

Enhancing Global Competence Through Japan–Thailand Robotics-Based Global PBL: A Consecutive-Cohort Mixed-Method Study Beyond Language Proficiency

Research Overview

This study examines whether participation in a Japan–Thailand robotics Global Project-Based Learning (gPBL) program enhances STEM students' global competence. Using MGUDS-S and CEFR-based self-assessment, it investigates program effects and the relationship between global competence development and English proficiency across two cohorts ($n = 65$).

Purpose

As engineering practice becomes increasingly globalized, STEM graduates must collaborate across cultural and linguistic boundaries. Over the past decade, global competence has been widely recognized by universities and international organizations, including the OECD, as essential in multicultural professional environments. This perspective is reflected in the strategic priorities of the study authors' institutions—Shibaura Institute of Technology (Japan) and King Mongkut's University of Technology Thonburi (KMUTT), Thailand—both of which identify global competence development as an educational outcome. gPBL has increasingly been adopted as a pedagogical approach for cross-cultural collaboration.

Improving English proficiency is also a shared priority for both institutions. Because English functions as a lingua franca in international engineering contexts, examining whether language confidence influences global competence development is significant. Research has often suggested that foreign language proficiency can support global competence development (Deardorff, 2006). Empirical studies report mixed evidence on the strength of this relationship (Feng et al., 2024; Wang et al., 2025).

Earlier studies of online robotics workshops at SIT-KMUTT identified challenges in hybrid formats, including disparities in technical preparedness and English proficiency, as well as limited gains in global competence (Yoshikubo et al., 2023). Later work introduced Slack-based evaluation and peer assessment to examine engagement (Yoshikubo et al., 2024; Kimura et al., 2025). More recently, AI-assisted speech-to-text and linguistic analysis have been proposed to enhance the objectivity of assessments (Thongking et al., 2026). The study addressed the following research questions:

RQ1: Does participation in a Japan–Thailand robotics gPBL program significantly improve global competence (MGUDS-S)?

RQ2: Does CEFR-based self-perceived English proficiency significantly improve following participation?

RQ3: To what extent does self-perceived English proficiency predict changes in global competence?

Methodology

The study employed a mixed-method design combining quantitative pre–post analysis with qualitative TA observations and follow-up interviews. Participants were 65 undergraduate engineering students in two face-to-face robotics cohorts: Spring 2025 ($n = 27$) and Summer 2025 KMUTT–SIT ($n = 38$). Students worked in mixed Japanese–Thai teams using an international rescue robotics kit.

Global competence was measured using the Shibaura version of the 15-item Miville–Guzman Universality–Diversity Scale – Short Form (MGUDS-S; Fuertes et al., 2000), adapted for SIT by Oda (2019) and validated at scale by Aihara (2024). After reverse scoring of items 3, 6, 9, 12, and 15, total scores were calculated. Paired

t-tests and Cohen's *d* assessed pre–post differences. Students also completed CEFR-based self-assessments across five skill domains (Council of Europe, 2001). Analysis focused on three dimensions: Conversation, Listening, and a Productive Composite.

To support the interpretation of the quantitative results, interviews were conducted with three student teaching assistants (TAs). During the workshop, they worked closely with the student teams and supported classroom activities while observing team communication recorded on Slack. These observations were used to examine structural factors that may influence participants' global competence development.

Results/Discussion

MGUDS-S scores showed statistically significant gains in both cohorts: Spring 2025 (+2.63, $t(26)=2.45$, $p=.022$, $d=.47$) and Summer 2025 (+3.34, $t(37)=2.55$, $p=.015$, $d=.41$), with medium effect sizes (RQ1). In the pooled sample, the overall gain was significant (+3.05, $t(64)=3.45$, $p=.001$, $d=.43$). In contrast, CEFR Conversation scores showed only small, non-significant gains (Spring: +0.19, $p=.42$; Summer: +0.32, $p=.11$) (RQ2). Neither baseline CEFR nor CEFR gains significantly predicted MGUDS-S gains, suggesting that global competence development cannot be explained by self-perceived language proficiency alone (RQ3). Nationality-based comparisons revealed substantially larger MGUDS-S gains among Thai students than Japanese students in both cohorts (Spring: Thai +4.89 vs. Japanese +1.50; Summer: Thai +4.23 vs. Japanese +1.64). This pattern was statistically significant for Thai students in both cohorts (Spring: $p=.037$, $d=.83$; Summer: $p=.016$, $d=.51$), although CEFR variables did not explain this difference. Qualitative observations suggest that structural and task-based dynamics—technical skill asymmetries and role allocation patterns—may influence students' engagement more strongly than language confidence alone.

The results challenge the common assumption that language proficiency necessarily drives the development of global competence. Notably, 77% of participants self-rated below B2 in CEFR Conversation at baseline, yet still demonstrated significant MGUDS-S gains, indicating that global competence development does not require advanced English proficiency. Instead, the findings indicate that global competence development depends less on language proficiency alone and more on structural factors—such as differences in technical skills—that influence how participants overcome communication barriers. Because such structural factors can be adjusted through instructional design, systematic assessment and feedback may support iterative refinement of gPBL programs, pointing to future directions for enhancing global competence development beyond language proficiency alone.

Key words

Global competence development, Global Project-Based Learning (gPBL), Engineering education, MGUDS-S, CEFR-based self-assessment

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