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Assessing the Impact of Short-Term Study Abroad Program to Chile on First-Year Engineering Undergraduates

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Abstract

This full paper aims to describe and evaluate intercultural competence and appreciation, professional skills, and desire to persist through a Global Engineering First-Year Engagement Seminar (FYS) experience in Latin America, Chile. This embedded short-term study abroad course was piloted with first-year engineering students at a large R1 Public Institution in the Mid-Atlantic. The FYS experience provides opportunities to increase first-year engineering undergraduate students' intercultural competence, appreciation, and professional skills, increase underrepresented students' retention and graduation rates, and increase access to study abroad in Latin America. Qualitative methodology was utilized to evaluate the impact of the FYS experience on students' intercultural awareness and competence, professional skills, and persistence. Qualitative data were collected from nine participants via focus-group sessions, and the data collected were analyzed using thematic analysis. Findings revealed that this program positively impacted students' perceptions of their professional skills as well as their intention to persist in engineering. We recommend incorporating more embedded study abroad course experiences into the first-year engineering curriculum.

Introduction

Due to the ever-changing technologies and increasingly globalized markets, engineering students must possess the skills and attitudes necessary to interact successfully with people from other cultural and national environments to be productive citizens and professionals in this complex world [1]. Engineering educators are now establishing curricula and programs to help prepare students for this new reality. One approach to enhance student's global citizenship is to provide opportunities for engineering students to study abroad. However, it is estimated that up to 7.5% of engineering students in the U.S. spend time abroad during their undergraduate studies [2]. Consequently, many schools have made commitments to increase this number, and in particular, offer more study abroad programs for first-year undergraduate engineering students.

According to the Institute of International Education (IIE) Open Doors report [3], most U.S. students study abroad in Europe (64.4%) while only a few of them study abroad in Latin America and the Caribbean (10.7%). Considering current trends, Latin America is on course to become middle class and at peace within a generation with rapidly expanding trade and business opportunities for U.S. companies [4]. Therefore, to enhance U.S. competitiveness, increase prosperity, and prepare a more globally competent workforce, future engineers would benefit from having an understanding and appreciation of Latin American culture (i.e., ability to communicate, behave effectively, and value and respect diverse cultures). Thus, it is essential to open the door for study abroad opportunities in Latin America to have more engineering relevance and import moving forward.

In addition to contributing to global awareness, previous research supports the belief that study abroad programs contribute to an increased retention and graduation rates for underrepresented students as well as enhancing the social mobility and employability of the students upon graduation [5]. To this end, the purpose of this study is to evaluate a First-Year Global Engagement Seminar (FYS) which was created to teach students the importance of

intercultural competence and leadership through an international engagement experience. FYS participants learned tenets of cultural humility and their global competencies were put into practice during intercultural engagements with peers at a partner institution in Latin America, Chile.

Definitions

Study abroad programs require successful evaluation to demonstrate students' development of intercultural agility and competence [6]. For this work, we considered Bennett's [7] definition of *intercultural competence* (IC), which states that IC is "a set of cognitive, affective, and behavioral skills and characteristics that support effective and appropriate interaction in a variety of cultural contexts" [p.16]. To supplement IC, we also considered *intercultural appreciation* as the positive emotional ability of individuals to understand and appreciate cultural differences and promote appropriate and effective intercultural communication [8]. Additionally, development of intercultural competence and appreciation naturally increases students' *professional skills* [9], [10], which we define as using leadership, communication, self-awareness, openness, and skills needed to appropriately interact with someone from a diverse cultural/ethnic background. Lastly, the increase in intercultural learning has also been linked to *persistence* [11], [12], which is referred to as a student's continued enrollment and academic progress from term to term until they achieve their educational goal. For this study, we are mostly interested in capturing their *intention* to persist in their program due to the longitudinal constraints of the study.

Literature Review

Study Abroad Program Assessment: The empirical assessment of study abroad programs has been well investigated for many decades. The extent of this research has applied numerous testing tools and methods to investigate the influence of study abroad programs on students' intercultural development. Specifically, quantitative measurement scales remain prevalent in intercultural student research [e.g., [13], [14], [15]]. However, there continues to be inconsistent intercultural construct definitions (due to its multidimensional nature), and small study-abroad sample sizes [16], [17]. To address some of these limitations, researchers have employed their own surveys, questionnaires, student journals, reflective essays, course papers, focus groups, and interviews [e.g., [18], [19], [20], [21], [22]]. Some studies adopt qualitative methods which tend to lend a deeper understanding of student experience and impact. Lyons et al. [22], used qualitative methods (i.e., focus group discussions, interviews, and reflections) to explore perceptions of undergraduate students' short-term education abroad experience's impact on their intercultural competence and leadership development, and their study findings illustrate how students changed their behaviors, awareness, and perceptions due to the study abroad experience. Ultimately, the most effective method to evaluate study abroad outcomes is to integrate multiple methods of assessment to focus on student learning outcomes rather than program outcomes [23].

Study Abroad Program Development: Student intercultural learning depends on the structure, duration and level of involvement (i.e., learning and engagement activities) of the study abroad program [24]. Studies and reports have examined these dimensions and their influence on intercultural competence. For example, study abroad literature has suggested that study abroad programs less than 12 weeks provide students with fewer opportunities to increase their intercultural competence, but they still show significant achievements in intercultural competence

development [25], [26], [27]. Specifically, 13-18 weeks (~about 4 months) abroad is the ideal period for intercultural competence development [27]. However, Rausch [28] argued that as universities look to increase their 4-year graduation rates, degree plans have become more lock step making it difficult for students to fit in a longer study abroad program, this is especially true for more "hard skill" based majors such as STEM majors [p.1]. As a consequence, of U.S. students who study abroad, 65% of them do so on a short-term basis [29], and thus, short-term (eight weeks or less) study abroad programs tend to provide a level of flexibility within the curriculum and academic semester that can allow students who are unable to travel abroad for extended periods to also take advantage of a study abroad experience [30].

Regardless of the study abroad duration, global and intercultural exposure does not ensure intercultural learning since students may fail to immerse themselves in the new culture [31]. That is, travel alone is not sufficient and an explicit focus on culture and what intercultural learning means is important for the success of study abroad programs [32]. Hence, keeping in mind that "intercultural learning does not happen automatically" [33, p. 90], careful involvement and well-structured study abroad programs may be needed to provide students with opportunities for intercultural learning [33]. To illustrate, an engineering study abroad program that prepared students before departure (i.e., providing training with reflective prompts, and reflection essays) supported students to leave their comfort zone during their time abroad and reflect their experience upon return [34]. Other well-structured study abroad programs include the 'hybrid' or 'embedded course-study abroad' models [see e.g., [28], [35]]. These models introduce preparatory courses taken on campus or online and include a short-term international travel component (e.g., during spring break or Maymester). Study abroad embedded models have demonstrated an increase in global citizenship over time [36] which ignites students to pursue additional global experiences in the future. Due to the prevalent critiques to develop more holistic study abroad educational experiences [37], [38], it is critical to consider the duration and structure of study abroad to fully build cultural competence in aspiring student leaders.

Study Abroad in Engineering Education: Engineering students in the U.S. may choose from a variety of intercultural programs (e.g., short-term study abroad, longer-term exchange programs, research experiences, and service learning) to gain intercultural sensitivity and skills that enable them to interact successfully in a variety of cultural situations [39]. However, engineering students have struggled to take part in study abroad programs with the very defined engineering curriculum, the need for summer internships, and limited (or no) engineering course offerings while abroad [3], [40], [41], [42]. Specifically, as Specking and colleagues [43] demonstrate, only a few engineers study abroad, and even fewer study abroad in countries where English is not the native language. Since foreign language is not normally a requirement within the engineering curriculum, students tend to opt out of foreign language courses [44]. Similarly, engineering students may falsely believe they will need to stay in college longer if they participate in a semester abroad [43], [45]. Further barriers and challenges for engineering students to take part in study abroad programs include financial considerations, socio-economic background, faculty and administrative program limitations, curricular limitations, program length, personal reasons, and information/awareness [1], [46], [47], [48].

To reduce engineering students' barriers to participating in study abroad programs, engineering-specific programs have increased in number over the past few decades [49]. Specifically, short-term study abroad programs have been implemented to address many of the engineering student concerns (e.g., not interfering with the typically constrained schedule of

engineering students, not incurring additional costs, and providing a global cultural and engineering context) [49], [50], [51], [52]. Moreover, study abroad programs for first-year undergraduate students in engineering are increasing. Adding study abroad programs early in the curriculum benefits first year students by helping them overcome anxiety about foreign travel, increase their intercultural competence and appreciation and ability to work in diverse teams, and encourage them to take part in other international activities [53]. Consequently, prompt exposure to study abroad can motivate engineering students to participate in another study abroad experience later in their academic journey. Hence, this study will employ a qualitative approach to evaluate the impact of a global engineering course with a one-week study abroad for first-year undergraduate engineering students at a large R1 land grant University in the Mid-Atlantic region of the United States. The guiding evaluation question for the study is as follows:

What is the influence of a short-term study abroad experience on intercultural competence and appreciation, professional skills, and desire to persist for first-year undergraduate engineering students?

Methods

This study presents the evaluation of a pilot study abroad experience which was embedded in a study abroad-course model developed at a large research-intensive (R1) land grant University in the Mid-Atlantic region of the United States. The land grant University happens to be the authors' University. Focusing on the students' study abroad experience to Chile, a qualitative evaluation approach was adopted in the form of a focus group discussion with students who participated in the study abroad program.

***Embedded Study Abroad-Course Description*:** In Spring 2023, a team of faculty at a large R1 land grant University in the Mid-Atlantic region of the United States endeavored to enhance the first-year student experience by developing an embedded study abroad course to address justice, ethics, and sustainable practices in a global engineering context. A 10-week pilot Global Engineering First-Year Engagement Seminar was offered with an enrollment of eighteen students and two faculty leaders during the Spring 2023 semester with one week of embedded travel to Chile during Spring Break (about halfway through the semester). The Seminar introduced first-year students to the global competencies and transferable skills needed for global engineers [54]. During the week abroad in Chile, students exercised global competencies (e.g., skills, attitudes, values, and behaviors) during project-based learning activities with their peers at the partner institution. Upon return from the study abroad experience, participants created individual websites to document their experiences and reflections on intercultural learning.

This study abroad opportunity marked the College's first global engineering program in Latin America and its first international program designed specifically for first-year students. An embedded faculty-led study-abroad model was adopted for student safety, increased accessibility, and short-term travel requirements. Each student was charged course fee of approximately $1600 for their in-country travel; however, to help ensure equity and inclusion, each participant was awarded a $1000 scholarship, and those with expressed financial need as indicated by filing of the Free Application for Federal Student Aid (FAFSA), received additional funding from the College of Engineering-sponsored travel grant.

Participant Description and Recruitment: Participants in the evaluation study were first-year engineering students who participated in an embedded study abroad course at the authors'

University. The course was broadly advertised by the Center for Global Engineering Engagement at new student orientation events and a college study abroad fair. The College of Engineering is one the largest colleges within the land grant University. The pilot study abroad course was open to all first-year engineering students, which provided a diverse application pool. Of those who participated, male (10) and female (8) students from a variety ethnic and of socioeconomic backgrounds participated in the study abroad course. Nine students in the study abroad course participated in the focus group for this study (Table 1). Emails were sent out to all participants who went for the study abroad program to volunteer to take part in the focus group conversation in order to evaluate the impact of the student abroad experience on their learning, professional and intercultural competency development. Snacks were provided for those students who attended the focus group. No other compensation was offered.

Table 1. Overview of participants in the focus group.

Participant	Sex	Proposed Major	Nationality
P1	Male	Computer Science	American
P2	Female	Architectural engineering	American
P3	Male	Mechanical engineering	American
P4	Male	Computer Science	American
P5	Female	Mechanical engineering	American
P6	Female	Chemical engineering	American
P7	Male	Industrial engineering	Indian
P8	Male	Computer Science	American
P9	Male	Undecided (Chemical or Mechanical)	American

Authors' Positionality: Creswell [55] noted three positionalities that researchers can maintain during a study. They include insider, insider/outsider, and outsider. The authorship team for this paper includes the coordinator and instructor for the study-abroad program discussed in this paper (insider) as well as the external evaluation team that did not participate in the study abroad course but evaluated the impact of the study abroad experience as outlined below (insider/outsider). All members of the study-abroad authorship team worked together to discuss the goals and objectives of the experience evaluation. The evaluation team has a background in engineering and engineering education with expertise in program evaluation. All team members are employed in the College of Engineering. The first author facilitated the focus group, the third and fourth authors conducted the qualitative analysis, and the second author coordinated the study abroad course. Every author was involved in writing the manuscript.

Data Collection: Two focus groups were the mechanism of data collection for the evaluation study. In total, nine first-year engineering students participated in the focus group. From scholarship, three to twenty-one individuals have been shown to participate in a focus group discussion [56]. The students were informed of the goal of the focus group, which is to evaluate the global and cultural competencies, professional and leadership skills development through international engagement experiences by undergraduate students. The interview protocol was developed based on the goal of the focus group. Consent was sought from participants for audio recording, and strict measures of confidentiality and anonymity were followed during the data collection session. The data collection was moderated by a facilitator and a timekeeper, who also

took notes and memos during the meeting. Memos include both verbal and non-verbal expressions of students. To avoid students being pressured or biased during the focus group, the interviewers who were evaluators were different from the instructor. Also, the interviewer also informed the students that we are looking for honest feedback to improve the program.

Two focus groups were conducted, with seven participants in focus group one and two participants in the second focus group towards the end of the semester. Participants selected which focus group interview time worked best for them. Each focus group lasted for about 50 minutes. Examples of questions in the focus group include: *How did this study abroad event impact your perception of other cultures/environments? How does this study abroad program impact your intercultural competence development? How did this study abroad experience influence your personal development?*

Data Analysis: Data exploration began with the memos and notes taken during the interview. Data collected from the participants were analyzed using thematic analysis [57], [58].The six-steps thematic analytical framework by Kiger and Varpio [59] guided the study analysis. The steps include "familiarizing with the data, generating initial codes, reviewing themes, defining and naming themes, and producing the manuscript" [p. 5]. Firstly, to familiarize with the data, the audio-recorded files during the interview were human transcribed by the researchers, and the transcribed files were reviewed multiple times. Secondly, participants' quotes that were related to the research questions were coded. Thirdly, similar codes were then grouped under a theme and defined. Fourthly, the themes and codes under them were reviewed and refined to reach finalized themes. Lastly, the outcomes of this thematic analysis are written up as the result section of this manuscript.

The data analysis underwent the first cycle and second cycles of coding [60]. For the first cycle of coding, open coding was utilized. Using open coding, the researcher identified concepts from the data that will be categorized into themes during the second cycle of coding [61]. For second-cycle coding, focused coding was adopted as the researcher grouped concepts identified in the first-cycle coding into themes [60].

Trustworthiness in qualitative research has been achieved by ensuring some or all of the following: credibility, transferability, dependability, and confirmability [62]. For this work, the trustworthiness of the qualitative analysis was fulfilled by ensuring that credibility and providing sufficient study context. The study context provided included participant description, program description, institutional information, and study abroad destination [62]. The researchers ensured credibility by using established research methods such as focus group and thematic analysis [63]. Also, two of the research team members coded, reviewed codes, and reached an agreement on the themes and sub-themes generated during the thematic analysis.

To further ensure the trustworthiness of the study, participants were given the opportunity to refuse participation so that only those who were willing and prepared to provide the necessary data were part of the study [62]. The facilitator of the focus group utilized probing to elicit more detailed responses from the participants. Also, a debriefing session was held by the research team. The investigator is a well-trained individual with a PhD in engineering education research studies, and the graduate student involved in the project is mentored via a weekly meeting in conducting engineering education research and evaluation [62]. Since this is an evaluation study, the authors do not argue for transferability as in research. However, enough study context is provided for readers who may want to use the outcome of the study for a similar approach in their own context [62].

Findings

The thematic analysis of the focus group highlights four themes: (1) Intercultural competence and appreciation, (2) Professional skills development, (3) Intention to persist in engineering, and (4) Motivation for participating and overall impressions of the program. The following subsections explore each of these individual themes.

Intercultural competence and appreciation: Every student noted an appreciation for the Chilean culture and their ability to experience said culture through the study abroad. Students also noted the impact of better understanding diverse cultures on themselves and how they view interacting with others. Since most students made a comment about the impact of the program on their intercultural competence and appreciation for the Chilean culture, we felt it best to share a sample of direct quotes from the students. A brief summary of the lesson highlighted by the quote or set of quotes will be provided. Students discussed the value of traveling to learn about diverse cultures and the impact of having a better understanding of the diversity between cultures even after the trip saying:

> "Nice reminder that there's the whole world out there besides [our college town]."
> "The more you travel the more you learn obviously, but they teach you when you come back home you can understand culture is easier here...One of the things we talked about on [our pre-trip reflections] was global tolerance and diverse cultures. I think the more you travel the more you gain. You'll be in that culture for however long you're there but to help you understand more when you come back."
> "It gave me a lot of perspective because I never left the continent before...It really gave me this global expansion of a more global perspective...there's all those different barriers between you and different people. But you still somehow find a way to connect to those people."

Other students highlighted that they felt everyone should have similar experiences to encourage empathy and understanding of diverse cultures.

> "If everyone had this experience, it would make everyone more tolerant, more understanding of each other, and maybe more patient with each other's views and cultural differences, which I think is something that our society lacks a lot today."
> "They look different, talk differently, act differently, things like that and their whole culture and society is different. But in reality, it's all humans, right?"

Another student combined comments from above noting the importance they felt in immersing themselves in the local culture to appreciate that culture in a much more meaningful way than can be communicated through books or non-immersive research.

> "It was really cool immersing yourself in a different culture because I've never done that before and lately a lot of us haven't. So, I thought it was really cool to learn about another culture and it's different to learn about it rather than actually be in it because before we

> went, we were told to do some research on it, but you could do as much research as you want, but it'll be so much different once you get there."

Finally, a student shared their specific appreciation for the local area that was visited during the study abroad and the value in learning the local history from the local perspective and how that varied from the perspective on history discussed in the US.

> "I really liked learning about the history of Valparaiso, I really like the history in Chile a lot because we went to a museum in Santiago and I thought that was really good experience because I knew a little bit about the dictatorship of Pinochet but I didn't know the extent to which it affected the civilians of Chile cause you don't really know that until you experience it first-hand. I thought that the trip to the museum was really impactful for a lot of people, and I really enjoyed it, even though it showed so many different things that were happening that were awful, it was very good to know that, if that makes sense, like learning about the culture an everything."

Many of the participants shared that their study abroad experience broadened their perspective about people from diverse cultures and an increased appreciation for diverse cultures.

Professional Skills Development: When discussing their experience within the study abroad, the students noted the development of multiple professional skills such as leadership skills, teamwork, empathy, creativity/adaptability in problem solving, and communication skills. One student noted the development of leadership or collaborative success skills saying, *"Being that far away from everything. It's a daunting task...There's nothing that will get you home either because this is some random city that you've never been to before, and if you say, get drunk and get lost, you're not coming back. I think that that sense of responsibility forced us to band together and work together and this camaraderie, so we don't lose each other...That camaraderie also leads to building leadership skills because you're responsible for other people and other people are responsible for you."*

This student highlighted the importance and responsibility of being part of a group in an unknown location and how that inspired a stronger sense of leadership and agency than they were used to in their more familiar space. Related to what they learned by being in a new and unfamiliar location, another student felt they developed a level of adaptability saying, *"it helped me become more adaptable to situations. When we first got there, we tried to order some coffee. By the end, [we were] having real conversations with the people working at the restaurants. So just being able to adapt to those [new] situations and learn how to overcome those barriers [of being somewhere different]."* Another student related adaptability to creativity when solving problems because the usual approach, like running to Target to buy a toothbrush, wasn't available to them and they needed to think differently to find a solution.

Adaptability and creativity were also tied to communication and empathy as the student worked to communicate in their non-native language and began to appreciate the new perspective from the local culture. One student noted, *"What words mean, trying to figure out and dig into a problem in another language to try and help people, how they think – that's how [the study abroad experience] helped me."* Another student built on this comment saying, *"physical language works too, usually, even though you can't understand like the language, but some things are just universal when it comes to like signs and places and reference points…how to traverse through a*

new environment just by using different things you already know that's universal across everywhere, regardless of the language." This student went on to say, *"being able to understand the person that you're talking to without just going in to this 'The mindset of they are the same as me', understand everyone's different regardless of anything…presenting better, understand who they are as a person, so that when you communicate, even if you don't understand the language, you can make it to a point where you can meet at a middle ground."* This student really began to find more commonalities with local people as they navigated the language barrier in creative ways, developing empathy and communication skills.

Another student reflected on a team project experience during the study abroad program saying, *"my team, we worked really hard to build a great, like a strong structure, but then we added things that we didn't need. And that was our downfall. So, I think it was a good learning experience for my group, for everyone's group because we realized what we did wrong and how we can improve in the future."* This student noted the importance of a teaming experience, learning from failure, and learning ways to improve their problem solving moving forward.

Intention to persist in engineering: The focus of this study abroad opportunity was around first-year engineering students. While abroad, multiple activities were planned around connecting the traveling students with students, faculty members, and engineers from Chile. Students within the focus groups discussed the impact of these activities as well as the overall trip on their perspective of engineers and their intention to persist within engineering. Their motivation to persist in engineering increased as they realized how applicable in real life their engineering degree was in solving societal problems and improving human well-being. One student noted the study abroad experience impacted,

> "My passion for trying to use my engineering degree to really help people because being in Chile let me see how engineering is seen differently there. But still has the common goal of finding ways to better help the lives of others and just showing me how much power engineers have in the sense they can fix a lot of problems in many ways. Regardless of just straight physical, but they have other ways to help other people using what they know."

Other students followed up this comment with, *"The trip actually…motivate[d] me even more [to be an engineer]"* while another noted, *"it opened my eyes to other fields of engineering that I thought were cool."* Along similar lines, another student commented,

> "the products that engineers make and the things that we design all end up for the same purpose, it's all just to help infrastructure, to help people live better lives. So, I think that kind of a global perspective helped expand on that to help understand that kind of, not really the necessity for engineering, but…the impact that it has on not just the local scale."

A different student commented that seeing engineering outside of their typical classroom experience helped them *"realize engineering has so many different applications and you could go anywhere with it and it just makes you so much more positive about the outcome, and all the hard work that you're doing finally pays off, and it's really helpful to know that."* Seeing the way, the Chilean engineers applied their work to the real world was also noted by another participant when they said, *"When the professors at the ecologist were explaining the program they run and how they do their stuff was just cool to see actual real-world examples, like this what we potentially*

could be doing in like 4 years." Another student noted that the students and professors in Chile seemed to be more excited about engineering. *"They seemed genuinely interested and they wanted us to learn to share the same care for it. I just thought that was cool."* Overall, the students' experience in the study abroad program had a positive impact on their intention to persist within engineering and broadened their perspective of the impact that being an engineer could have on their community as well as the global community.

Motivation for participating and overall impressions of the program: Before diving into the impact and influence of this program, we asked students about their motivation for enrolling in the course. Multiple students discussed a desire to travel, and the one-week trip seemed like a good starting point. One student stated, *"I just like to travel. I thought it'd be cool just to head off on spring break and learn a few things along the way."* Another noted, *"I wanted to get a taste of what it [study abroad] is because I've always wanted to do it, but this was my first steppingstone into it, and I picked it since it was on a break."* Other students also noted a desire to enhance their language skills by being able to practice their Spanish. One student tied it together saying, *"I took Spanish since like 4th grade and obviously it's very different learning in school versus being immersed in it. So, I feel like that was a great experience because I realized how much of my Spanish I've lost since I've gotten here at [University] not taking any Spanish classes and also just the difference between actually being in school doing it and being there."* Multiple students noted their interest in travel and diverse cultures being part of their motivation for taking the course, typically tied to the lower stakes of taking a short trip during a course break.

When asked about their overall impressions and experience with the program, the responses were incredibly positive. The program itinerary and activities were all positively commented on. One of the activities at a Chilean university experienced some technical problems resulting in a less engaging experience, however, many of the students noted that it was still a positive experience and were very understanding about the technical challenges. One student noted, *"It's one of the best choices, decisions that I've ever made in my life is to go on this trip." Other students noted the experience was "pretty close to perfect."* Other comments from students included, *"We always had the opportunity to do something that wasn't the same every day," "I feel like I have a lot better understanding of Chile and the culture,"* and *"Just really fun, but also, we learned something. I feel like everything that they put together for us was helpful and really fun."* The overall experience for the students was positive, and they desired a longer study abroad experience. They all felt this was a meaningful experience that increased their appreciation for another culture while fitting into their busy semester.

Discussion

Revisiting our evaluation question: *What is the influence of a short-term study abroad experience on intercultural competence and appreciation, professional skills, and persistence for first-year undergraduate engineering students?* The focus group findings highlight that this short-term study abroad experience positively impacted student's intercultural competence and appreciation for other cultures, their perceptions of their professional skills – including intercultural competency and leadership – as well as their intention to persist within engineering.

When preparing undergraduate students for entry into a diverse society and contemporary workforce, developing intercultural competence is a skillset that engineering programs must integrate into the curriculum [22]. By providing a study aboard experience as part of a First-Year

Seminar already integrated into the curriculum, students were able to grow their intercultural competency and professional skills during a set break in the semester. Where the course provided preparation materials and post-trip reflections, this evaluation heavily focused on the students' experience aboard. From our findings, we would encourage other universities to consider short within-course abroad experiences that provide course/discipline-specific opportunities while abroad.

The first-year engineering students in this study were motivated to enroll in the global engineering first-year seminar course due to their desire to travel and enhance their language skills. Where many US study abroad programs travel to English-speaking countries [3], the students in this program highlighted being able to practice their language skills as a reason to join the program. Other students noted the benefits of developing a sense of responsibility and leadership as well as their creativity and adaptability by gaining experience in a non-English speaking country through the study abroad program. The personal development experienced by our student participants is encouraging for other study abroad opportunities to consider non-English speaking opportunities.

Overall, the study abroad experience helped students be more open-minded and gave them a better understanding of Chile and its culture and how to solve societal problems with engineering. The students responded positively to the Chilean engineering applications highlighted during the student abroad that focused on societal impact and aiding in local challenges. Focusing on health, happiness, and society, have been found to be impactful for traditionally URM students and women to be interested and to persist in engineering. Additionally, women in comparison to men, have also been shown to benefit more from intercultural competence development from this study abroad experience [64]. Finding opportunities for disciplinary experiences helped our participants to find inspiration and intention to persist from their study abroad experience. Highlighting different professional perspectives while in-country may be beneficial for other study abroad programs.

The study abroad experience also influenced students' personal leadership development by becoming more adaptable to situations and environments (i.e., communication and decision-making), appreciating different points of view (i.e., relationship building, negotiation), and thinking critically (i.e., problem-solving, creativity & innovation). These findings align with the student knowledge areas presented in previous qualitative intercultural competence scholarship [21], [22], [65], yet the themes in this study go beyond those in the previous literature by allowing them to meet new people, discover different engineering applications, and increase their motivation and persistence in engineering.

This study corroborates other empirical work that shows that international study experience improves students' global perspective, intercultural awareness, and competence development of undergraduate engineering students [66], [67]. Furthermore, this study aligns with other research that shows evidence that international study experience increases retention and persistence to graduation of engineering students [68].

Limitations: While this study helps to illuminate the experiences of these students on their first-year study abroad to Chile, there are some limitations that readers should keep in mind. This study mainly includes a limited sample of students who participated in one study abroad opportunity and the associated focus group evaluation. The experiences of these specific students may differ from other cohorts. Secondly, this work is more of an evaluation study than research. These limits the transferability of the outcome of this work. However, since we provided enough context for this study, readers, based on their judgment, can use our study outcome for their

educational purposes. Thirdly, since the study abroad experience is situated within the course itself, it might be difficult to separate the impact of the course from the study abroad experience. The study team mitigated this by developing interview questions more directly aligned to the study abroad experience itself. This was the first implementation of this program, so longitudinal data is recommended to be collected that would further support the effectiveness and repeated results from this evaluation. Also, there should be a follow-up evaluation on the students who participated in study abroad to compare them to students who did not participate in the program to determine the impact of study abroad on undergraduate engineering. Implementation of similar programs at other institutions and repeated studies at the same institution would add more evidence and support for this approach to study abroad and further affirm the results presented here.

Conclusion

One of the engineering discipline's significant challenges is the attrition of first-year students [69]. To increase intercultural competence and persistence of first-year engineering students, we developed and piloted a First Year Global Engagement Seminar (FYS) experience in Latin America, Chile during Spring Break 2023. Specifically, this unique international engagement experience introduced engineering students at a large public R1 institution in the Mid-Atlantic to the importance of intercultural competence and leadership through international engagement experiences. From our findings, we found that students were more open-minded to learning about diverse cultures, travelling more, learning to speak another language, and interacting more with diverse others. Additionally, this opportunity affected their personal leadership development by becoming more adaptable to situations and environments, appreciative of different points of view, and thinking critically to solve societal problems in engineering. Lastly, this unique study abroad experience contributed to their increased motivation and intention to persist in engineering.

The authors recommend incorporating more study abroad experiences into the first-year engineering curriculum. In a situation where study abroad may not be feasible, faculty and administrators are encouraged to provide out-of-class learning experiences where students have real-world application of what they learn in the classroom. Such service learning and real industry projects from their first year in college could potentially increase the perception of the importance of engineering in the local and global space. Such a perspective of engineering discipline as one that improves human welfare has been shown to motivate minorities' interest in engineering particularly [70], [71].

This evaluation study of first-year engineering students in a study abroad experience provided a rich description of the program's impact on their professional development. Future work should conduct a statistical analysis to evaluate the effect of study abroad on students' cultural competence. Also, a longitudinal study of student retention and persistence rates who participated in the study abroad course should be evaluated. Furthermore, a comparative study of engineering students who participated in study abroad with those who did not is another research direction to consider in the future.

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