Facilitating Intercultural Development: Preparing Future Engineers for Multidisciplinary Teams and Multicultural Environments

Darshini N. Render, Horane A. Holgate, Charles A. Calahan
Purdue University
West Lafayette, Indiana, United States
render@purdue.edu, hholgate@purdue.edu, calahanc@purdue.edu

Abstract— **This innovative practice full paper describes an inclusive on–campus intercultural development program that can be applied in engineering learning environments. A major outcome of engineering programs across the nation is to graduate professional engineers who are able to work and communicate effectively in multicultural environments and multidisciplinary teams. Therefore, developing multicultural/intercultural competencies is an important aspect of engineering programs. Generally, study abroad programs are seen as an effective means to develop intercultural/multicultural competence. However, the opportunity to study abroad is often not accessible for all students, particularly those from traditionally underrepresented racial and ethnic backgrounds. This paper describes the design, implementation, and assessment of an on campus intercultural development program, and the outcomes based on quantitative and qualitative data collected from two separate cohorts of engineering students during 2016 and 2017. The program is grounded in a developmental intercultural paradigm – Developmental Model for Intercultural Sensitivity (DMIS) and Intercultural Development Continuum (IDC) - with an intentional focus on constructs identified on the Intercultural Knowledge & Competence VALUE Rubric. The outcomes and effectiveness are assessed using the Intercultural Development Inventory (IDI) and the Attitudes, Skills, and Knowledge Short Scale (ASKS^{2+}). The overall results suggest that by intentionally focusing on the cognitive, affective, and behavioral dimensions of intercultural development, coupled with a developmental approach, it is possible to achieve intercultural outcomes without or even before studying abroad.**

Keywords—Intercultural Competence, On-Campus Internationalization, Multidisciplinary Teams, Multicultural Environments

I. INTRODUCTION

The complexity in world challenges needs adaptive mindsets to find flexible solutions. Such solutions need agile thinking and behaving. Engineers are often called to find adaptive solutions for technical problems in global socio-economic contexts [1]. Working in multidisciplinary teams, formulating solutions that are socially and culturally sensitive and reflective, are important for organizational productivity and growth [2]. In the current higher education context, one school of thought argues that sending students overseas is the key to shaping global mindsets, while the other school of thought argues that campus internationalization will naturally increase domestic-international student interactions which will eventually lead to global understanding and shaping mindsets [3], [4], [5]. Though both these approaches have some impacts, a growing body of literature in intercultural competencies development suggests that studying abroad without intentional interventions such as reflections, cross-cultural mentoring, coaching, and more importantly assessment of growth will not produce meaningful gains in student learning [6]. Similarly, on-campus programs designed to increase domestic-international partnerships, attitudes, and knowledge should focus on assessing intercultural gains through validated instruments and measurement using mix methods [7].

The need to create inclusive, cost effective, and transformative educational experiences is a challenge that many higher education institutions face. The number of students participating in study abroad programs is increasing steadily in U.S universities and colleges. This translates to positive outcomes such as increased retention and higher degree attainment. Yet, less than 10 percent of the US undergraduates participate in a study abroad program and only 25 percent of those are racial/ethnic minority students [8]. To meet the needs of the complex socio-economic and political systems, higher education institutions will need to find intentional, innovative yet cost effective ways to develop intercultural/multicultural competencies for students from all demographics beyond traditional approaches [9]. The pilot program: the Cross-Cultural Leadership Program (CCLP) described here is an innovative approach to facilitate intercultural development and prepare future engineers for multicultural environments and multidisciplinary teams.

II. THEORETICAL APPROACH

The research on intercultural development spans over five decades with the myriad models and definitions of what it means to be interculturally competent/sensitive [10], [11], [12]. Nevertheless, the consensus among scholars suggests

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that 1) intercultural competence development is an on-going process that is facilitated through continuous reflection and opportunities to assess individual development [13], [14]; 2) intercultural competence constitutes a set of cognitive, affective and behavioral skills which facilitate effective and appropriate interactions across cultures and contexts [15]; 3) cultural knowledge and cultural contact does not necessarily lead to competence, but the latter may lead to reduction in stereotypes; and 4) language learning may not be sufficient for culture learning [16]. Two paradigms have dominated intercultural competence research, the Cognitive, Affective and Behavioral (CAB) paradigm and the developmental paradigm, specifically, the Developmental Model for Intercultural Sensitivity (DMIS) [17].

The CAB paradigm represents a compositional approach focused on identifying the components of intercultural competence. This approach to intercultural development focuses on specific personal characteristics and factors that are related to intercultural competence [11], [17]. For example: being culturally self –aware, having respect and value for cultural diversity, being open to learning from culturally different others or being adaptable and flexible to name a few [11]. The developmental paradigm however, assumes that intercultural development improves overtime through ongoing interactions and experiences, focusing on various ways individuals engage cultural differences. Models associated with the developmental paradigm tend to apply stages of progression with markers that show achievement of improved competency [11], [17].

The CCLP program was developed by incorporating models and frameworks specifically from the CAB paradigm, the Intercultural Knowledge and Competence (IKC) VALUE Rubric [18], as well as from the developmental paradigm, the Intercultural Development Continuum (IDC) [19], which was adapted from the DMIS [20]. The assumption for incorporating these frameworks was that by targeting specific components of intercultural competence identified on the IKC VALUE Rubric, it would be possible to observe developmentally appropriate growth towards the intercultural mindsets described by the IDC. Additionally, Hofstede's Model for Cultural Difference [21] and Vande Berg's [22] four-step process for developing intercultural competence were also incorporated to provide guidelines for facilitating student reflection during training sessions throughout the program.

A. The Intercultural Knowledge and Competence VALUE Rubric

The Intercultural Knowledge and Competence (IKC) VALUE Rubric [18] conceptualizes intercultural competence as cognitive, affective and behavioral skills and characteristics supporting effective and appropriate interactions in different cultural contexts [23]. The rubric identifies six key components of intercultural knowledge and competence representing intercultural knowledge, attitudes, and skills. The components identified as intercultural knowledge are: *cultural self – awareness*, which involves being aware of one's own cultural rules and biases, and *knowledge of cultural worldview frameworks,* which involves, being able to understand complex elements of another person's culture (e.g. politics, economy, and values). The components for intercultural attitudes identified are: *curiosity*, which involves asking complex questions and seeking out answers, and *openness*, which involves initiating intercultural interactions and suspending judgment during intercultural interactions. Finally, the components for intercultural skills are: *empathy*, which involves using a worldview which is not your own to interpret cultural situations, as well as understanding the feelings of others. The other skill is in *verbal and nonverbal communication*, which involves understanding and being able to negotiate the shared meanings of differences associated with communication (e.g. direct/indirect and explicit/implicit meanings) [18]. The VALUE Rubric provided specific components, which guided the selection of specific activities and assessments to examine specific change in development of intercultural attitudes, skills, and knowledge.

B. The Intercultural Development Continuum (IDC)

The IDC describes a set of orientations that individuals have towards cultural differences and commonalities. The orientations are organized along a continuum distinguishing among monocultural/ethnocentric mindsets (denial and polarization orientation) and intercultural/global/ethnorelative mindsets (acceptance and adaptation orientation). Individuals with a denial orientation are described as able to recognize observable cultural differences but may not notice deeper cultural differences and may avoid or withdraw from cultural differences. Individuals with a polarization orientation, however, tend to hold judgmental views towards cultural differences in terms of "us" and "them". This is seen as either holding a critical view towards other cultures and an uncritical view towards one's own culture ("us") or an overly critical orientation toward one's own cultural values and practices, and an uncritical view toward others cultural values and practices ("them"). Individuals with an acceptance orientation are able to recognize and appreciate patterns of cultural difference and commonality in their own culture and in others. An individual with an adaptation orientation is described as capable of shifting their cultural perspective and changing behavior in culturally appropriate and authentic ways. The model also identifies a transitional orientation between the more monocultural and intercultural mindsets called minimization. Individuals with this orientation tend to highlight cultural commonality and universal values and principles but may also mask deeper recognition and appreciation of cultural differences [19], [20]. Each orientation along the continuum aligns with the Intercultural Development Inventory (IDI) [19], [24], [25], a measure of intercultural competence. This measure was used to assess intercultural growth for participants in the program described in this paper (CCLP).

Another element of the program design and implementation was utilizing Hofstede's Cultural Dimensions Model [21]. This model was included to provide a framework for reflecting, analyzing, and discussing

cultural differences in the training sessions. Hofstede's model proposes six dimensions of cultural differences, which govern the cultural values, beliefs and behaviors across cultures. These include: 1) power distance – hierarchical versus flat social structures with respect to equality and inequality, 2) uncertainty avoidance – degree of tolerance for ambiguity, being comfortable versus avoidant of uncertainty, 3) individualism versus collectivism – degree of importance given to the individual versus the group 4) masculinity versus femininity – preference for distinctive, interchangeable or unidentified gender roles, 5) long term versus short-term orientation – degree of importance placed on traditions and the past versus the present and the future, and 6) indulgence versus restraint – the degree of freedom versus control based on human pleasures.

The training sessions for CCLP were facilitated using Vande Berg's [22] four-step process for developing intercultural competence. These include: 1) increasing cultural and personal self – awareness through reflection on past and present experiences, 2) increasing awareness of others within one's own cultural and personal contexts, 3) learning to manage emotions and thoughts in the face of ambiguity, change, challenging circumstances, and people and 4) learning to shift frames, attune emotions and adapt behavior to cultural contexts.

III. PARTICIPANTS AND METHODS

A. Participants

The participants of the study were undergraduate engineering students in a research institution located in the Midwest. The students who participated in the CCLP program in 2016 (n=14) and 2017 (n=16) represented a single engineering discipline and multiple engineering disciplines respectively. The 2016 cohort were all juniors while the 2017 cohort ranged from freshmen to seniors. All engineering students were invited via direct email and self-selected individuals were interviewed by the program administrator to assess their commitment to participating in the intercultural development program. Table 1 indicates the demographic composition of both cohorts.

TABLE I: DEMOGRAPHIC INFORMATION OF THE CCLP PARTICIPANTS

		Gender	Country of Citizenship	Ethnic Minority
2016 Cohort	Sample (n=14)	43% Female	86% USA	21%Yes
		57% Male	14% Non-USA	79% No
2017 Cohort	Sample (n=16)	50% Female	45% USA	43% Yes
		50% Male	55% Non-USA	57% No

B. Program Goals and Description

Both programs were implemented with overarching goals of capitalizing on competency development through (1) the exchange of cultural values through domestic-international student partnerships, (2) guiding domestic and international students to cross cultural boundaries, (3) eliminating social barriers, and (4) fostering intellectual discussions through organic relationship building activities.

These goals were achieved by introducing learners to the intercultural knowledge, skills, and attitudes modules, experiencing culture, and reflecting as a group and individually, and fostering mentoring relationships.

C. CCLP Structure

Over the course of two semesters, participants in both cohorts were introduced to 10 modules of intercultural attitudes (openness and curiosity), skills (empathy, verbal and nonverbal communication), and knowledge (cultural self – awareness, worldviews, and frameworks). The program required 40 hours of total time investment over the fall and spring semesters in non-curricular settings. Each module included a training session and a reflection assignment. Each training session was 2 hours long and students completed reflections after each training session on their own. Program administrators added a peer-to-peer mentoring component to the 2017 cohort to facilitate intercultural dialogues with peers. Four participants of 2016 cohort were recruited to serve as 2017 cohort peer mentors. Both cohorts were required to engage in social-cultural activities with assigned culturally different peers. Participants were rewarded with a cross-cultural learner certificate for successful completion of the program. Participants successfully completed the program by attending the module trainings, submitting reflective assignments, engaging with peers on social settings, and setting-up individual pre and post IDI debriefs. Participants in the 2017 cohort had additional peer mentoring meetings to facilitate further discussions on the modules. Each of the module training sessions was designed around active learning pedagogies. The program facilitators embedded Vande Berg's [22] four core competencies model into each of the training modules to increase participants ability to interact effectively and appropriately with cultural different other and learning ways to bridge the cultural gaps. An example of an activity below reflects on an amalgamation of intercultural constructs used during one training module during the spring semester as a recap.

Example Activity Global Engineering Competency Vignette:

Students watched a video vignette that depicted a hypothetical yet realistic global engineering scenario of a production engineering team meeting at a manufacturing plant in China. The opening caption suggested they were affiliated with a major multinational (USA and China) firm, their conversation revolved around the team's efforts to troubleshoot a quality control problem. As the meeting progressed, two subordinates (from US and China) reported on their efforts to check the firmware versions on all the lines, while the manager (from China) appeared convinced that the problem is with the roller pins and dictated further action in this direction. The video concluded with one of the subordinates expressing frustration and concern about how to handle this situation, particularly given his disagreement with the supervisor's suggestion. In this exercise students were asked to first describe, interpret, and analyze the scenario, and second use cultural dimensions such as Hofstede's dimensions, direct and indirect communication style, openness, and cultural worldviews to reflect on how to

leverage engineering domain knowledge (e.g., the responsibility of an engineer to take action when faced with a quality control problem), cultural knowledge (e.g., how groups work together, and how decisions are made in Chinese cultural context), and cultural sensitivity (e.g., responding appropriately when facing a difficult situation in a Chinese business context).

D. Assessment of Intercultural Competence Structure

The program goals and outcomes were measured by using two assessments- one, the Intercultural Development Inventory (IDI) [19] v3 for education, and second, the Attitudes, Skills, and Knowledge Short Scale (ASKS^{2+}) [26]. The IDI is a 50 – item questionnaire that measures intercultural competence and aligns with the five (5) orientations towards cultural difference and commonalities described on the IDC. After completing the IDI, individual reports are generated for each participant based on the scores calculated from the IDI web based analytic program [19]. Participants are expected to attend an individual debrief session for an hour with an IDI qualified administrator to discuss their profile scores and receive their intercultural development plan which provides resources for improving intercultural competence. While different scores are reported on the IDI, the primary score of interest is the Developmental Orientation (DO) score. The DO score is a measure of the individual's primary orientation towards cross – cultural differences and similarities based on the IDI. This score represents the perspective an individual most likely uses when they encounter situations that involve navigating cultural differences and commonalities. The individuals DO aligns with the orientations on the IDC and can be either Denial, Polarization, Minimization, Acceptance or Adaptation [19], [27].

The ASKS^{2+} is a quantitative and qualitative formative assessment tool developed based on the Intercultural Knowledge and Competence VALUE Rubric [18]. On the quantitative section of ASKS^{2+}, students responded to specific statements related to behaviors that represent one of the six components identified on the VALUE Rubric, using a six - point Likert scale. The Likert Scale was adapted from Bloom's Affective Domain. Responses on the scale represent the degree to which an individual values or perceives the specific behavior as important when interacting with individuals from different cultures, as well as being culturally self – aware. *The scale ranges from 1 – not at all aware or don't recognize this behavior, 2 – low degree, I am only aware of and recognize this behavior, 3 – somewhat low degree, I corporate or comply if required by others, 4 – somewhat high degree, I recognize the value of and prefer this behavior, 5 – high degree, this behavior is an important priority for me to 6 – very high degree, the behavior is natural, habitual or represents who they are.* In the qualitative section, students were asked to identify three statements from the quantitative section, then describe, interpret, and evaluate the experience related to the specific statement. Finally they were expected to set a goal for how they will continue to improve. The purpose of the ASKS^{2+} was to facilitate student reflection on specific components of intercultural knowledge and competence. This allowed them to assess their own intercultural development based on their experiences, and then use the information they gain about themselves to set goals for improving. Because each statement aligns with one of the six components on the VALUE Rubric, students were able to identify and reflect on specific components related to intercultural attitudes (openness and curiosity), skills (empathy and verbal and non – verbal communication) or knowledge (cultural self – awareness and knowledge of cultural worldviews and frameworks). The quantitative and qualitative data from the ASKS^{2+} provided insights into how students changed in their perceptions towards interactions with culturally different others, as well as become more culturally self – aware. The ASKS^{2+} data was also used to assist program administrators' with program evaluation; to identify specific components of intercultural knowledge and competence that students developed in the program.

IV. RESULTS

Pre and Post scores from the IDI and the quantitative section of the ASKS^{2+} were analyzed using a paired samples t-test to examine participants' intercultural development. Table II shows the results from the t-test which revealed that there were statistically significant differences between the pre and post – IDI scores for both the 2016 and 2017 cohorts. This result suggests that, participants in the program improved in their degree of intercultural competence by the end of the program. The IDI scores from both cohorts show that on average students started the program with monocultural mindsets representing a denial and polarization orientation towards cultural differences and commonalities or were approaching the transitional orientation – minimization. However, by the end of the program on average participants improved to the transitional approach closer to intercultural/global mindsets (i.e. acceptance and adaptation).

TABLE II. GROUP IDI SCORES OF PRE- AND POST-PROGRAM

	IDI Scores				
Cohort	Pre DO Mean	Std Deviation	Post DO Mean	Std Deviation	Mean Difference
2016	90.19	14.25	105.80	17.38	15.61**
2017	83.94	12.74	106.54	17.80	22.60**

:< P – VALUE < .05, ≤ .01**

Notwithstanding the group results, developing intercultural competence is an individual process. Therefore, considering participants individual development, most participants in the 2016 and 2017 cohorts had gains in their intercultural competence. The IDC model and the IDI scores are aligned to track individual development to the next immediate orientation and overall improvement through

each developmental stage. Overall, the results show that 13/14 participants from the 2016 cohort (Figure 1) and 15/16 participants from the 2017 cohort (Figure 2) improved in their intercultural competence.

Specifically, for the 2016 cohort, 5/14 participants improved to the next orientation, which represents a shift towards the intercultural/global mindsets. For example, a student who started the program with polarization orientation, improved in intercultural competence by the end of the program to have a minimization orientation (e.g. participant 4 figure 1). For the 2017 cohort, 10/16 participants improved to the next orientation, which also represents a shift towards the intercultural/global mindsets. For example, a student who started the program with a minimization orientation, by the end of the program, improved in intercultural competence to have an acceptance orientation (e.g. participant 10 figure 2). Although some participants who started the program with a minimization orientation also ended the program with a minimization orientation, the points gained on the IDI suggest that they improved in intercultural competence with increased understanding of cultural differences and commonalities.

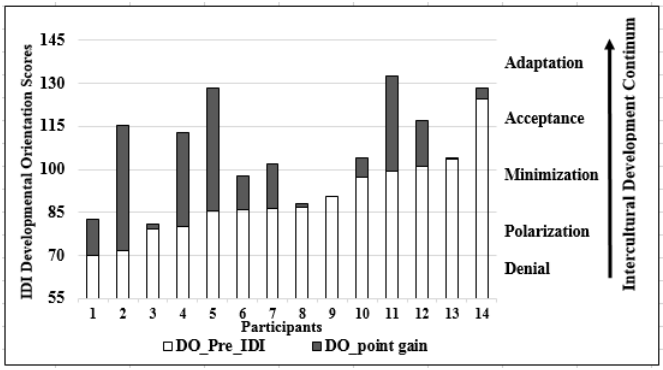

Fig. 1. 2016 Cohort Gains in Intercultural Competence

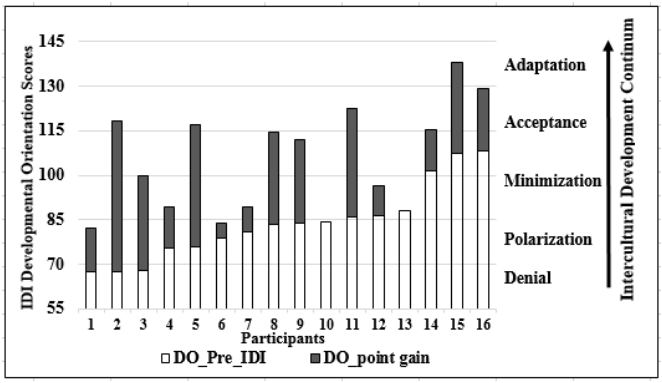

Fig. 2. 2017 Cohort Gains in Intercultural Competence

The results from the ASKS^{2+} also show statistically significant differences with respect to development in intercultural attitudes, skills, and knowledge based on paired samples t-test analysis shown in Table III.

TABLE III. GROUP ASKS^{2+} SCORES OF PRE- AND POST-PROGRAM

	Attitudes		Skills		Knowledge	
Cohort	Pre Mean (Std)	Post Mean (Std)	Pre Mean (Std)	Post Mean (Std)	Pre Mean (Std)	Post Mean (Std)
2016	3.39 (.53)	4.98 (.52)**	3.16 (.66)	4.71 (.63)**	3.62 (.77)	5.21 (.59)**
2017	4.75 (.73)	5.27 (.59)*	4.33 (.79)	4.84 (.83)	4.48 (.74)	5.15 (.57)**

:< P – VALUE < .05, ≤ .01**

The results show that participants in the 2016 cohort had a significant development in all three components of ASKS^{2+} ($p < .01$), however, for the 2017 cohort significant development was observed in intercultural attitudes and knowledge but not for skills. This result suggests that, by the end of the program, participants valued behaviors associated with intercultural attitudes, skills, and knowledge to a higher degree than at the beginning. Specifically, on average behaviors associated with intercultural attitudes (i.e. openness and curiosity) and knowledge (cultural self – awareness and cultural worldviews and frameworks) became a priority for students as shown in figure 3.

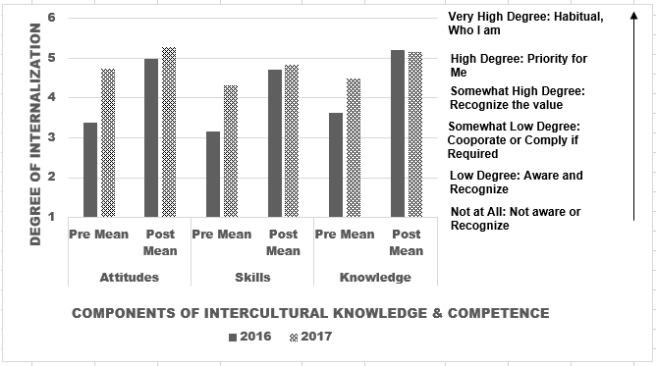

Fig. 3. 2016 and 2017 ASKS^{2+} Pre and Post Mean Scores

Reflection statements from participants based on responses to the qualitative questions on the ASK^{2+} were reviewed to further understand participants' perceptions of their development for each component of the IKC VALUE Rubric. After reviewing all the items in the rubric, one reflection statement was chosen for each of the six components of intercultural knowledge and competence. Finally, one reflection was selected to represent the intercultural attitude *openness,* one for skills, *empathy* and one for knowledge, *cultural self – awareness*. The criteria for selecting a specific reflection was based on the amount of details provided by the student, and the extent to which the student reflected on how their perspective changed or how they would like to improve.

The qualitative results from the ASKS^{2+} provided support for the quantitative results highlighting development of intercultural attitudes, skills, and knowledge based on specific statements students chose to reflect on and set goals for development. As shown in figure 3, the most significant improvement was primarily in intercultural attitudes (i.e. openness and curiosity) and knowledge (i.e. cultural self – awareness and knowledge of worldviews and frameworks). Reviewing the specific behaviors participants chose to reflect on the qualitative section of the ASKS^{2+}, it was clear that most participants chose to reflect on items related to intercultural attitudes and knowledge. The following are student reflections from the post ASKS^{2+} assessment:

1) Reflection on developing intercultural attitude of openness related to suspending judgement when interacting with culturally different others.

> I learned this after passing judgement and being proven wrong many times throughout this program. I passed judgement and then was surprised and embarrassed when I was wrong. This was good for me because it corrected my habit and made me realize how damaging that habit is to the development of relationships.

2) Reflection on developing intercultural skill of empathy. This student reflected on an activity developed to help them understand what it means to demonstrate empathy which involves acting in supportive ways to understand the feelings of others and use a world view different that their own to interpret views and actions of others.

> The experience was valuable to me because it required me to leave my own framework and think about how people from other cultures were likely to think of these scenarios which helps to build understanding and empathy. I gained more than I thought from this activity. I thought that I would think of the parable and provide clear answers but as I thought about it more, more opportunities arose. I hope to have more experiences like this in the future and on these I will try to suspend my initial bias better.

3) Reflection on developing intercultural knowledge of cultural self – awareness related to being of aware of one's own cultural rules and biases.

> For me the experience I went through enabled me to understand that first and foremost it is important to realize my own viewpoints and what shapes them. The experience meant for me to ask myself some hard questions and really analyze the way that I process my thoughts and actions, something I didn't do very often. This concept is something I feel like I have grown in. Through my experience I can now question and understand how my thoughts and actions are shaped. Next, I will need to incorporate myself – awareness into my interactions with individuals to prevent myself from jumping to conclusions and understanding other better.

V. DISCUSSION

The traditional approach to intercultural development for future engineers is study abroad [28]. However, considering the results from the two cohorts of the CCLP, there is evidence to suggest that by intentionally designing, implementing, and assessing on-campus programs, it is possible to achieve significant intercultural development with engineering students from diverse backgrounds and disciplines. The development in intercultural competence as measured by the IDI from these two cohorts of the CCLP were greater in some cases or on par with study abroad program reports [29]. A review of 60 study abroad programs with limited intercultural interventions while abroad reported average gains of +1.32 on the IDI [6]. The gains reported for intentionally designed programs with pre – departure courses, on site interventions and re – entry courses ranged between +6.00 and +18.00 points [29], [31]. Furthermore, considering that study abroad programs are sometimes designed to immerse students in the host culture for an extended period of time (e.g. two weeks, a semester or even two years), the results from the CCLP were achieved in two semesters, but with only 40 hours of time investment. But what do these results mean in the context of developing intercultural competence as assessed by the IDI (based on the IDC framework) and the ASK^{2+}?

The results suggest that participants in the CCLP program developed from having monocultural mindsets, to a more advanced transitional minimization orientation towards cultural differences and commonalities. Based on the IDC conceptualization, individuals with monocultural mindsets tend to 1) use broad stereotypes to identify cultural difference; 2) support less complex perceptions and experiences of cultural difference and commonality; and 3) make sense of cultural differences and commonalities based on their own cultural values and practices. However, individuals with the more transitional orientation – minimization – tend to highlight cultural commonality and universal values and principles but may ignore deeper recognition and appreciation of cultural differences [19], [27]. By the end of the program, participants in both cohorts on average moved towards more advanced minimization orientation, with several students developed an intercultural/global mindset to approach cultural differences and commonalities. Based on the IDC, individuals with intercultural or global mindsets tend to 1) make sense of cultural differences and commonalities based on their own as well as the other culture's values and practices; 2) use cultural generalizations to recognize cultural difference; and 3) support more complex perceptions and experiences of cultural difference and commonality [19], [27]. Results from the ASK^{2+} suggest that students started to value intercultural attitudes, skills, and knowledge that will facilitate

developing more intercultural/global mindsets. The degree of intentionality is a requisite for achieving significant intercultural development [16], [32]. Therefore, the question becomes how were the results achieved?

The process of designing, implementing, and assessing the CCLP program was based on established intercultural development paradigms (CAB and IDC) and frameworks which provided a way to evaluate the program outcomes. First, using both quantitative and qualitative methods of assessment were helpful in identifying students' actual intercultural competence development as assessed by the IDI, as well as their perceptions of their own development of the intercultural attitudes, skills, and knowledge and goals to continue their development based on the ASK^2. It is important to have mixed methods assessments in intercultural development programs, including assessments that allow students to reflect on their own development [10], [14]. Second, the role of mentoring was pivotal in the process of intercultural development. The majority of the students reported that the individual meetings with program administrators, as well as working with a cultural mentor in groups, helped them reflect on their cultural awareness, as well as provide a safe environment to ask questions about cultural interactions they would not have otherwise been able to ask. One student stated "I think that mentors helped my development by giving me a safety net of people to go to. I knew that if I had problems or questions, I could go to them and they would try to help me, and this sense of security helped me greatly." Another student stated:

> My CCLP group leader really changed how I perceived people from other cultures. Having spent the previous 10 years all throughout Asia before coming to the Midwest, I had the preconceived notion that people in Central America [the Midwest] were not as culturally open as compared to the coastal states, like my own hometown of NYC, where any form of racism is immediately shut down by every bystander. Not having travelled outside the United States, CCLP leaders, really surprised me with how open [they were] with other cultures and I came to the realization that I myself was not as open to other cultures than I thought I was. This lead to a period of reflection for me throughout the semester whereas I began to catch myself with "automatic" thoughts when talking to someone from a culturally different background. Through the guidance of the CCLP and my group leader, I am able to speak to learn and listen to understand.

This highlights the importance of interculturally competent administrators and mentors to facilitate intercultural development [10], [16], [33]. Third and lastly, by identifying different components of intercultural knowledge and competence to align with the assignments and activities presented in the modules, the program administrators were able to look at the results and see where more reflection and greater intentionality in developing specific components could be achieved. For example, students' perceptions on intercultural skills development were lower than knowledge and attitudes for both cohorts. This may be an indication of how some activities were facilitated or perhaps need for including more activities and assignments that are focused in intercultural skills development.

The implications of this work are twofold. First, to provide faculty and staff with a model for intentionally designing, implementing, and assessing intercultural development programs on– campus. This serves also to further advance scholarship related to internationalization at home initiatives [5]. Furthermore, this model can also be applied to faculty and staff planning study abroad programs to prepare students for intercultural experiences while abroad, as a means of intervening before students study abroad [30]. Second, for students participating in such programs to identify outcomes that can be achieved in developing competencies associated with becoming an interculturally competent engineer [34], [36]. Additionally, the applications of this model can serve to provide opportunities for inclusiveness in engineering programs among students from diverse cultural and academic backgrounds. By intentionally designing programs that focus on building cultural self – awareness and awareness of others, engineering programs can leverage the diversity on their campuses to provide opportunities for intercultural development to all students; equipping them with the competencies needed to work and live in an increasingly globally connected and multicultural world.

VI. LIMITATIONS AND FUTURE DIRECTIONS

The significant results of the pilot program indicated that intentional design of on-campus program like CCLP can increase engineering students' intercultural competence. The program administrators addressed some of the 2016 cohort program limitations by incorporating suggestions from colleagues and the students [29] which yielded greater results in the group and individual IDI gains. The first limitation addressed in the 2017 program was diversifying participants discipline backgrounds and class standings. For instance, 2016 program was piloted with participants in junior standing from a single engineering discipline while in the 2017 program, participants represented multiple engineering disciplines which ranged from freshmen engineering to graduate class standing. The composition of the multiple disciplines and class standings may have contributed to diversity of thought processes yet, this aspect was not measured as part of the cohort analysis. Another aspect that was added from 2016 to 2017 was peer to peer mentoring. Four participants of 2016 cohort were recruited to serve as 2017 cohort peer mentors. The increased number of intercultural coaching and touch points including the program administrator and peer mentors may have also contributed to significant gains. However, the impact of interculturally trained peer mentors and its affect was not directly measured.

The other limitations of both studies include, small sample size, financial constraints associated with scaling-up, lack of engineering specific modules, and student motivation. Given the size of student enrollment in the college of engineering, scaling-up of programs in this nature is challenging. The cost associated with assessments and number of qualified administrators needed for the individual coaching and mentoring can be a major challenge to overcome in the future program execution. Additionally, the results must be considered based on the fact that students self – selected into the program. This would suggest that the students entered the program with some degree of openness to intercultural development. However, degree of openness is only an initial step towards intercultural development, and the reports from students in both cohorts suggest a positive change in value and perspective towards cultural differences which is an important outcome for engineering graduates. Nonetheless, these limitations are opportunities for future interventions needed from technological advances for scaling-up without tarnishing effect of individual coaching. Future program evaluations of this nature should also focus on measuring the impact of peer mentoring in the context of intercultural learning and examining students perceived knowledge transfer of intercultural competencies as they work in multicultural and multidisciplinary teams.

VII. CONCLUSION

As higher education institutions aim to graduate engineers with abilities to function in multidisciplinary teams, communicate effectively across cultures, and develop agile mindsets to meet the challenges of contemporary issues, it is extremely important to have an array of options for all students to develop intercultural competencies. The program described in this paper reports significant growth of intercultural competencies measured by the IDI. The gains (+15.61 and +22.60) of 2016 and 2017 CCLP cohorts were greater in some cases or on par in the study abroad program literature [6], [29]. It is also evident from the program results, which by increasing intentional intercultural touch points such as adding peer mentoring and also by collecting artifacts through quantitative and qualitative measures helped the program administrators to measure the impact of the program.

Intercultural competence is a life - long developmental process which involves being able to communicate effectively and appropriately across cultural contexts. Developing specific attitudes, skills, and knowledge that support the value and understanding of cultural differences and commonalities is pivotal to facilitate this process. As workspaces become increasingly more diverse and multicultural, it is incumbent upon engineering programs and disciplines to be intentional about program design, implementation, and assessment to prepare graduates not only with technical knowledge and skills, but with the cultural knowledge, attitudes, and skills to work in multicultural environments and teams [34],[36]. The complementary approach described in this paper is a model that can potentially be applied and modified across engineering disciplines to facilitate the development of well-rounded engineers.

The opportunities for all engineering students to develop intercultural competence should be inclusive, cost effective, transformative, and adaptive to social, cultural and political environments. In conclusion, by intentionally focusing on cognitive, affective, and behavioral dimensions of intercultural development (i.e. components of intercultural knowledge and competence) coupled with a developmental approach (IDC), the results suggest it is possible to achieve intercultural outcomes without or even before studying abroad.

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