia	1	0
East Asia & Pacific	2	2
Other	0	12
Total experiences	23	31

Discussion

The information gleaned from the data collected serves several purposes. First, it highlights the degree of alignment between students and alumni regarding the importance of particular global competencies. This may be a result of the intentionality of aligning the gateway course and student program's topics with scholarship from the international engineering field and the inclusion of global professionals as guest speakers. Furthermore, it provides insight into which

global competencies may warrant greater emphasis within the curriculum and co-curricular global engineering programs.

The findings suggest value in further exploring how alumni working in global contexts conceptualize and apply competencies such as adaptability and flexibility, teamwork in multicultural or global teams, cross-cultural communication, problem solving in resource-constrained or novel contexts, and intercultural sensitivity or humility. Gathering examples from current professional environments could inform curricular design and help prepare students for these contexts. In the interim, existing programs, including the gateway course and global experiences, can continue to deliberately refine these competencies, implementing a continuous improvement cycle. (See Figure 1)

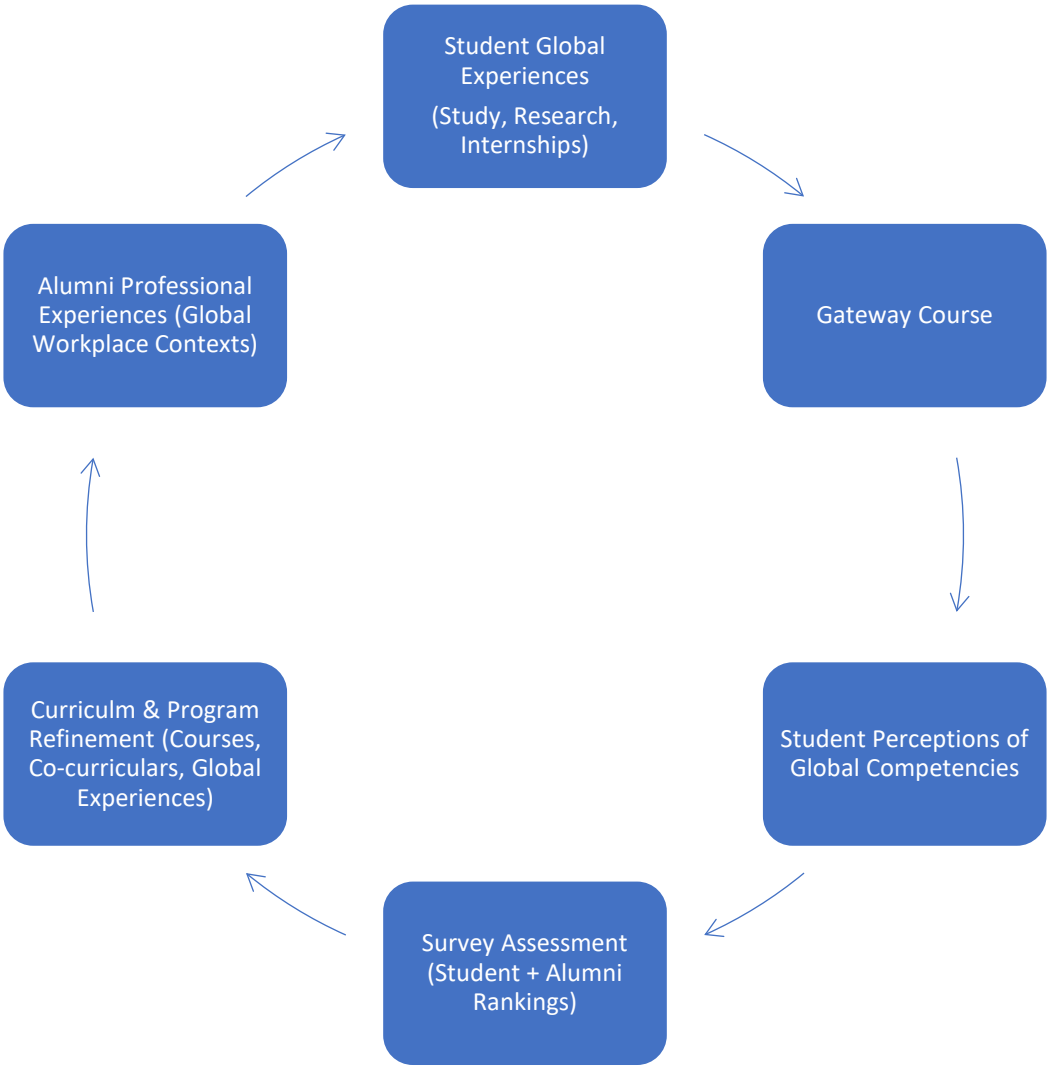

Figure 1. Advancing global competencies through a continuous improvement cycle integrating student and alumni feedback.

For example, flexibility and adaptability may be intentionally developed through international or intercultural learning experiences, while teamwork in multicultural or global teams could be strengthened through collaborative projects involving students from partner institutions. One potential approach is the incorporation of Collaborative Online International Learning (COIL) type projects, in which students work virtually with peers at universities around the world. Such experiences may provide structured opportunities to develop global teamwork, communication, and adaptability skills within the classroom.

Another area warranting further investigation is the emerging theme of foreign language proficiency or language humility. This finding is particularly noteworthy in an era when artificial intelligence tools increasingly support translation and communication, while virtual platforms such as Zoom or Microsoft Teams enable international access and collaboration with ease. Exploring why foreign languages remain salient, and how an engineering college might respond to this perceived need, represents a promising direction for future work.

With regard to the current curriculum, as discussed in prior ASEE work, existing assignments already align with many of the top-ranked global competencies [1]. Students are asked to reflect on moments in which they demonstrated adaptability and flexibility and to develop Cultural Intelligence (CQ), which supports effectiveness in cross-cultural communication and global teamwork [11]. Meanwhile, adaptability and flexibility may also be more intentionally embedded within study abroad programs or similar global experiences that provide opportunities for students to collaborate with peers at partner institutions. However, this represents an area for further investigation.

Limitations

This exploratory assessment reflects a single institutional context and a relatively small respondent pool, consistent with its purpose as a program-level assessment. Results should therefore be interpreted descriptively and may not generalize to all engineering programs. Additionally, rankings reflect perceived importance rather than demonstrated proficiency. Future work will expand the samples and explore longitudinal changes in competency prioritization. To more fully understand the relationship to global competencies and international engineering programs, as more data is gathered, it may be valuable to disaggregate the information. For example, respondents primarily indicated experience in Europe, Australia & NZ, Latin America & Caribbean. It is possible the rated competencies could change if respondent locations included a greater emphasis on Sub-Saharan Africa, North Africa & Middle East, South Asia, and East Asia & Pacific. Greater data could allow for the exploration of trends related to the participant profile and the impact of diverse geographic locations. Furthermore, global competencies in the curriculum, may need to follow institutional priorities. At the college where this assessment occurred, a new university strategic plan and evolving college strategic plan are under implementation. It is anticipated that they will have a role in driving focus areas for student outcomes and professional skills. Future work will need to align global competencies within these objectives.

Conclusion

This exploratory program-level assessment examined how engineering students and alumni prioritize global competencies using a framework-informed ranking approach. Results indicate strong alignment between the two groups, with substantial overlap in the highest-ranked competencies, suggesting that students' perceptions of global skill importance are largely consistent with professional experience. These findings may demonstrate that the design of the Global Engineering Fellows program and gateway course emphasize competencies relevant to graduates' careers as had been intended.

Importantly, the results offer input as part of a continuous improvement process, which can help inform curricular and co-curricular decisions related to global competency development. By periodically incorporating alumni perspectives alongside student feedback, the program can verify its curricular direction and make targeted adjustments as professional expectations evolve. While more data is needed, and the sample limited in scope, this assessment supports the college's ongoing efforts to align global engineering education with workforce needs and accreditation expectations. Lastly, the assessment yielded a list of global competencies from a synthesized, grounded framework. This artifact may be of interest to those in the field who wish to administer a global competencies survey to their constituents and stakeholders.

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