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Evaluating intercultural competence in a structured international engineering workshop

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ABSTRACT

Short-term international engineering workshops have grown as a practical response to curriculum constraints on extended international mobility, yet methods for evaluating how intercultural competence (IC) develops within these programs remain limited. This study evaluates self-reported IC outcomes among undergraduate engineering students who participated in a structured workshop in Thailand. Post-program data were collected from 89 students at 10 institutions in eight countries (response rate=74.2%), using a mixed-methods design combining a survey instrument across four dimensions with open-ended responses. The results reveal that attitudinal competencies outpaced behavioral skills, with significant variation across nationality and English proficiency groups. Engineering terminology was linked to reduced behavioral engagement beyond general English proficiency, even among intermediate-level speakers. Host-country participants showed a possible developmental pathway distinct from visitor groups, one that sojourner-centered models may not fully capture. This study provides empirical evidence that disciplinary context and participant characteristics relate to IC development in ways general IC frameworks have not fully addressed, applying existing theory to an engineering-specific, short-term setting. The approach also provides valuable insights for program designers and educators, supporting more equitable IC development that better prepares graduates for multinational professional environments.

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1. INTRODUCTION

Engineering graduates increasingly enter workplaces where collaboration across national and cultural boundaries is routine. Multinational technology projects, from semiconductor design teams distributed across Asia, Europe, and North America to open-source software platforms built by contributors from dozens of countries, require engineers to work effectively with people who frame and solve problems differently [1]–[3]. Intercultural competence (IC) is therefore not a peripheral skill for engineers; it is a functional requirement of modern professional practice. However, the rigid structure of engineering curricula often leaves little room for the extended international programs that IC development has traditionally relied on [4]. Short-term workshops have grown as a practical response to this constraint, offering a compressed form of intercultural engagement that fits within tighter program schedules.

IC covers knowledge, attitudes, and practical abilities that work together across cultural contexts [5]–[8]. Three widely cited frameworks inform this study's approach to IC evaluation: Byram [5] model of intercultural communicative competence, Deardorff's [6], [7] process model, and Bennett [8] developmental model of intercultural sensitivity (DMIS). Synthesized across these frameworks, IC is understood as a multidimensional construct in which knowledge, attitudes, skills, and learning outcomes are theoretically distinct and may develop at different rates. These frameworks together support a dimension-specific approach to IC evaluation rather than treating it as a single aggregate outcome.

In engineering, IC extends further than general communicative competence. Engineers need to work with people who approach the same technical problem differently, which requires negotiating problem definitions across cultural and disciplinary boundaries [1], [2], [9], [10]. Research consistently shows that students tend to develop awareness of IC before they can act on it in practice [4], [11]. Engineering students are no exception. In short-term formats, this challenge is compounded by time pressure: students must negotiate cultural and technical differences simultaneously, often before they have developed the communicative capacity to do so effectively. Intercultural learning requires deliberate pedagogical design rather than contact alone, with guided interaction, structured reflection, and collaborative tasks identified as key conditions [11]–[13]. Short-term formats can produce measurable IC gains when carefully designed, and structured reflection within disciplinary contexts appears to be among the most important design features [11], [14]. In Southeast Asia specifically, short-term exchange programs have shown IC gains even where participants face language barriers and cultural adjustment challenges, though most available evidence draws on qualitative designs with small samples [15]. Shorter structured workshop formats in this region remain comparatively understudied.

Research in this area remains limited in three respects: the absence of rigorous empirical evidence in short-term formats, a focus on Western and study-abroad contexts, and a reliance on aggregate outcome reporting that obscures participant-level variation. Within engineering education, most available evidence focuses on study abroad and extended immersion. This gap is particularly pronounced in regions such as Southeast Asia, where access to extended international mobility remains constrained, making domestically hosted short-term workshops one of the few viable formats for intercultural engineering education [15]–[17]. Less well understood is how specific engineering tasks such as medical device design function as catalysts for IC development in these contexts. While dimension-specific analysis has been conducted in some higher education contexts [18], how different participant groups perform across dimensions in disciplinary engineering settings remains underexamined [19], [20]. These dimensions are theoretically distinct and may respond differently depending on participant characteristics [12], [21]. These gaps point to a question that has received little direct attention: how participant characteristics relate to IC development within the same short-term engineering workshop, and what evaluation approaches can make that variation visible.

This study evaluates self-reported IC outcomes among engineering students who participated in a structured international workshop at a Thai engineering faculty. A post-program evaluative design was used to examine how IC patterns relate to learning design and participant characteristics. The study is guided by two research questions:

- Asks the extent to which engineering students report IC following participation in the workshop (RQ1)
- Asks which participant characteristics are associated with self-reported IC outcomes in this setting (RQ2)

Its contribution is novel in application, not in theory: it does not propose a new IC framework or instrument, but examines how different dimensions of self-reported IC vary across participant characteristics and engineering task demands within the same program. Two findings are particularly relevant. First, technical engineering vocabulary appeared to present an additional barrier beyond general English proficiency. Second, host-country participants showed a possible developmental pathway that may not be fully captured by sojourner-centered models, consistent with evidence of diverging host and visitor experiences. These findings suggest that, in short-term engineering contexts, IC frameworks may need to account more explicitly for disciplinary task demands and host positioning. For program designers and educators, this approach helps identify which groups may need additional support and how engineering tasks could be structured to ease language-related barriers. As short-term international workshops become more common in the region, how these programs are evaluated will matter for how effectively they support IC development in engineering education.

2. METHOD

2.1. Research design

A post-program evaluative design was used for two reasons. First, the workshop's short duration precluded pre-post measurement. Second, participation in an intensive intercultural program can alter participants' internal standards for self-evaluation, meaning pretest scores may not reliably reflect baseline functioning [22]–[24]. Post-only assessment avoids this problem by capturing self-reported competence after

participants have completed the experience. All findings reflect perceived IC at program completion. Mixed-methods data were collected to map IC outcomes across four dimensions and to provide complementary qualitative evidence [20].

2.2. Participants and context

The target population comprised 120 undergraduate engineering students from ten institutions across eight countries: Thailand, the Philippines, Japan, Cambodia, South Korea, Belgium, Nigeria, and Taiwan. Participation was voluntary and anonymous; all students enrolled in the workshop were invited to complete the questionnaire at program completion. A total of 89 responded (response rate=74.2%). The workshop was conducted at the Faculty of Engineering, Kasetsart University, Thailand, over one week. All participants were enrolled in engineering programs and took part in discipline-specific activities including problem-solving, case-based design, and collaborative presentations.

2.3. Workshop structure

The workshop was structured around three interconnected mechanisms: intercultural interaction, engineering-based collaboration, and peer presentation and feedback, as illustrated in Figure 1. Participants worked in mixed-nationality groups throughout a one-week program. The schedule comprised four phases: team formation and initial problem-scoping activities on day 1, discipline-specific technical skill-building including 3D scanning, computer-aided design (CAD) design, and 3D printing on days 2 to 4, a clinical immersion and design phase on day 5, and a prototyping and presentation phase on days 6 and 7. Alongside the engineering design challenge, the program incorporated cultural immersion activities including ice-breaking sessions, a local cultural experience, and visits to engineering facilities and heritage sites, providing additional contexts for intercultural engagement beyond the technical tasks. Figure 1 presents the conceptual model that guided the workshop design and frames the analysis in this study.

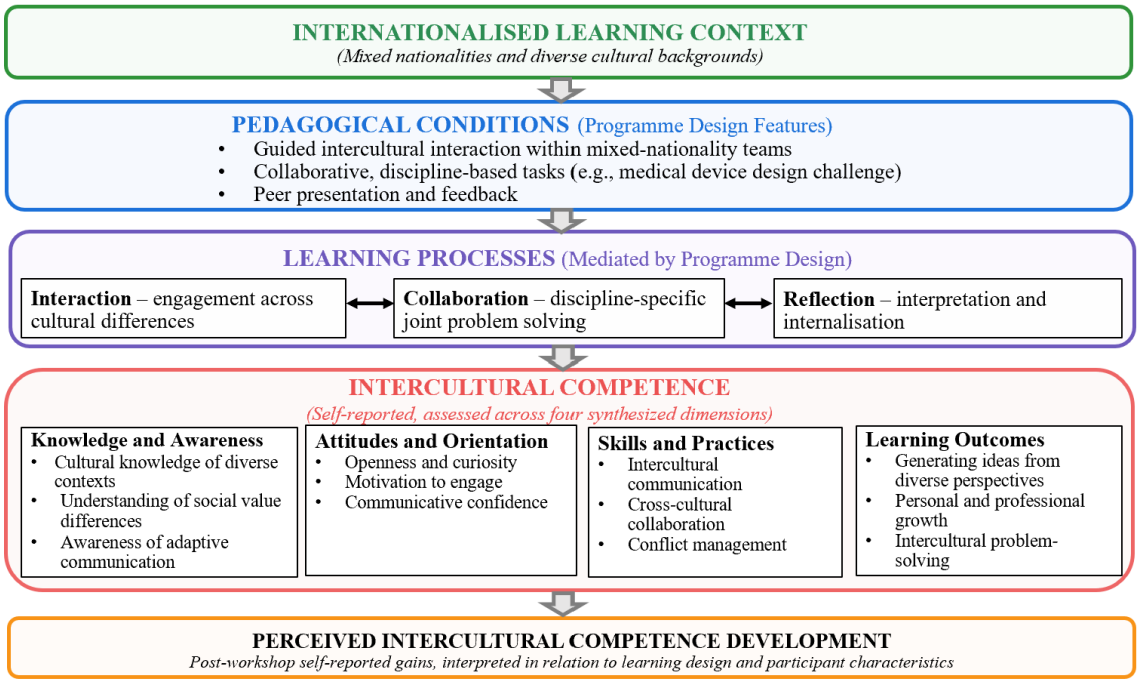


Figure 1. Conceptual model of IC development in structured workshop environments

The culminating activity was a medical device design challenge in which teams were tasked with designing an improved ankle-foot orthosis (AFO) for patients with foot drop conditions. The objective was to develop a device that improves walking stability, comfort, and quality of life while addressing real clinical and engineering constraints. Teams were evaluated against six criteria: mechanical support for ankle stability, lightweight structure and user comfort, ease of use and wearability, patient safety and ergonomic considerations, manufacturability and cost-effectiveness, and feasibility within real-world healthcare settings.

On day 5, participants conducted structured interviews with actual patients, observed clinical gait patterns, and collected biomechanical data using the M-Gait 3D motion analysis system. Teams then used 3D scanning (EinScan), CAD software (Blender and SolidWorks), and 3D printing (PrusaSlicer) to develop their designs. Material properties were assessed using tensile testing equipment to support design decision-making. Final deliverables comprised a physical AFO prototype and a design concept presentation, submitted on day 7 to a mixed-nationality evaluation panel.

The task required participants to integrate engineering principles with clinical user requirements across cultural and disciplinary boundaries, making cultural differences in problem framing visible and negotiable [1]. Each team included participants from at least three different countries, and all deliberation and presentation were conducted in English. While the program incorporated multiple contexts for intercultural engagement, participant reflections were captured through post-program responses. This approach draws on the view that in engineering education contexts, shared technical problems act as the primary driver of IC development rather than functioning as background context for intercultural exchange [1], [2].

2.4. Instrument design and reliability

The survey instrument comprised three components. The first was a 12-item Likert-scale IC instrument across four synthesized dimensions: knowledge and awareness, attitudes and orientation, skills and practices, and learning outcomes, with three items per dimension. The full instrument is provided in Appendix. The second was a structured multiple-response question asking participants to identify challenges encountered during the workshop, with an open-ended option for responses not captured by the provided categories. The third consisted of open-ended questions inviting participants to describe their impressions of the program, suggest improvements, and recommend future activities. Open-ended responses were collected in participants' language of choice: English, Thai, or Japanese. A 7-point Likert scale was used, chosen because seven-point scales outperform five-point scales in reliability and discriminating power [25], [26].

The four dimensions were derived from a synthesis of three widely cited frameworks, as set out in Table 1. Byram [5] model of intercultural communicative competence provides the dimensional structure, conceptualizing IC as a combination of knowledge, attitudes, and skills operating across cultural contexts. Deardorff's [6], [7] process model contributes the developmental logic: attitudinal openness forms the entry point for IC development, with skills and behavioral competence developing progressively over time. Bennett [8] DMIS is used to interpret developmental variation in participant responses, not to measure outcomes directly. Each dimension is theoretically distinct and may develop at a different rate depending on participant characteristics. The instrument was synthesized from these frameworks and was not independently validated.

Internal consistency was assessed for all four dimensions and the overall scale using Cronbach's alpha. Table 2 reports the coefficients, which ranged from acceptable to excellent, supporting the use of the instrument for descriptive analysis of self-reported IC. The findings should be interpreted as descriptive patterns of self-reported IC rather than objective competence measures.

Table 1. Analytical framework for assessing IC in this study

Synthesized dimensions	Byram's ICC model	Deardorff's process model	Bennett's DMIS
Knowledge and awareness	Savoirs: knowledge of own and others' cultures; Savoir comprendre: interpreting across cultures	Cultural self-awareness; deep knowledge; understanding of worldviews	Ethnocentric recognition toward awareness of cultural complexity
Attitudes and orientation	Savoir être: openness, curiosity, willingness to suspend judgment	Respect; openness; curiosity; tolerance of ambiguity	Denial/defense toward acceptance of differences
Skills and practices	Savoir apprendre/faire: discovery and interaction; Savoir s'engager: critical cultural awareness	Perspective-taking; flexibility; intercultural communication skills	Frame-shifting, code-shifting, adaptive behavior
Learning outcomes	Intercultural speaker; mediation between cultures	Internal: adaptability, empathy; External: effective behavior	Adaptation and integration of differences into identity

Note: synthesized from Byram [5] ICC model, Deardorff's [6] process model, and Bennett [8] DMIS. Bennett's model was used as a developmental lens rather than a measurement framework.

Table 2. Internal consistency reliability of the IC instrument (N=89)

Dimension	No. of items	Cronbach's α	Interpretation
Knowledge and awareness	3	0.783	Acceptable
Attitudes and orientation	3	0.811	Good
Skills and practices	3	0.837	Good
Learning outcomes	3	0.846	Good
Overall scale	12	0.943	Excellent

Note: interpretation based on Nunnally [27]: $\alpha \geq 0.70$=acceptable; $\alpha \geq 0.80$=good; $\alpha \geq 0.90$=excellent. Internal consistency was the primary reliability indicator used here; see section 2.4 for validity considerations.

2.5. Data analysis

Descriptive statistics including means and standard deviations were calculated for each IC dimension and item. One-way analysis of variance (ANOVA) was used to examine mean differences across nationality groups (Thai, Filipino, Japanese, and Cambodian) and English proficiency groups (beginner, intermediate, advanced, and proficient), with significance set at $p<0.05$. Levene's test was applied to each dimension prior to group comparisons; where it indicated unequal variances, Welch's ANOVA was substituted, as it is more robust to violations of the homogeneity of variance assumption given the unequal and small cell sizes across nationality subgroups in this dataset [28]. Games-Howell post-hoc comparisons were then conducted for each significant result, as this procedure does not assume equal variances or group sizes [29]. Pairwise results are reported alongside the omnibus tests, though all subgroup findings remain exploratory given the post-only design and unequal cell sizes.

Qualitative data were drawn from two sources. The first was an open-ended question inviting participants to describe their impressions of the program, to which all 89 respondents provided written responses in their language of choice (English, Thai, or Japanese); non-English responses were translated by the lead researcher prior to coding. The second was a structured multiple-response question on challenges encountered, completed by all 89 respondents. Challenge response frequencies were used to contextualize and triangulate the qualitative themes rather than as primary findings.

Open-ended reflections were analyzed using inductive thematic analysis following Braun and Clarke [30] in six phases: familiarization through repeated reading; initial coding of data extracts without imposing prior categories; theme generation by grouping codes based on shared conceptual content; theme review against the coded data and full dataset; theme definition specifying the name and scope of each theme; and write-up with illustrative quotations representing the range of responses. Coding was conducted by the lead researcher. Analysis generated three themes: intercultural interaction, engineering-based collaboration, and personal growth and cultural awareness. Codes were generated inductively without reference to the theoretical frameworks used in the quantitative strand, allowing qualitative findings to complement rather than simply confirm the survey results. Trustworthiness was supported through peer debriefing with a faculty colleague with expertise in engineering education and qualitative research methods, an audit trail of coding decisions, and researcher journaling throughout analysis.

3. RESULTS AND DISCUSSION

3.1. Uneven intercultural competence outcomes across dimensions

Overall self-reported IC was high (M=6.25), but dimensions did not develop equally. Table 3 presents mean scores and standard deviations for each IC dimension and item across the full sample. Attitudes and orientation was the strongest dimension (M=6.36), while skills and practices scored lowest (M=6.11) with the most variation (SD=1.02). At the item level, openness to learning about other cultures scored highest (M=6.47), while collaborative skills and conflict management both scored lowest (M=6.10). This attitudinal-behavioral gap is consistent with findings from comparable programs. Nelson *et al.* [11] observe that engineering students tend to recognize the value of IC before they can act on it, and Chédru and Delhoume [4] document similarly uneven IC development across dimensions even in longer formats.

Table 3. Self-reported IC by dimension and item (N=89)

Dimension	Item	M	SD	Dimension M	Dimension SD
Knowledge and awareness	Knowledge of cultural contexts of international peers	6.18	0.87	6.22	0.83
	Understanding of social value differences	6.22	0.95		
	Awareness of need to adapt communication styles	6.26	1.15		
Attitudes and orientation	Openness to learning about other cultures	6.47	0.99	6.36	0.86
	Confidence in intercultural communication	6.16	1.12		
	Positive attitudes toward multicultural environments	6.44	0.90		
Skills and practices	Self-directed intercultural learning	6.13	1.18	6.11	1.02
	Collaborative skills in intercultural contexts	6.10	1.23		
	Skills in managing intercultural conflict	6.10	1.10		
Learning outcomes	Ability to generate ideas from diverse perspectives	6.33	0.97	6.32	0.87
	Awareness of professional development opportunities	6.39	0.92		
	Application of intercultural perspectives in problem-solving	6.25	1.07		

The gap has a clear explanation. In Deardorff process model [6], attitudinal openness is the entry point for IC development, not its endpoint. This pattern contrasts with dimension-specific analyses in other higher education contexts, where behavioral communication has been found to predominate over affective engagement [18], suggesting that program format and disciplinary context are linked to which dimensions are

most accessible to participants. A one-week program appears sufficient to reach that starting point, but behavioral competence requires repeated practice that a single week cannot provide. As Downey *et al.* [1] argue, engineering IC is fundamentally about the capacity to act across cultural difference, not simply to recognize it. A program that shifts attitudes without developing behavioral competence risks producing graduates who are aware of intercultural demands but not equipped to meet them in professional practice. The variation in skills and practices scores (SD=1.02) also suggests that the behavioral gap was not uniform across participants, pointing to participant-level factors beyond program design alone. Whether those factors relate to engineering task structure or participant characteristics is what the following sections examine.

3.2. Engineering-based collaboration as intercultural context

High attitudes did not automatically translate into behavioral competence. The qualitative data suggest that the structure of the engineering tasks, more than general intercultural contact alone, was linked to how far that translation went. Table 4 presents three themes from open-ended responses with supporting evidence, reported challenges, and interpretations.

Table 4. Qualitative themes from open-ended responses (N=89)

Theme	Supporting evidence	Reported challenges	Interpretation
Intercultural interaction	Filipino: 'It was nice to step out of my comfort zone and be closer with other people.' Japanese (beginner): frustration at being unable to communicate due to limited English. Thai (intermediate): 'Initially I was very anxious about language communication, but once we started, everyone tried to understand each other.'	Lack of English confidence (32.6% overall; 82.4% of Japanese group). Adapting to different working cultures (28%). Thai hosts reported English-confidence challenges (38.5%), while technical vocabulary was more prevalent (65%).	Mixed-nationality groups created conditions for intercultural contact, but interaction quality varied by language proficiency and national position. Japanese participants' frustration aligns with their lower skills scores (M=5.43). Thai hosts showed a different challenge profile from Japanese participants, with technical vocabulary more prominent than English confidence among the Thai group.
Engineering-based collaboration	Cambodian: 'Such incredible opportunities to exchange knowledge and experiences... networking connections with engineering students from different regions.' One participant noted the group could focus on the task even if they could not fully explain everything in English.	Understanding technical vocabulary (43.8% overall; 65% of Thai group). Working with peers who think differently (25%). Unfamiliarity with expressive formats (20%).	Engineering tasks created shared cognitive ground enabling participation across language differences. Technical vocabulary as one of the most prevalent challenges points to a layer of intercultural complexity specific to discipline-specific content.
Personal growth and cultural awareness	Filipino: 'I was impressed by how I was still able to learn on top of all the recreational activities.' Japanese (beginner): 'I realized how low my English proficiency was in an environment completely different from Japan. This motivated me to study more.' Thai: 'Language is a mindset to communicate with foreigners, beyond just the language itself.'	Presentation anxiety (39% overall). Schedule fatigue (44%). Fatigue more prevalent among Filipino (Proficient) participants; language anxiety concentrated in Japanese (Beginner) group.	Participants reported increased openness and motivation, but experiences were uneven. Presentation anxiety as a cross-national challenge suggests structured task demands generated intercultural stress alongside intercultural learning.

Across all three themes, a common pattern emerges. Intercultural contact created conditions for interaction, but interaction quality depended on how much participants had to rely on verbal negotiation versus shared task structure. The medical device design challenge required teams to define a clinical problem, divide technical work, and present a joint solution under time pressure. These demands made cultural and disciplinary differences both visible and practically consequential. As Downey *et al.* [1] argue, engineering IC is specifically about working with people who define problems differently, and the AFO design task introduced conditions consistent with this argument. The low scores on conflict management (M=6.10) and collaboration (M=6.10) suggest that negotiating those differences in real time remained genuinely difficult even when participants were willing to engage.

Communicative confidence reflects a related pattern. It was the lowest-rated and most variable item within attitudes and orientation (M=6.16, SD=1.12), sitting at what Byram [5] and Deardorff [6] describe as the boundary between disposition and practice. One Thai participant described how language anxiety did not disappear before the tasks began, but through them. Once the group had a shared problem to work on, the basis for interaction shifted from verbal fluency to shared purpose. Engineering tasks helped lower the threshold for participation by giving all groups something concrete to work toward regardless of language level.

Technical vocabulary, however, remained a barrier that task structure alone did not resolve. Overall, 43.8% of participants reported it as a challenge. The breakdown by proficiency level reveals a more specific

pattern: 71% of beginner-level participants, 62% of intermediate-level participants, and 19.5% of advanced and proficient speakers combined still reported it as a barrier. This distribution points to engineering terminology as a separate language layer that general communicative ability does not automatically cover. Participants who identified technical vocabulary as a challenge scored lower on skills and practices (M=5.67 vs. M=6.46), with the sharpest gap in collaboration specifically (M=5.59 vs. M=6.50). The attitudes and orientation gap between the two groups was considerably smaller (M=6.05 vs. M=6.59), indicating that technical language difficulties limited behavioral engagement without dampening openness or willingness to engage.

Standard IC frameworks, including those of Byram [5] and Deardorff [6], treat language primarily as a social barrier and do not account for the disciplinary layer specific to engineering terminology, which appeared to extend beyond general English proficiency. Jesiek *et al.* [2] argue that global engineering competence requires exactly this kind of disciplinary negotiation. The data here support that argument and suggest that short-term workshops are unlikely to resolve this barrier without targeted technical language preparation before or during the program. Whether participants were equally affected depended substantially on who they were, which section 3.3 addresses directly.

3.3. Participant characteristics and program evaluation

The same program produced meaningfully different IC profiles across nationality and English proficiency groups. Both variables were significantly associated with all four IC dimensions at the omnibus level, as shown in Tables 5 and 6. Table 5 presents IC scores by nationality group, framed as host-country and visitor pathways.

Table 5. Self-reported IC by nationality

Dimension	Host	Visitor pathways			Overall
	Thai (n=26)	Filipino (n=32)	Japanese (n=17)	Cambodian (n=8)	(N=89)
Knowledge M (SD)	6.01 (0.76)	6.65 (0.53)	6.14 (0.65)	5.33 (1.50)	6.22 (0.83)
Attitudes M (SD)	6.27 (0.83)	6.72 (0.49)	6.00 (0.79)	5.67 (1.58)	6.36 (0.86)
Skills M (SD)	6.10 (0.95)	6.66 (0.50)	5.43 (1.11)	5.33 (1.53)	6.11 (1.02)
Learning M (SD)	6.51 (0.63)	6.69 (0.53)	5.78 (0.82)	5.50 (1.66)	6.32 (0.87)
Overall M	6.22	6.68	5.84	5.46	6.25

Note: Korean (n=3) and other (n=3) were excluded from group comparisons. Significant differences were found for knowledge (Welch's F=6.45, p=0.002), attitudes (Welch's F=5.42, p=0.006), skills (Welch's F=8.62, p<0.001), and learning outcomes (Welch's F=6.31, p=0.003). Games–Howell tests showed higher Filipino scores than Thai and Japanese participants in knowledge, higher Filipino scores than Japanese participants in attitudes and skills, and higher Thai and Filipino scores than Japanese participants in learning outcomes. Findings remain exploratory due to small and unequal cell sizes.

Thai host-country participants entered the program from a structurally different position than all visitor groups. Their knowledge scores were lower than those of Filipino and Japanese participants (M=6.01), a pattern consistent with host positioning rather than limited cultural exposure: as hosts, Thai participants already operated within a familiar institutional and cultural environment, leaving less room for the kind of knowledge gain typically associated with encountering new cultural contexts for the first time. Despite this, their learning outcomes (M=6.51) were the second highest across all groups. Technical vocabulary was their primary challenge (65%) rather than English confidence, suggesting that IC development for Thai participants operated through a relational and applied pathway rather than through cultural discovery. This is consistent with research showing that on-campus international experiences are associated with intercultural dispositions among both domestic and international students [31]. Program design and evaluation frameworks built around visitor experiences may risk misreading host-country outcomes as underperformance when they instead reflect a different developmental starting point.

Filipino participants reported the highest scores across all dimensions with the smallest gap between attitudes (M=6.72) and skills (M=6.66). Schedule fatigue (47%) and presentation anxiety (31%) were their primary challenges rather than language barriers, suggesting that communication capacity enabled consistent engagement across all IC dimensions. This pattern has a practical implication: program evaluation should examine not only average IC scores, but also the challenge profiles behind those scores, since high-performing groups may still require support in areas such as workload management and presentation confidence.

Japanese participants showed the reverse pattern. They recorded low skills and practices scores (M=5.43), and 82.4% reported lack of English confidence as a challenge. The knowledge-to-skills gap of 0.71 points was the largest across all groups, suggesting that language barriers constrained participants' ability to translate awareness into action. Jenkins [32] highlights the communicative effectiveness of English as a lingua franca in international settings; the pattern observed here suggests that language confidence may

also shape participants' ability to translate awareness into action. The gap between what Japanese participants knew and what they could do in practice points to a structural barrier rather than a motivational or attitudinal one: their attitudes scores (M=6.00) remained higher than their skills scores (M=5.43), which makes the skills deficit more striking. A program unaware of this pattern will interpret lower behavioral scores as individual limitation rather than a structural barrier that program design could address.

Cambodian participants recorded the lowest mean scores across all dimensions (overall M=5.46), though Games-Howell post-hoc comparisons showed no significant difference from any other group, likely reflecting the small subgroup size (n=8). Their challenge profile nonetheless points to a different kind of barrier from the Japanese group. Unfamiliarity with expressive activity formats was the most reported challenge (62.5%), ahead of both language difficulties and technical vocabulary. This suggests that the workshop's pedagogical format, including collaborative presentations, open-ended problem scoping, and structured reflection activities, may have been less familiar as an educational mode. Program design, in other words, may not be culturally neutral [13]. This finding warrants further investigation, and differences in participants' prior educational experiences may be a relevant factor worth examining in future research.

Table 6 extends the analysis to English proficiency level. The proficiency-level data reinforce the nationality-level patterns and add a further layer of specificity. Beginner-level participants scored significantly lower than advanced and proficient groups on skills (M=5.41), though not significantly different from intermediate, and their attitudes scores were descriptively the lowest across proficiency groups (M=5.98). Although the omnibus difference in attitudes was statistically significant (F=3.400, p=0.021), no Games–Howell pairwise comparison reached significance. This suggests that for beginner-level participants, language barriers may have suppressed not only behavioral engagement but also the confidence to report positive intercultural attitudes, consistent with the double barrier of general English and technical vocabulary. Intermediate-level participants, despite being capable of general conversation, also showed a meaningful skills gap (M=5.89), suggesting that conversational proficiency does not transfer automatically to the disciplinary demands of engineering collaboration. Advanced and proficient participants showed the most consistent profiles across all four dimensions, with smaller gaps between attitudinal and behavioral scores. Across the subgroup analyses, the Filipino–Japanese contrast was one of the clearest patterns, particularly in skills and practices.

Table 6. Self-reported IC by English proficiency level

Proficiency	n	Knowledge M (SD)	Attitudes M (SD)	Skills M (SD)	Outcomes M (SD)
Beginner	14	6.17 (0.66)	5.98 (0.86)	5.41 (1.16)	5.83 (0.79)
Intermediate	34	5.89 (0.99)	6.16 (1.04)	5.89 (1.16)	6.17 (1.05)
Advanced	14	6.45 (0.75)	6.62 (0.66)	6.57 (0.63)	6.64 (0.66)
Proficient	27	6.54 (0.58)	6.67 (0.51)	6.52 (0.56)	6.60 (0.55)

Note: significant differences were found for knowledge (F=3.815, p=0.013), attitudes (F=3.400, p=0.021), skills (Welch's F=6.040, p=0.002), and learning outcomes (F=3.768, p=0.014). Games–Howell tests showed higher proficient scores than intermediate in knowledge; no significant pairwise differences were found for attitudes; higher proficient and advanced scores than beginner in skills, with proficient also exceeding intermediate in skills (p=0.038); and higher advanced and proficient scores than beginner in learning outcomes. Subgroup findings remain exploratory due to unequal cell sizes.

Considered together, these findings suggest that the attitudinal-behavioral gap was not a single uniform outcome. In this short-term format, self-reported openness and positive attitudes were more evident than confidence in behavioral skills, a pattern consistent with the limited time available for repeated intercultural practice. Section 3.2 adds an engineering-specific explanation: technical vocabulary was linked to lower behavioral engagement and appeared to create difficulties beyond general English proficiency. However, section 3.3 shows that this gap varied across participant groups. Among Japanese and beginner-level participants, it appeared closely related to language, with attitudes scores remaining higher than skills scores. Among Thai host-country and Cambodian participants, the patterns seemed to reflect additional factors, including host positioning and unfamiliarity with the workshop's presentation-based format. Filipino participants, by contrast, showed the most consistent engagement across dimensions, and language barriers did not emerge as a primary challenge for this group. These differences suggest that aggregate reporting may obscure distinct pathways across participant groups, which dimension-specific, participant-aware evaluation can reveal.

Two limitations should be noted. Because the study used a post-program self-report design and an instrument that was not independently validated, the quantitative patterns remain exploratory rather than causal evidence. The host-country comparison also did not control for potential confounders such as prior international experience or baseline IC.

4. CONCLUSION

This study suggests that IC outcomes in a structured international engineering workshop are not uniform across participant groups. Attitudinal and behavioral competencies were reported at different levels, engineering terminology was associated with a language barrier that appeared to extend beyond general English proficiency, and participants from different nationality and proficiency groups showed meaningfully different self-reported IC profiles within the same program. These patterns suggest that IC development in engineering contexts is varies with how participant characteristics interact with program design.

These findings highlight the value of participant-aware, dimension-specific evaluation in developing more equitable and effective international engineering programs. The study provides an applied contribution to IC evaluation by identifying that engineering task structure was linked to discipline-specific intercultural demands, particularly around technical vocabulary, and that host-country developmental pathways remain largely absent from models built around visitor experiences. For program designers, knowing which groups develop which competencies, and why, is a prerequisite for programs that serve all participants well. Pre-program technical language preparation is one response that this study's findings suggest. Longitudinal follow-up would establish whether the participant-level patterns identified here persist into professional practice and shape how graduates navigate intercultural demands in engineering workplaces. For the IC field more broadly, this study underscores the need for evaluation frameworks that are built for the disciplinary and participant diversity that international engineering programs increasingly involve.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

Participation was voluntary. Participants were informed of the purpose of the study, the confidentiality of their responses, and the use of the data for research purposes prior to completing the questionnaire. Completion of the questionnaire constituted informed consent.

ETHICAL APPROVAL

The study was conducted in accordance with relevant national regulations, institutional policies, and the ethical principles of the Declaration of Helsinki. The study was reviewed by the Kasetsart University Research Ethics Committee (KUREC) and was granted exemption from ethical review (COE No. COE68/048; Study Code KUREC-SSR68/061) on 06 June 2025.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [PJ], upon reasonable request. Data are not publicly available due to participant privacy restrictions.

REFERENCES

[1] G. L. Downey *et al.*, "The globally competent engineer: working effectively with people who define problems differently," *Journal of Engineering Education*, vol. 95, no. 2, pp. 107–122, Apr. 2006, doi: 10.1002/j.2168-9830.2006.tb00883.x.

[2] B. K. Jesiek, Q. Zhu, S. E. Woo, J. Thompson, and A. Mazzurco, "Global engineering competency in context: situations and behaviors," *Online Journal for Global Engineering Education*, vol. 8, no. 1, pp. 1–16, 2014.

[3] L. Jin, A. Jaiswal, D. C. Jones, M. Sapkota, S. N. McClure, and A. Stahl, "Enhancing intercultural learning in study abroad through an online curriculum in group-mentored intervention," *Frontiers: The Interdisciplinary Journal of Study Abroad*, vol. 36, no. 1, pp. 350–383, Apr. 2024, doi: 10.36366/frontiers.v36i1.811.

[4] M. Chédru and C. Delhoume, "How does studying abroad affect engineering students' intercultural competence: a longitudinal case study," *European Journal of Engineering Education*, vol. 48, no. 3, pp. 375–390, May 2023, doi: 10.1080/03043797.2023.2171853.

[5] M. Byram, *Teaching and assessing intercultural communicative competence*, 1st ed. Clevedon, U.K.: Multilingual Matters, 1997.

[6] D. K. Deardorff, "Identification and assessment of intercultural competence as a student outcome of internationalization," *Journal of Studies in International Education*, vol. 10, no. 3, pp. 241–266, Sep. 2006, doi: 10.1177/1028315306287002.

[7] D. K. Deardorff, "Assessing intercultural competence," *New Directions for Institutional Research*, vol. 2011, no. 149, pp. 65–79, Mar. 2011, doi: 10.1002/ir.381.

[8] M. J. Bennett, "Becoming interculturally competent," in *Toward Multiculturalism: A Reader in Multicultural Education*, 2nd ed., J. S. Wurzel, Ed., Newton, MA: Intercultural Resource Corporation, 2004, pp. 62–77.

[9] I. Ortiz-Marcos *et al.*, "A framework of global competence for engineers: the need for a sustainable world," *Sustainability*, vol. 12, no. 22, p. 9568, Nov. 2020, doi: 10.3390/su12229568.

[10] D. Jiang, B. Dahl, and X. Du, "A systematic review of engineering students in intercultural teamwork: characteristics, challenges, and coping strategies," *Education Sciences*, vol. 13, no. 6, p. 540, May 2023, doi: 10.3390/educsci13060540.

[11] J. Nelson, K. Cheh, A. Garg, A. Dewan, A. Jaiswal, and S. Aggrawal, "Building intercultural skills in engineering students through study abroad," in *2025 ASEE Annual Conference & Exposition*, 2025, pp. 1–12, doi: 10.18260/1-2--56040.

[12] H. E. Hoff, "The evolution of intercultural communicative competence: conceptualisations, critiques and consequences for 21st century classroom practice," *Intercultural Communication Education*, vol. 3, no. 2, pp. 55–74, 2020, doi: 10.29140/ice.v3n2.264.

[13] J. Mittelmeier *et al.*, "Learning design in diverse institutional and cultural contexts: suggestions from a participatory workshop with higher education professionals in Africa," *Open Learning: The Journal of Open, Distance and e-Learning*, vol. 33, no. 3, pp. 250–266, Sep. 2018, doi: 10.1080/02680513.2018.1486185.

[14] L. Chieffo and L. Griffiths, "Large-scale assessment of student attitudes after a short-term study abroad program," *Frontiers: The Interdisciplinary Journal of Study Abroad*, vol. 10, no. 1, pp. 165–177, Aug. 2004, doi: 10.36366/frontiers.v10i1.140.

[15] M. P. Thinh, "Developing intercultural competence through short-term exchange programs in Southeast Asia: insights from Vietnamese students," *Journal of Intercultural Communication Research*, vol. 53, no. 3–4, pp. 160–180, Jul. 2024, doi: 10.1080/17475759.2024.2431811.

[16] R. Y. Chao, "Intra-ASEAN student mobility: overview, challenges and opportunities," *Journal of Applied Research in Higher Education*, vol. 15, no. 5, pp. 1736–1751, Nov. 2023, doi: 10.1108/JARHE-07-2019-0178.

[17] S. Lerke, "Intercultural learning in summer schools in higher education: a case study on the international summer school of the Department of Protestant Theology at Paderborn University," *Die Hochschullehre*, vol. 6, pp. 221–241, 2020, doi: 10.3278/HSL2013W.

[18] E. Gutiérrez-Santiuste and M. Ritacco-Real, "Intercultural communicative competence in higher education through telecollaboration: typology and development," *Education and Information Technologies*, vol. 28, no. 11, pp. 13885–13912, Nov. 2023, doi: 10.1007/s10639-023-11751-3.

[19] R. L. Griffith, L. Wolfeld, B. K. Armon, J. Rios, and O. L. Liu, "Assessing intercultural competence in higher education: existing research and future directions," *ETS Research Report Series*, vol. 2016, no. 2, pp. 1–44, Dec. 2016, doi: 10.1002/ets2.12112.

[20] J. Luo and C. K. Y. Chan, "Qualitative methods to assess intercultural competence in higher education research: a systematic review with practical implications," *Educational Research Review*, vol. 37, p. 100476, Nov. 2022, doi: 10.1016/j.edurev.2022.100476.

[21] Y. Munezane, "Conceptualizing intercultural communicative competence in higher education in the Japanese context: insights from language learners, practitioners, and public arena," *Social Sciences & Humanities Open*, vol. 11, p. 101205, 2025, doi: 10.1016/j.ssaho.2024.101205.

[22] G. S. Howard, "Response-shift bias: a problem in evaluating interventions with pre/post self-reports," *Evaluation Review*, vol. 4, no. 1, pp. 93–106, Feb. 1980, doi: 10.1177/0193841X8000400105.

[23] D. Moore and C. A. Tananis, "Measuring change in a short-term educational program using a retrospective pretest design," *American Journal of Evaluation*, vol. 30, no. 2, pp. 189–202, Jun. 2009, doi: 10.1177/1098214009334506.

[24] J. Drennan and A. Hyde, "Controlling response shift bias: the use of the retrospective pre-test design in the evaluation of a master's programme," *Assessment & Evaluation in Higher Education*, vol. 33, no. 6, 2008, doi: 10.1080/02602930701773026.

[25] K. Finstad, "The usability metric for user experience," *Interacting with Computers*, vol. 22, no. 5, pp. 323–327, Sep. 2010, doi: 10.1016/j.intcom.2010.04.004.

[26] C. C. Preston and A. M. Colman, "Optimal number of response categories in rating scales: reliability, validity, discriminating power, and respondent preferences," *Acta Psychologica*, vol. 104, no. 1, pp. 1–15, 2000, doi: 10.1016/S0001-6918(99)00050-5.

[27] J. C. Nunnally, *Psychometric theory*, 2nd ed. New York, NY: McGraw-Hill, 1978.

[28] M. Delacre, C. Leys, Y. L. Mora, and D. Lakens, "Taking parametric assumptions seriously: arguments for the use of Welch's F-test instead of the classical F-test in one-way ANOVA," *International Review of Social Psychology*, vol. 32, no. 1, pp. 1–12, Aug. 2019, doi: 10.5334/irsp.198.
[29] P. A. Games and J. F. Howell, "Pairwise multiple comparison procedures with unequal N's and/or variances: a Monte Carlo study," *Journal of Educational Statistics*, vol. 1, no. 2, pp. 113–125, Jun. 1976, doi: 10.3102/10769986001002113.
[30] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77–101, Jan. 2006, doi: 10.1191/1478088706qp063oa.
[31] S. Katsumoto, "Internationalizing international students' experiences: analysis of intercultural dispositions for international students who engage in study abroad and internationalization at home," *Journal of Studies in International Education*, vol. 28, no. 1, pp. 125–142, Feb. 2024, doi: 10.1177/10283153231178128.
[32] J. Jenkins, "English as a lingua franca: interpretations and attitudes," *World Englishes*, vol. 28, no. 2, pp. 200–207, Jun. 2009, doi: 10.1111/j.1467-971X.2009.01582.x.

APPENDIX

Post-program survey: intercultural competence in a structured international engineering workshop

This survey examines self-reported intercultural competence among students participating in an international workshop. Participation is voluntary, and all responses will be kept confidential and used for research purposes only.

Part 1: General information

1. Gender: □ Male □ Female □ Prefer not to specify
2. Age: □ 18–20 □ 21–23 □ 24–26 □ >26
3. Education level: □ Bachelor's □ Higher than Bachelor's
4. Nationality: _____
5. Languages you can communicate in: _____
6. English proficiency: □ Beginner □ Intermediate □ Advanced □ Proficient
7. Previous international experience (select all that apply):
   □ Have been abroad □ Have international classmates □ Have worked with international students
   □ Have studied in international programs □ Have participated in exchange programs

Part 2: Perceived intercultural competence following the workshop

Key definitions:

Intercultural refers to interactions and collaboration among individuals from different cultural backgrounds. Intercultural competence refers to the ability to understand, communicate, and work effectively with people from diverse cultural backgrounds.

Instructions:

The following statements refer to knowledge, attitudes, and skills that you experienced or developed as a result of your participation in this workshop. Please indicate the extent to which you agree with each statement, with your workshop experience in mind. **Use the scale below 1-7**: 1=strongly disagree, 2=disagree, 3=slightly disagree, 4=neither agree nor disagree, 5=slightly agree, 6=agree, 7=strongly agree.

A. Knowledge and awareness

A1. I have knowledge of the cultural contexts of my international peers (e.g., country, traditions, and social norms).
A2. I understand social value differences across cultures (e.g., family, education, and work values).
A3. I am aware of the need to adapt my communication style when interacting with people from different cultural backgrounds.

B. Attitudes and orientation

B1. I am open to learning about other cultures.
B2. I feel confident in engaging in intercultural communication as a result of this workshop.
B3. I have a positive attitude toward working in culturally diverse environments.

C. Skills and practices

C1. Through this workshop, I developed strategies for learning about other cultures independently (e.g., by asking questions, observing, or seeking information).
C2. I am able to collaborate effectively with people from different cultural backgrounds.
C3. I am able to manage conflict and solve problems when working with peers from different cultural backgrounds.

D. Learning outcomes
D1. This workshop helped me consider diverse cultural perspectives when developing ideas or solutions.
D2. Participating in this workshop has created opportunities for my personal and professional development.
D3. I apply intercultural perspectives when approaching problems in my field.

Part 3: Challenges and open-ended feedback
Challenges encountered during the workshop (select all that apply):
□ Lack of confidence in English communication
□ Fatigue from intensive schedule
□ Difficulty understanding technical terminology
□ Time management challenges
□ Other: _____
□ Difficulty adapting to different cultural working styles
□ Anxiety in presenting ideas
□ Working with peers with different perspectives
□ Unfamiliarity with expressive activity formats

Open-ended questions:
1. What aspects of the workshop most contributed to your intercultural learning?
2. What suggestions do you have for improving future workshops?
3. What activities or topics would you recommend for future international workshops?

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