

Self-reported impact of undergraduate global experiences on engineering professionals' career outcomes

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1. Introduction

In recent years, there have been increasing calls to integrate global education into engineering curricula in response to the growing need to prepare engineers for a complex and interconnected professional landscape [1]. In turn, engineering programs have expanded investments in global initiatives that link international and intercultural experiences with traditional technical training [2]. Participation in these programs, including study abroad, research abroad, and globally oriented coursework, has steadily increased, and prior research has examined their outcomes, largely focusing on short-term impacts immediately following program completion. This body of work suggests that global educational experiences support the development of intercultural competence and related global learning outcomes among engineering students [3], [4], [5], [6], [7].

Despite these contributions, comparatively little is known about how undergraduate global experiences influence engineers after they transition into the workforce. Although preparing students for a globalized engineering profession is a central motivation behind the development of global programs, the long-term career implications of these experiences remain underexplored. In this paper, we address this gap by investigating the self-reported long-term career impacts of undergraduate global educational experiences among engineering alumni. Using a qualitative approach, we analyze responses to a single open-ended question embedded within a larger survey to examine how participants reflect on the enduring influence of their global experiences. By foregrounding alumni perspectives, this study advances conceptual understanding of career-related outcomes associated with global education and offers insights to inform global engineering program design, engineering education research, and the professional development of future engineers in an increasingly global workforce.

2. Background

2.1 Global Engineering Experiences and Competence Development

The current engineering landscape has been marked by accelerated technological advancements, evolving demographics, and expanding globalization, requiring engineers to develop skills and competencies necessary to effectively navigate continuous change throughout their careers [8]. Although traditional engineering curricula provide strong technical foundations, they often do not fully support the development of broader professional competencies that are essential for long term success [9]. As a result, experiential learning opportunities outside the classroom have become an important avenue for developing these capabilities. A central component of this preparation is intercultural competence, defined as the ability to communicate effectively and

appropriately in intercultural situations based on one's knowledge, skills, and attitudes [10]. However, effective engineering practice in global contexts requires more than intercultural communication alone. It also involves the ability to work across geographic, cultural, organizational, and disciplinary boundaries. Collectively, these capabilities are commonly referred to as global engineering competence (GEC), which captures the skills and dispositions uniquely relevant to engineering work in a global context [11].

Empirical research has demonstrated how international experiences play a significant role in the development of global engineering competency and intercultural competence among engineering students. Prior studies show that global courses enhance students' cognitive, intrapersonal, interpersonal, transversal, and intercultural skills [5], [12], [13]. Participation in study abroad programs has similarly been associated with increased intercultural competence, greater awareness of global perspectives [3], [4], [14], [15]. In addition, international research experiences contribute to students' personal and professional learning, cultural intelligence, adaptability, and preparedness to work effectively across cultural contexts [16], [17], [18]. Together, this body of work highlights how global experiences, both domestic and international, can support the development of competencies essential for engineers operating in an increasingly globalized workforce.

2.2 Career Outcomes from Global Experiences

A growing body of research has examined how global engineering experiences shape participants' career-related outcomes, particularly in terms of interests, goals, and early career decisions. Davis and Knight [19] found that participation in the Rising Sophomore Abroad Program influenced students' interest in international career opportunities, with many participants reporting increased motivation to pursue globally oriented work. Similarly, Huang [20] demonstrated that study abroad experiences enhanced Chinese engineering students' employability by strengthening their resumes, refining career interests, and shaping subsequent career directions. Other studies have examined the influence of global experiences on educational and professional decision-making. Knight et al. [21] reported that participation in International Research Experiences for Students (IRES) programs supported alumni in making key career decisions, including applying to graduate school. Hunter et al. [22] further found that study abroad experiences facilitated the development of professional networks abroad, which influenced participants' decisions to work for multinational organizations. Together, these studies suggest that global engineering experiences can shape career pathways by influencing interests, opportunities, and professional preparedness, particularly in the period immediately following program participation.

Within the international education literature, a few studies have explored the long-term impact of global experiences on alumni learning and career outcomes. Across studies, evidence suggests that study abroad participation is associated with sustained global engagement, personal and professional development, and internationally oriented career trajectories years and in some

cases decades after program completion [23], [24], [25]. A longitudinal analysis spanning more than 25 years further indicates that study abroad fosters enduring personal growth and global awareness, particularly when programs incorporate experiential or service-learning components [26]. Additional research has further linked global experiences to the development of employability skills and increased motivation to pursue internationally oriented careers [27]. These studies suggest that global experiences exert a durable influence on alumni that unfolds over extended time horizons, shaping both professional pathways and broader global engagement. However, few of the studies that have explored these long-term outcomes have included engineering alumni as participants, due to the historic low participation rates of engineering students in study abroad programs.

2.3 Gaps in the Literature

Despite the well-established impacts of global educational experiences, several gaps remain in the literature. First, many studies exploring the outcomes of global undergraduate experiences assess impact immediately following program completion, while participants are still students or in the early stages of their career [12], [20], [28], [29], [30]. Consequently, less is known about how these experiences shape longer-term career development as graduates transition into professional engineering practice. Second, existing longitudinal and retrospective studies often examine general student populations and include relatively few engineering participants [22], [23], [24], [25], [31]. Thus, we lack understanding of the distinctive career pathways, professional competencies, and outcomes associated with global experiences in engineering contexts. Finally, there is limited qualitative research examining how alumni interpret the career impacts of their global experiences. Previous studies of global program alumni have all been large-scale surveys, which necessarily limit participants' ability to self-report the range of possible outcomes in their careers. In this study, we address these gaps by examining engineering alumni who participated in global experiences during their undergraduate education and investigating the perceived impact of these experiences on their career development through the lens of Social Cognitive Career Theory (SCCT). Specifically, we address the following research questions:

RQ1: How does participation in a global experience influence engineers' career development (as operationalized by SCCT constructs)?

RQ2: What types of performance domains and attainments do engineers highlight as outcomes of their global experiences?

3. Theoretical Framework

3.1 Social Cognitive Career Theory (SCCT)

This study is framed using Social Cognitive Career Theory (SCCT), which explains how individuals develop career interests, make career-related decisions, and attain performance outcomes through interactions among learning experiences, personal beliefs, and contextual factors [32], [33]. SCCT provides a useful framework for understanding how global engineering experiences shape engineers' beliefs, motivations, and behaviors. Central SCCT constructs include self-efficacy beliefs, outcome expectations, interests, choice goals, choice actions, and performance domains. Learning experiences shape self-efficacy and outcome expectations, which in turn influence interests. Interests inform choice goals, leading to concrete choice actions, which ultimately contribute to performance outcomes. Figure 1 provides an overview of the SCCT framework.

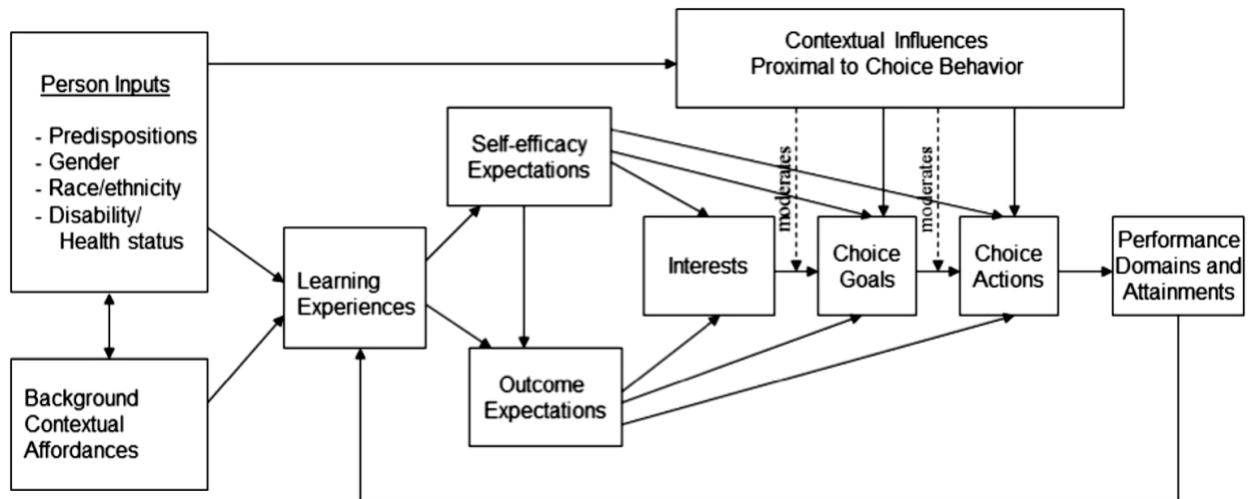


Figure 1. *The Social Cognitive Career Theory*

The definitions of SCCT constructs as operationalized in the current study are presented in Table 1. Each construct is linked to participants' global experiences, illustrating how international exposure may influence beliefs, motivations, and behaviors.

Table 1. *Definitions of SCCT Constructs as Operationalized in this Study*

Construct	Definition
Learning experiences	Any activity that is educationally or occupationally related to one's goals. Reflective statements describing what was learned, not necessarily tied to a specific SCCT construct.
Self-efficacy expectations	Beliefs about one's capability to perform tasks, succeed in a domain, or navigate challenges. This is about confidence, not outcomes.
Outcome expectations	Beliefs about the consequences of performing a task ("if I do this, what will happen?"). Beliefs about the future consequences or benefits of career choices are influenced by global experience.
Interests	Enduring patterns of likes, dislikes, and preferences for particular activities, tasks, or occupational domains. Developed or strengthened personal preferences, passions, or curiosity due to the global experience. This is internal motivation, not behavior and not goals.
Choice goals	The intention or aspiration to pursue a particular activity. Future-oriented intentions or aspirations influenced by the global experience. Reflect planned directions, not actions already taken.
Choice actions	The action of either achieving or abandoning a set goal. Concrete behaviors, steps, or actions taken because of the global experience. These are observable behaviors tied to immediate or early decision-making.
Performance domains and attainments	The goal fulfillment or skill development that occurs once a course of action has been taken. Concrete skills, competencies, accomplishments, or achievements that participants attribute to their global experience.

SCCT is particularly well-suited for examining the career impacts of global engineering experiences because these programs function as intensive learning contexts that expose students to unfamiliar professional, cultural, and social environments. Prior SCCT research with engineering populations has demonstrated that self-efficacy, outcome expectations, and contextual supports and barriers are key predictors of career choice behavior and persistence [34]. By framing global experiences as formative learning events within SCCT, this study examines how the experiences influence engineers' career-related beliefs, interests, goals, and actions over time.

In our second research question, we focus specifically on the final construct of SCCT, performance domains and attainments. This construct refers to areas of competence and professional functioning in which individuals develop and show their capabilities [32]. These domains cover both task-specific skills and broader professional competencies, such as communication, adaptability, collaboration, and leadership. Performance outcomes within these domains contribute to the development of self-efficacy beliefs and shape future interests and career-related decisions. Global engineering experiences have the potential to influence a wide range of performance domains by putting students in contexts that require cross-cultural communication, problem-solving, and adaptation to different engineering practices. In this study, examining performance domains and attainments provides valuable insight into how alumni perceive the professional outcomes of their global experience and how these outcomes intersect with broader career trajectories.

4. Methods

4.1 Research Design

This study involves a qualitative analysis embedded within a larger mixed-methods survey study. The larger study focuses on a survey of three long-running (10+ years) global engineering programs at different universities in the United States. These universities include a Midwestern land-grant university (Purdue University), a New England public university (University of Rhode Island), and a Midwestern public research university (University of Cincinnati). All three are large or very large public research universities with broad engineering discipline offerings. According to the Integrated Postsecondary Education Data System (IPEDS), in 2023, the three institutions awarded between 316 and 2,413 engineering bachelor's degrees, representing 8.9–26.6% of all undergraduate degrees [35]. These figures represent the most recent data available at the time of this study. The size, longevity of global engineering programs, and large engineering graduating cohorts of these programs supported the feasibility of recruiting a substantial alumni sample.

Participants were recruited from two groups: alumni who completed one of the global engineering programs and a comparison group of alumni from the same institutions who did not participate in a global program during their undergraduate studies. For this study, global experiences included short-term study abroad programs (less than three months), semester- or year-long study abroad, international internships or co-ops, and research experiences conducted abroad. We focused specifically on responses to a single open-ended survey question completed by alumni with global program experiences. This qualitative component enables an in-depth examination of participants' reflections on how their global experiences shaped their professional development and perspectives. By analyzing open-ended responses within the broader survey context, this embedded approach provides nuanced insights that complement and extend the quantitative findings reported elsewhere [36].

4.2 Participants

The analytic sample for this study included only individuals who indicated prior participation in global programs that required students to spend at least one semester abroad through study or internship experiences. At the time of the survey, respondents ranged from 1 to 31 years post-graduation, allowing for examination of perceived impacts across career stages. Of the 595 global program alumni who participated in the larger study, 426 provided valid responses to the open-ended survey question analyzed in this paper. Our study was approved by the Purdue Institutional Review Board (IRB # IRB-2024-354), and all participants indicated consent to participate in the study at the start of the survey.

4.3 Data Collection

We collected data for this study as part of a larger survey that was designed based on SCCT to understand the career impacts of undergraduate global experiences. The survey was distributed

electronically and included both closed-ended items and open-ended questions designed to capture participants' educational and professional experiences. All participants received \$15 gift cards for completing the survey. Our analysis for this paper focuses on responses to an open-ended survey question completed only by alumni with global program experiences: *"What other impacts have the global educational programs you participated in as an undergraduate student had on your career path so far? Please share with us any impacts on professional growth, skill development, overall perspective, or other outcomes that you feel have been important for your career or you personally."* This question was included in the broader survey to elicit detailed qualitative insights into how global experiences have shaped the career trajectories of the participants. Participants could write as much as they wanted in response to this question, and most responses were 2-4 sentences long.

4.4 Data Analysis

We analyzed the data in two stages aligned with the research questions and guided by Social Cognitive Career Theory (SCCT). To address RQ1, we conducted deductive coding using the SCCT-aligned codebook shown in Table 1 in Section 2, which includes learning experiences, choice actions, choice goals, interests, outcome expectations, self-efficacy expectations, and performance domains and attainments. We coded the responses at the excerpt level, with multiple codes permitted when applicable, and used Microsoft Excel to support transparency and collaborative review. To assess coding reliability, two researchers independently double-coded a subset of responses. An initial interrater reliability check yielded moderate agreement, prompting refinement of the SCCT codebook. A second reliability check using the revised codebook demonstrated substantial agreement (Cohen's $\kappa = 0.75$) [32]. We resolved the remaining discrepancies through consensus, and the finalized codebook was applied to the full dataset.

To address RQ2, we conducted an inductive thematic analysis of responses coded under the SCCT performance domains and attainments construct ($n = 203$). We began with in vivo coding to remain grounded in participants' language [38]. To reduce researcher projection, both researchers independently applied initial in vivo codes and then compared coding decisions to assess consistency in data selection. The researchers subsequently met to examine and reconcile initial codes, mapping them onto one another to develop a shared preliminary codebook [39]. These codes were then iteratively grouped into emergent themes through discussion and consensus-building with all authors on the paper. This inductive process enabled us to identify the specific types of performance outcomes engineers attributed to their global education experiences.

Trustworthiness strategies: To enhance the trustworthiness of this study, we employed multiple strategies, including the use of multiple coders, interrater reliability checks, and peer debriefing. To assess coding reliability, two researchers independently double-coded a subset of the data. An initial interrater reliability check showed moderate agreement between coders (Cohen's $\kappa = 0.45$), prompting refinement of the SCCT codebook to clarify overlapping constructs. A second

reliability check using the revised codebook demonstrated substantial agreement (Cohen's $\kappa = 0.75$), after which remaining discrepancies were resolved through consensus, and the finalized codebook was applied to the full dataset. Peer debriefing further supported analytic credibility, with a third researcher reviewing the finalized codes and emergent themes to evaluate their coherence, alignment with the research questions, and consistency across the dataset.

5. Findings

5.1 Global Experience Influence on Career Development (RQ1)

To address RQ1, we examined how participation in a global experience influences engineers' career development using SCCT as an analytic framework. Figure 2 presents the distribution of coded excerpts across the SCCT dimensions used to address RQ1. The counts shown in Figure 2 represent the number of coded excerpts associated with each SCCT construct rather than unique participants. Responses were coded at the excerpt level, and individual participants frequently contributed multiple excerpts, including multiple excerpts coded to the same SCCT construct (e.g., multiple performance domains or attainments). These counts are provided to illustrate the relative salience of different influences described by participants, rather than to suggest statistical prevalence.

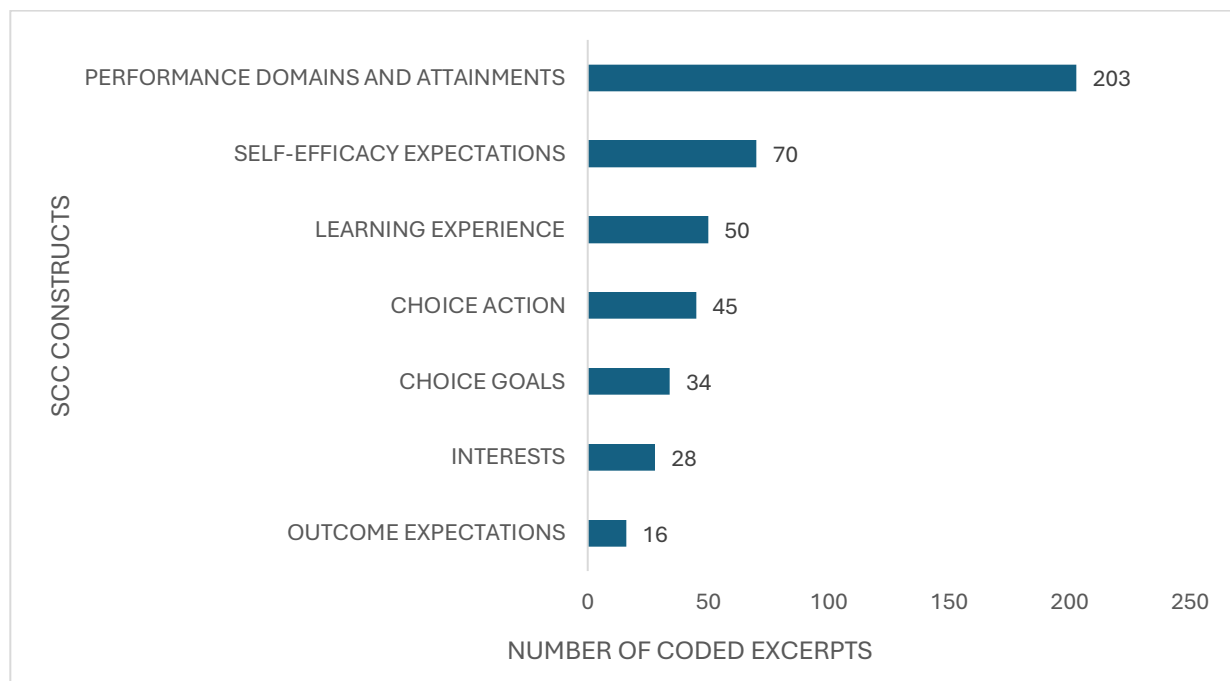


Figure 2. *Distribution of SCCT-Aligned Coding Across Qualitative Responses*

Note: Counts represent the number of coded excerpts associated with each SCCT dimension; individual responses could be coded to multiple dimensions.

As shown in Figure 2, participants most frequently described the influence of global experiences in terms of performance domains and attainments, followed by self-efficacy expectations and learning experiences. References to choice actions, choice goals, and interests appeared less frequently, while outcome expectations were least commonly articulated. This distribution suggests that alumni most often framed the impact of global experiences through accounts of professional growth, skill development, and increased confidence, with comparatively fewer references to anticipated future outcomes.

The following sections elaborate on how participants described multiple ways in which their global education experiences influenced their career development, illustrating these patterns with representative excerpts. We present the findings aligned with each of the SCCT constructs and report them in the order that the constructs occur within the SCCT framework (see Figure 1). We refer to participants using their participant identification numbers (PID) to protect participant confidentiality.

Learning Experience

Participants described global education experiences as influential learning events that occurred outside traditional classroom environments. These experiences included navigating unfamiliar cultural contexts, relying on others, and managing challenges independently. One participant reflected on the transformative nature of being immersed in a foreign context, noting, *“The unique experience of being an outsider is hugely humbling and a great experience for any American to have for sure. It’s so mind expanding to see how other people view your home country and your culture. The need to ask for help, rely on others, and develop resilience to overcome setbacks in a foreign place is really powerful”* (PID 163). Another participant emphasized the centrality of international experiences to their undergraduate education, positioning them as more impactful than formal coursework, stating that *“my international experiences were the cornerstone of my undergraduate education”* and that they *“learned much more from them than I did in any classroom”* (PID 87). These accounts highlight the role of global experiences as salient learning events that fostered reflection, resilience, and perspective-taking, reinforcing their influence on participants’ broader development.

Participants also highlighted the flexibility of global programs as an important learning affordance. Some described how customizable program structures allowed them to pursue individualized interests and engage deeply with topics they found meaningful. As one participant explained, *“GEARE had such a customizable track”* and that they *“could really pick something [they were] interested in and go do it”* (PID 316). Similarly, another participant reflected, *“It allowed me to pursue interests during school and ultimately changed my perspective on my interests in continuing to pursue global opportunities”* (PID 104). The flexible program structures functioned as enabling learning contexts that supported interest development and reinforced participants’ motivation to pursue globally oriented opportunities.

Self-Efficacy Expectations

Participants frequently described global education experiences as contributing to increased confidence in communication, adaptability, and functioning in unfamiliar or cross-cultural environments. Several participants described gaining confidence through independent international experiences, which they viewed as transferable to professional contexts. One participant shared, *“I went abroad by myself, and I think this instilled a large amount of confidence in my abilities on a personal level,”* noting that this confidence later *“translated to [their] professional confidence”* (PID 68). Others described specific experiences that contributed to confidence development. For example, one participant described how delivering a technical presentation in a second language became a pivotal moment for confidence development, stating that *“once you successfully give a 20-minute technical talk in your second language to a group of neurosurgeons in a foreign hospital system, every other presentation seems simple”* (PID 237). These quotes illustrate how global education experiences served as developmental contexts for building communicative self-efficacy and adaptive confidence, which participants perceived as directly transferable to their professional engineering practice.

Participants also noted feeling prepared to work in diverse professional settings, stating that they felt *“better prepared to handle working in cross-cultural teams”* and to have *“confidence in uncomfortable or unfamiliar environments”* (PID 89). One participant noted that they felt *“more comfortable working in a professional environment with people of different cultures and backgrounds”* (PID 34). Global engineering experiences strengthened participants’ self-efficacy by providing opportunities to test and affirm their ability to perform in challenging, unfamiliar, and culturally diverse settings.

Outcome Expectations

Though this code was less common, some participants described how their global experience shifted their expectations related to personal growth, career impact, and life direction. Several participants described these experiences as having enduring consequences that they expected to shape their professional trajectories over time. One participant stated that *“a global educational program is a life-changing experience”* and that *“experience carries with you throughout your whole career”* (PID 1). Others discussed expectations related to increased maturity and independence, particularly as they navigated adult responsibilities while abroad. For example, one participant reflected that the experience helped them understand *“what it means to be an adult by having a job, having to pay rent and utilities, and seeing a lot of the world”* (PID 232). These reflections suggest that participants viewed global experiences as formative in shaping expectations about personal responsibility and professional readiness. Participants also reported expectations related to work-life balance, including one participant who explained, *“Personally, I want a good work-life balance, which I feel I am able to achieve better in Europe than in Asia or in the United States”* (PID 119). These accounts indicate that global education experiences

influenced participants' longer-term expectations about career pathways, professional values, and life priorities.

Interests

Participants reported changes or expansions in academic and professional interests following their global experiences. Some participants described discovering new interests that guided later educational pursuits. One participant explained that *“by becoming fluent in a second language and making connections with other multilingual people,”* they became *“excited about language acquisition and processing in the brain,”* which led them to pursue a PhD in biomedical engineering (PID 237). Others described sustained interest in global engagement that persisted beyond their undergraduate experiences. Several participants noted that early participation in global programs motivated them to continue seeking international or cross-cultural opportunities, with one stating that *“participating in global programs in undergrad set [them] up to always seek global work and diverse perspectives”* (PID 4). Several participants also expressed interest in continued intercultural interaction in both personal and professional contexts. As one participant reflected, they *“learned [they] enjoyed interaction with other cultures”* and hoped to have *“more interaction with these cultures in [their] personal and professional life”* (PID 296). Global education experiences functioned as catalysts for interest development, shaping participants' academic trajectories and reinforcing sustained engagement with global and intercultural dimensions of engineering practice.

Choice Goals

Participants articulated career-related goals involving working abroad, pursuing graduate education, or seeking global impact. One participant described a change in long-term plans, stating, *“I did not think about working abroad before, but now my plan is to work in a different part of the world every year or two”* (PID 16). Others described educational and relocation goals, emphasizing how global experiences influenced their intended next steps. For example, one participant explained, *“I will be attempting to attend graduate school or move abroad in the coming years”* (PID 88). Some participants emphasized global impact as a guiding goal. One participant described how *“the opportunity to have a global impact catalyzed my need to find a career where I can have a global impact”* and provided *“a much stronger north star for my life”* (PID 5). These experiences shaped participants' long-term intentions by expanding their envisioned career pathways, educational plans, and aspirations for globally oriented impact.

Choice Actions

Participants described actions taken following their global experiences, including career pivots, job selection, and educational decisions. One participant stated that their global experiences *“inspired me to make almost a 180 turn in my career and pursue a graduate degree internationally”* (PID 33), illustrating how exposure to global contexts prompted a significant

redirection of career trajectory. Others described selecting employment based on international opportunities. For example, one participant noted that *“when choosing a first job out of college, I only pursued opportunities that would allow me to live or work abroad”* (PID 44). Such accounts suggest that global experiences influenced not only participants’ aspirations but also the criteria they used when making concrete career decisions. Several participants linked their career trajectories directly to global program participation. One participant summarized this influence succinctly, stating that *“my entire career after undergrad stemmed from participating in the [Program Name]”* (PID 492). Overall, these narratives indicate that global education experiences not only shaped participants’ aspirations but also directly guided their concrete career and educational choices, leading to tangible actions aligned with their interests.

Performance Domains and Attainments

In this most common code, participants reported professional outcomes associated with their global experiences, including employment opportunities, promotions, and cross-cultural competencies. For example, one participant attributed their initial job attainment to skills gained through international exposure, stating, *“I got my first job because I could speak German”* (PID 211). More broadly, participants emphasized that global experiences supported their ability to perform effectively in professional contexts, particularly when working across cultural boundaries. One participant noted that they were able to *“understand where culture is impacting project progress”* and *“communicate to the different motivations of [their] international partner”* (PID 20). Others noted that these competencies remained salient across roles, explaining that global experiences *“helped me take a more global perspective and better collaborate with international teams”* (PID 133). Collectively, these accounts indicate that global engineering experiences contributed to career-related attainments by equipping participants with capabilities and qualifications that supported their professional effectiveness. The specific types of performance domains and competencies highlighted by participants are examined in greater detail in the findings for RQ2.

5.2 Performance Domains Described in Participant Responses (RQ2)

In the analysis for RQ1, we coded two hundred and three responses under the performance domain dimension of the SCCT framework. We then carried out inductive analysis of these responses to address RQ2 and identified three overarching themes, each comprising three sub-themes. Table 2 summarizes these themes along with definitions and frequency counts.

Table 2. *Performance Domain Themes, Sub-Themes, Frequencies, and Definitions*

Themes	Sub-Theme	Count	Definition
Mindset Shift	Broadened perspective	43	Thinking globally, developing a bigger-picture, global view that shapes how people approach work and life.
	Cultural awareness	47	Recognizing and accounting for cultural differences when collaborating, planning, and making decisions.
	Confidence & personal growth	30	Increased independence, maturity, assertiveness, empathy, and comfort operating outside one's comfort zone.
Skill Development	Language development	33	Gaining and using foreign-language skills (e.g., French, German, Spanish, Mandarin) in professional and personal contexts.
	Multicultural teamwork	34	Working effectively with diverse/global teams and building rapport across cultures.
	Professional skills	28	Strengthening workplace skills such as leadership, teamwork, and interpersonal effectiveness.
Career Impact	Job acquisition	31	Resume/interview advantages and employer interest that lead to offers, rotational programs, or first roles.
	Career advancement	28	Promotions, role changes, international assignments, or strategic career decisions influenced by global experience.
	Professional networks	14	Lifelong connections who are pivotal to career advancement.

Theme 1: Mindset Shift

This theme captures participants' reflections on how global experiences transformed their worldview, cultural understanding, and sense of self. Within this theme were three sub-themes: Broadened Perspective, Cultural Awareness, and Confidence & Personal Growth.

Broadened Perspective (n = 43). This was the second most frequently identified sub-theme among the 203 coded excerpts. Participants described developing a global, big-picture orientation that influenced how they approached problem solving, collaboration, and professional decision-making. Alumni frequently emphasized increased openness, curiosity, and adaptability when navigating complex or unfamiliar contexts. As one participant explained, *"It has helped me take a more global perspective and better collaborate with international teams.... In general, it helps me to remain open-minded and to maintain curiosity which helps me to be resilient and learn to better navigate diverse situations and adversities"* (PID 133). Such broadened perspectives facilitated stronger interpersonal relationships and more effective engagement with individuals from diverse cultural backgrounds. Another participant noted, *"Having a broader view of things and an added perspective, which is very much an advantage that I could bring to*

the table within my professional career” (PID 50). Overall, participants’ experiences fostered a more expansive worldview that participants actively applied in their work.

Cultural Awareness (n = 47). Cultural awareness was the most frequently cited sub-theme within this category. Participants emphasized heightened sensitivity to cultural norms, values, and communication styles, as well as increased ability to navigate cross-cultural interactions in professional settings. Reflecting on this development, a participant noted, *“As mentioned above, it provided me with the foundation to understand how cultural differences need to be accounted for when working with international teams. It also gave me the jump start on peers when traveling internationally, I felt comfortable from day 1 out of school going overseas. Somewhat trivial, but I bring up my experience in GEARE quite often with international colleagues and it's a great conversation topic”* (PID 7). Participants also described improved reflexivity regarding their own cultural assumptions. As one Participant explained, *“...I am able to understand where culture is impacting project progress. I have a better awareness of my own culture and the cultural biases of my own team when communicating cross-culturally. I am able to see and communicate to the different motivations of our international partner...”* (PID 20). These reflections suggest that global experiences contributed meaningfully to participants’ intercultural competence in professional contexts.

Confidence & Personal Growth (n = 30). Participants frequently attributed increased self-confidence, independence, maturity, and emotional resilience to their global program experiences. This sub-theme extends beyond self-efficacy expectations, which focus on confidence to perform specific tasks, to capture broader personal, behavioral, and attitudinal development. Many participants described overcoming academic, linguistic, or cultural challenges that reshaped their self-perceptions and professional identities. A participant reflected, *“...Indirectly, my study abroad experience rose my level of confidence to new roofs. Learning engineering classes in another language while I learned that language was one of the hardest things I've ever done in my life. Coming out on the other side made me unstoppable. My calm and warm demeanor in high-stress situations is possible because I always know that I've been through tougher and come out on top. And this trait was well noticed in all roles of my career and a factor that has helped me to stand out and thrive in every situation I've been put in”* (PID 96). Such experiences appeared to foster sustained confidence and composure in high-pressure professional situations. Another participant noted, *“The confidence, independence, and maturity I developed while abroad has helped me tremendously. I've often found these traits further developed than many others my age or at this point in their career. It has helped me stand out for unique opportunities and has helped me grow quickly both personally and professionally”* (PID 269). These accounts highlight how global experiences contributed to participants’ long-term personal growth, shaping professional demeanor, adaptability, and readiness to navigate complex workplace environments.

Theme 2: Skill Development

Alumni consistently attributed the development of transferable skills to their participation in undergraduate global programs. Three sub-themes emerged: Language Development, Multicultural Teamwork, and Professional Skills.

Language Development (n = 33). Participants reflected on gains in foreign-language proficiency and confidence using those languages in both professional and personal contexts. Immersion experiences were particularly influential. As one participant described, *“Prior to my participation in the International Co-Op Program and 8 months living and working in Japan, I used to say I studied Japanese. Through my daily experience practicing listening and conversation with my Japanese colleagues, I developed the proficiency level at which I was confident to start saying I speak (not just study) Japanese”* (PID 215). These linguistic gains often reduced communication barriers and strengthened workplace relationships. Another participant reflected, *“I was never close to becoming fluent in Mandarin but learned enough to break down barriers with team members either within my organization or on the client or contractor side”* (PID 8). Beyond formal language acquisition, these experiences enhanced their ability to actively use the language in real-world settings, enabling more effective communication, collaboration, and cross-cultural engagement.

Multicultural Teamwork (n = 34). Participants emphasized enhanced ability to collaborate effectively with culturally diverse teams. Global experiences supported improved communication, empathy, and coordination across geographic and cultural boundaries. Language skills and cultural familiarity were frequently described as facilitating trust and team cohesion. An example of how a participant described this outcome is one who said, *“I have noticed that having spent time in Asia as well as speaking Mandarin has helped me work more collaboratively and effectively with my colleagues especially from our sites in Asia. As a result, it has helped me facilitate the communication of our teams across world regions. I also notice that speaking the language makes my colleagues more comfortable and at ease when working together on projects”* (PID 265). Another participant reflected, *“My experience abroad helped me develop my intrapersonal skills, my problem-solving abilities, my ability to work harmoniously with diverse groups of people”* (PID 47). These accounts illustrate how global programs foster teamwork skills that participants continue to apply in professional settings.

Professional Skills (n = 28). Participants also highlighted growth in broader professional competencies, including communication, leadership, adaptability, and interpersonal effectiveness. These skills were often described as distinguishing factors in professional settings. One participant explained, *“In addition to my research interests, I am more confident in my communication and presentation skills due to my experiences abroad. Once you successfully give a 20-minute technical talk in your second language to a group of neurosurgeons in a foreign hospital system, every other presentation seems simple. I am more flexible and better able to adapt to new situations, and I feel like I am able to approach interactions with others from a*

more understanding perspective now. My time abroad has also been useful for bringing up in interviews and fellowship applications, as there were so many situations from then that exemplify my skills and adaptability in ways that a traditional undergraduate experience might not” (PID 237). Other participants felt it enhanced their interpersonal communication skills in more of a professional context, including one alumnus who said, *“it was extremely helpful in helping my ability to communicate with coworkers from all over and explain my ideas and point in more simple language”* (PID 184). Overall, global experiences provided opportunities to develop professional skills that participants later leveraged in their careers.

Theme 3: Career Impact

Participants described meaningful career outcomes associated with their global experiences, including employment opportunities, advancement, and professional networks.

Job Acquisition (n = 31). Many alumni reported that global experiences strengthened their resumes and served as focal points during interviews, often contributing to job offers. Participants emphasized that employers valued the skills and perspectives gained through international experiences. As one participant explained, *“My global experiences were a big talking point during interviews when I was looking for a full-time job after graduating. The skills I learned during my time abroad were valued by my employer and helped me get hired”* (PID 148). Similarly, another participant noted, *“It was a very interesting point on my resume that sparked a few conversations during a very competitive interview process, which helped me find the job I am currently at”* (PID 11). Alumni experiences gave them a competitive edge in the job market by signaling adaptability, intercultural competence, and unique professional skills.

Career Advancement (n = 28). Beyond initial employment, participants linked global experiences to promotions, international assignments, and strategic career mobility. One participant explained, *“I received my first role after graduation because I had dual majored and lived abroad. I was the only member of my team with fluent Chinese, so I was selected to travel back and forth to China to help manage a billion-dollar business relationship + technical collaboration. Because of that success, I was invited to executive development programs and had my graduate studies paid for. Those graduate studies made me a leading expert in machine learning and language models. I consistently was selected for international travel or leading global teams due to my experiences”* (PID 246). Another participant reflected, *“When choosing a first job out of college I only pursued opportunities that would allow me to live/work abroad. This led me to working in Saudi Arabia and a few other Middle Eastern cities for the first 2 years of my career. This time in my career allowed me to continue to travel and expand my view of the world. My position in Saudi Arabia taught me skills that I was able to leverage when applying for my next job which was US based and where I have been for the last 4 years and have been promoted multiple times”* (PID 44). These accounts suggest that global experiences not only facilitated entry into the workforce but also supported sustained professional growth.

Professional Networks ($n = 14$). Participants also emphasized the lasting value of professional relationships formed during global programs. These networks often facilitated interviews, job transitions, and continued collaboration. As one participant shared, *“The connections I made in Germany at Rohde & Schwarz helped me land an interview for a full-time job in the US with the same company”* (PID 16). Another explained, *“I feel good reaching out to contact to ask about jobs/collaborations in the future because I worked with them in abroad. I also feel more able to get a job abroad given that I have already worked abroad. Also, I'm aiming for a job at a university and now have a handful of close friends from my time studying abroad who are on the similar academia tracks who can help me figure out academia in Europe if that's what I want to do.”* (PID 321). These reflections indicate that beyond the immediate learning experience, global programs foster professional networks that continue to shape participants' career trajectories.

Although the impacts of global experiences were overwhelmingly positive, a small number of participants reported minimal or primarily superficial professional influence. Additionally, an emergent but less frequent finding was that some participants attributed the formation of long-term romantic partnerships to their global experiences, suggesting broader life-course implications beyond professional outcomes.

5. Discussion

Our study explored the self-reported impact of global educational experiences on the career outcomes of engineers using the SCCT framework as a lens. In response to our first research question, we found that these experiences influenced engineers' career development across multiple SCCT constructs. Participants most commonly highlighted outcomes in terms of performance domains and attainments, self-efficacy expectations, and learning experiences. Across responses, engineers described how global experiences functioned as intensive learning contexts that strengthened their confidence in navigating unfamiliar environments, expanded their professional skillsets, and contributed to tangible markers of career growth and effectiveness. Participants frequently linked specific learning moments abroad to increased belief in their capabilities (self-efficacy), which in turn shaped how they approached early career opportunities and evaluated their professional progress (attainments). Rather than affecting a single aspect of career development, global experiences functioned as formative learning contexts that informed how participants navigated career decisions, envisioned future possibilities, and applied their skills in professional settings. In response to our second research question, we learned that engineers most frequently highlighted performance domains related to mindset transformation, though many participants also discussed transferable skill development and tangible career outcomes as key outcomes of their global education experiences. These domains reflect not only what participants were able to do differently in professional contexts but

also how global experiences reshaped their perspectives, competencies, and career trajectories in ways that extended beyond initial participation.

These results suggest that the impacts of global educational experiences are sustained well beyond graduation. One recurring pattern, consistent with prior research [22], [28], was participants' continued interest in globally oriented careers or working abroad as a result of their undergraduate global experience. Importantly, the nature of this study allowed us to trace how these interests translated into career goals and, subsequently, into concrete career actions. Participants described setting goals aligned with their global interests and taking intentional steps such as pursuing international roles, graduate education, or globally connected work to achieve them. Beyond shaping interests and goals, participants frequently described their global experience as influential during job applications, recruitment, and hiring processes. Alumni reported that these experiences strengthened their resume, served as compelling points of discussion during interviews, and signaled valuable skills to employers, resulting in job offers. These findings align with prior studies linking global experiences to increased employability [20], [40] and extend this prior work by demonstrating how global experiences supported subsequent career advancement. Participants described how language proficiency, intercultural competence, and international experience opened doors for leadership roles, international assignments, and expanded professional opportunities over time. These outcomes suggest that participants are able to meaningfully connect learning experiences gained through global education to their long-term trajectories.

Our study also contributes new insights into the types of performance domains and attainments that engineers view as impactful in their careers. We identified performance domains ranging across our themes of mindset transformation, transferable skill development, and tangible career outcomes, which deepens our conceptual understanding of what "career impact" means from the perspective of engineers themselves. These findings extend prior research that has primarily characterized the career outcomes of global experiences in terms of skill development, expanded career opportunities, and altered professional trajectories [21], [41]. In addition, our study draws on a broader and more diverse sample of engineers representing multiple global program types, allowing for a more comprehensive understanding of long-term impacts. Collectively, these findings suggest that career outcomes associated with global experiences encompass not only measurable achievements, such as employment or advancement, but also less tangible yet critical dimensions, including worldview, personal growth, and intercultural competence.

The sustained and developmental nature of these outcomes suggests that global engineering programs should be intentionally designed with long-term career development in mind, rather than solely short-term learning gains. As Wong [42] notes, the impacts of global experiences may not be immediately apparent to participants and often emerge over time. Similarly, Dwyer [41] suggests that the positive impact of these experiences can be sustained over a period as long as 50 years. Our findings lend empirical support to these assertions by demonstrating how alumni retrospectively connect global experiences to long-term career development rather than isolated

post-program outcomes. These patterns highlight the importance of designing global programs with intentional structures that support both immediate learning and long-term career development. Program designers may benefit from embedding structured reflection, mentoring, and career-oriented framing to help students articulate how global learning experiences connect to future professional pathways. When these connections are made explicit, it reinforces the importance of investing in these experiences as high-impact educational practices rather than peripheral or enrichment activities.

6. Limitations and Future Work

Although this study provides insight into the long-term career impacts of global educational experiences, the study has certain limitations that should be considered when interpreting the findings. First, the data are self-reported and therefore subject to recall and social desirability biases. Participants may have emphasized positive aspects of their experiences or interpreted impacts retrospectively in ways that align with professional identities developed over time. Second, the sample includes alumni from global engineering programs at three universities, which may limit the diversity of institutional contexts represented and the generalizability of the findings to other program models or settings. Third, this study draws on qualitative data from responses to a single open-ended survey question, which constrains the depth with which individual experiences and career trajectories can be explored. Our future work will address these limitations by incorporating in-depth, semi-structured interviews with alumni to enable a more nuanced examination of how global experiences influence engineers' career development and approaches to engineering practice over time. Additionally, subsequent phases of the larger study will include a comparison group of alumni who did not participate in global experiences, allowing for examination of alternative pathways to similar career outcomes as well as factors that may hinder participation in global programs. Together, these efforts will support a more comprehensive understanding of the mechanisms through which global educational experiences shape engineers' professional trajectories.

7. Conclusion

This study examined the self-reported long-term career impacts of undergraduate global educational experiences through the lens of Social Cognitive Career Theory (SCCT), using qualitative responses to an open-ended survey question. The findings indicate that alumni are able to meaningfully connect learning experiences gained during global programs to their career development years after graduation. Specifically, participants described how global learning experiences shaped their self-efficacy beliefs and outcome expectations, which in turn influenced their interests, informed the goals they set, and guided the actions they took to pursue those goals, ultimately resulting in career-related attainments. Notably, the majority of responses were

coded within the SCCT performance domains and attainments construct. Inductive analysis of these responses revealed three overarching themes: mindset shift, skill development, and career impact. Alumni highlighted how global experiences broadened their worldview and cultural awareness, strengthened transferable skills valued in the engineering workforce, and contributed to career enrichment across hiring, professional growth, and advancement contexts. Together, these findings demonstrate that the impacts of undergraduate global experiences can be sustained over time and highlight the importance of intentionally structuring global programs to support long-term career development. By fostering opportunities for reflection, skill articulation, and career alignment, global engineering programs can better support engineers in translating global learning into enduring professional outcomes.

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AI Use Disclosure

Generative artificial intelligence tools, including Purdue GenAI Studio, ChatGPT and Microsoft Copilot, were used during manuscript preparation for language refinement and as a secondary check on qualitative coding to assess consistency and coherence. AI tools were not used to generate codes, identify themes, or interpret findings. All analytic decisions, including code development and theme construction, were conducted by the authors, who reviewed and verified all AI-assisted output.

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