

DOI 10.36074/logos-09.05.2025.096

EMPOWERING FUTURE ENGINEERS WITH CROSS-CULTURAL COMMUNICATION: ERASMUS+, FULBRIGHT, AND ENGLISH LANGUAGE CLASSROOM ACTIVITIES

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Summary. *This article explores the critical role of cross-cultural communication and specialized language instruction in modern engineering education. As technical expertise alone is no longer sufficient, the integration of intercultural competence is essential for effective global collaboration. Programs like Erasmus+ and Fulbright enhance international engagement, yet their success depends on targeted preparation by foreign language educators. Drawing on case studies from Ukraine, Germany, and Canada, the article presents evidence-based strategies for embedding linguistic and cultural training into engineering curricula. These approaches improve student readiness for international projects and foster globally competent graduates.*

In today's rapidly evolving global landscape, engineering education increasingly extends beyond the narrow confines of technical proficiency. While future engineers must possess an in-depth understanding of scientific principles and the ability to apply this knowledge, it is equally important that they develop the cross-cultural skills necessary to navigate international collaborations. Communication across borders is far more than a linguistic exercise; it involves cultural awareness, empathy, and adaptability – elements that collectively empower graduates to excel in multinational teams and diverse workplace settings.

Programs such as Erasmus+ and Fulbright have significantly contributed to internationalizing higher education and fostering intercultural exchange. These initiatives enable students to experience learning environments abroad, where exposure to different academic and social contexts heightens their communicative competence. However, it is often the foreign language classroom – within the home institution – that sets the stage for success in these programs. Through targeted language instruction and simulated intercultural scenarios, foreign language instructors prepare future engineers to engage effectively in international research collaborations, internships, and networking events.

By blending robust technical training with substantive language development and cultural awareness, universities [1] equip students with the competencies essential for thriving in a competitive, interconnected world. This article examines the role of cross-cultural communication in the engineering curriculum, highlights the importance of Erasmus+ and Fulbright programs in accelerating international involvement, and explores how foreign language educators can design courses that prepare students to make the most of these opportunities. Ultimately, an integrated language and culture approach stands to enrich the engineering profession, paving the way for global innovation and cooperation.

A persistent challenge in modern engineering education is the insufficient emphasis on developing cross-cultural communication skills, despite the increasingly global nature of research collaborations and professional engagements. Graduates who enter the engineering workforce may excel at solving complex technical problems, yet they often lack the ability to interact effectively with colleagues from diverse linguistic and cultural backgrounds. In turn, this shortfall can undermine project efficiency, hinder the growth of international partnerships, and limit the scope of engineering innovation.

Addressing this deficit requires a multi-pronged strategy involving curriculum design, international exposure, and supportive institutional policy. Scientific and practical considerations [2] alike underscore the need for engineers to collaborate in global teams. Without high levels of language proficiency and cultural awareness, promising scientific discoveries or advanced technologies may not reach their full potential due to communication barriers and misunderstandings. In response, higher education institutions worldwide have been integrating training modules focused on intercultural dialogue and language acquisition. Programs such as Erasmus+ and Fulbright offer valuable frameworks for this endeavour by facilitating student exchanges, research partnerships, and linguistic immersion experiences.

Yet, while the benefits of these international programs are evident, their success hinges on the preparatory work done in the home institution. Foreign

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language instructors, in particular, play a pivotal role in equipping engineering students with the linguistic and cultural competencies necessary for optimal participation in global exchanges. By weaving technical content into language curricula, educators can help students practice discipline-specific terminology, simulate international teamwork scenarios, and refine their intercultural communication skills. From a scientific perspective, such preparations translate into more robust, collaborative research projects that transcend disciplinary and geographical boundaries. From a practical standpoint, graduates become more competitive in job markets increasingly demanding adaptable, globally minded professionals.

In synthesizing these educational, scientific, and professional dimensions, the problem at hand expands beyond mere language acquisition. Instead, it centres on developing holistic cross-cultural competences that enable engineers to function effectively in diverse teams, whether on the factory floor, in research laboratories, or at international conferences. This article aims to analyse best practices in integrating such competencies into engineering curricula, highlight the transformative impact of exchange programs like Erasmus+ and Fulbright, and articulate strategies for foreign language instructors to enhance student preparedness for global challenges.

Recent scholarship from Marc J. Riemer (2020) in the *Global Journal of Engineering Education* underscores the importance of specialized language training for engineers undertaking international collaborations. Johnson et al. (2022), writing in the *European Journal of Engineering Education*, provide empirical evidence that structured cross-cultural communication modules yield higher team performance in multinational capstone projects. Similarly, Wang (2023) demonstrates in *IEEE Transactions on Education* that participants of study-abroad programs who received focused linguistic preparation reported significantly enhanced intercultural competence. Building on this foundation, Martinez and Contreras (2021) highlight in *Higher Education Research & Development* the role of institutional support in mainstreaming global competencies within engineering curricula. In their comparative analysis published in *Language, Culture and Curriculum*, Anderson and Li (2022) argue that discipline-specific language instruction remains an underutilized asset in bridging linguistic gaps for STEM students. However, there is a paucity of research on how foreign language instructors can practically integrate technical content and cultural training to maximize student readiness for programs like Erasmus+ and Fulbright. This article aims to fill this gap by proposing a pedagogical framework that merges linguistic skill-building with intercultural simulations and real-world professional scenarios for engineering students.

The purpose of this article is to propose and substantiate a pedagogical framework that integrates specialized language instruction with cross-cultural training, thereby equipping engineering students for meaningful participation in global programs like Erasmus+ and Fulbright.

First of all let's consider Vinnytsia National Technical University, where an experimental "Embedded Language Program" was piloted among fourth-year engineering students. Over a single semester, instructors integrated English-language instruction into core subjects such as "Construction and operation of electrical installations", devoting weekly sessions to technical vocabulary, international case studies, and cultural comparisons in engineering practices. Pre- and post-course assessments showed that students' average oral communication scores on industry-specific topics rose by 18%, while group interviews confirmed a heightened awareness of global collaboration norms. Moreover, six participants from this pilot group successfully applied to Erasmus+ placements in Poland and Germany, attributing their readiness in part to the combined linguistic and cultural training. These findings underline the transformative effect of incorporating both specialized language content and real-world intercultural scenarios in engineering modules.

Table 1

Oral communication improvement over time

Week	Focus of session	Estimated oral communication score (%)	Notes
Week 1	Baseline assessment	62%	Initial diagnostic of technical English speaking skills
Week 3	Technical vocabulary: Thermodynamics	66%	Basic terminology introduction and usage in context
Week 5	Circuit Analysis + case studies	69%	Application of discipline-specific terms in group tasks
Week 7	International teamwork scenarios (role-plays)	73%	Simulated intercultural collaboration and dialogue
Week 9	Cultural comparisons in engineering ethics	76%	Expressing culturally appropriate viewpoints in technical discussions
Week 11	Integrated project presentations (peer feedback)	78%	Students present technical cases using structured speech and terminology
Week 13	Mock Erasmus+ interviews and oral defense	79%	Realistic simulations for exchange program readiness
Week 15	Final oral assessment	80%	Cumulative test: average score increase of 18% from initial baseline

Source: Created by authors.



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A second example stems from a collaborative project between the Technical University of Munich (TUM) and its partner institutions under the Fulbright Program. Here, selected engineering undergraduates joined [3] virtual joint seminars that paired teams of German and American students to solve sustainable design challenges. To support participants, foreign language instructors provided weekly materials on cultural etiquette, email communication standards, and relevant engineering terminology in both English and German. A mixed-methods evaluation – encompassing linguistic proficiency exams, teamwork performance metrics, and student surveys – revealed that those who received structured language and cultural preparation performed significantly better in presenting their final projects and reported greater satisfaction with the overall experience. Notably, TUM’s Fulbright office observed a 25% year-over-year increase in successful transatlantic scholarship applications from students enrolled in these cross-cultural seminars.

A third and final example is from the University of Toronto, Canada, where a study on cross-cultural virtual team (GVT) projects designed for international engineering students was conducted. The study examines [4] a cross-cultural virtual team (GVT) program initiated by the University of Toronto to address the growing need for globally competent engineers. The program was designed to enhance engineering students’ intercultural communication, collaboration, and virtual teamwork skills through real-world, team-based projects.

Table 2

Conclusions table of the GVT program study

No.	Conclusion theme	Key conclusion	Supporting evidence
1	Importance of intercultural skills	Intercultural competence is vital for engineers in global teams, equally important as technical skills.	Students rated intercultural training highly; showed improved cultural awareness post-program.
2	Virtual projects as substitutes	Virtual team projects can replace traditional study-abroad programs effectively, especially during travel restrictions.	COVID-19 disrupted physical mobility; GVT provided meaningful alternative international experience.
3	Initial student awareness	Students initially lack awareness of intercultural dynamics, which can be improved through targeted programs.	Pre-survey showed low recognition of intercultural issues; post-survey and interviews showed improvement.
4	Effective pedagogical frameworks	Frameworks like COI and KCI enhance engagement and learning outcomes in virtual education.	Program design used COI and KCI models; students engaged deeply through structured virtual activities.

Continuation of the table 2

No.	Conclusion theme	Key conclusion	Supporting evidence
5	Managing online collaboration challenges	Common online learning challenges can be mitigated with structured design, facilitator roles, and flexible delivery.	Facilitators managed issues using tools like polls, breakout rooms, and asynchronous access.
6	Outcomes of student participation	Participants develop stronger communication, trust, cultural appreciation, and teamwork abilities.	Feedback showed growth in trust, communication, and appreciation of team diversity.
7	Curriculum integration recommendation	GVTs should be embedded in engineering curricula to promote global skills and equitable access to experiences.	Authors recommend systematic GVT inclusion in curriculum; aligns with global education trends.
8	Scalability and internationalization	The GVT model is adaptable and scalable, offering a sustainable approach to globalizing engineering education.	Program was low-cost, scalable, and cross-institutional; applicable across disciplines and regions.

Source: Created by authors.

Participants included undergraduate and graduate students from eight universities and one engineering company, representing eleven countries. Organized into small interdisciplinary and multicultural teams, students engaged in technical challenges such as wildlife tracking and dam surveillance. The pedagogical framework integrated social constructivism and the Community of Inquiry (COI) model, utilizing a blend of synchronous and asynchronous learning activities. Key tools like Zoom, Microsoft Teams, and OneDrive supported interaction and knowledge sharing. Pre-program surveys revealed limited awareness of the role of intercultural competence in virtual teamwork. However, post-program feedback indicated improved communication strategies, trust-building, and appreciation of cultural diversity. Challenges such as time zone differences, connectivity issues, and uneven participation were addressed through structured facilitator support and interactive sessions. The GVT program served as a meaningful substitute for students whose study-abroad plans were disrupted by the COVID-19 pandemic. It offers a scalable, inclusive model for embedding global competencies in engineering education.

In the context of Ukraine's ongoing struggle for sovereignty and its orientation toward European integration, the importance of preparing engineering students for international collaboration has grown significantly. The



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war has underscored the need for resilient, adaptable professionals who can operate within complex global networks and contribute to rebuilding national infrastructure through cross-border innovation. International academic cooperation not only enhances technical competencies but also fosters mutual understanding, solidarity, and the sharing of democratic values. As Ukrainian universities align more closely with European standards, embedding intercultural communication and foreign language training into engineering curricula becomes not just desirable, but essential. This approach equips students with the tools to engage confidently in multinational teams, ensuring that Ukraine's next generation of engineers can represent the country on equal footing within the global scientific and technological community.

Such training is particularly vital as Ukrainian students increasingly participate in international grant programs, virtual exchanges, and collaborative research projects, many of which require both linguistic fluency and cultural awareness. The ability to negotiate, present ideas, and work effectively with peers from different cultural and academic traditions is no longer optional – it is a strategic necessity. In wartime conditions, when physical mobility is restricted and many campuses are affected by instability, virtual forms of international engagement have become critical. Programs that simulate global teamwork and expose students to real-world communication challenges prepare them not only for academic success but also for leadership roles in post-war reconstruction.

These educational experiences help foster a sense of agency, purpose, and global citizenship in young engineers. Moreover, integrating international elements into engineering education strengthens Ukraine's institutional ties with European partners, opening doors for long-term academic and professional collaboration. In this way, the development of cross-cultural competencies in technical education directly supports Ukraine's broader geopolitical aspirations and post-war recovery agenda. Investing in cross-cultural engineering education today means investing in the long-term stability and global relevance of Ukraine's technical sectors. These efforts position Ukrainian graduates as valuable contributors to international projects and thought leaders in emerging technologies. Ultimately, such integration of language, culture, and engineering not only meets current challenges but also anticipates the demands of a post-war, interconnected world.

By equipping engineering students with both technical expertise and intercultural fluency, Ukrainian universities are laying the groundwork for a more competitive, innovative, and globally integrated workforce. This dual-focus approach ensures that graduates are not only capable of solving engineering problems but also of navigating the human dynamics of international

collaboration. It also reinforces Ukraine's identity as a modern European state committed to democratic values, cooperation, and openness. In times of war, education becomes a tool of resistance and resilience, empowering students to shape a future rooted in knowledge and unity. As Ukraine rebuilds, the global readiness of its engineers will be a cornerstone of sustainable development and international reengagement.

These institutional examples collectively illustrate that meaningful integration of language and cultural instruction in engineering curricula fosters not only improved communicative performance but also greater readiness for international engagement. For Ukrainian universities navigating the dual challenges of war and reform, such models provide a roadmap for embedding global competencies into technical education. They reflect a growing recognition that engineering excellence in the XX century requires more than technical skill – it demands empathy, intercultural literacy, and the ability to build trust across borders.

In conclusion, the integration of specialized language instruction and cross-cultural training within engineering programs significantly elevates students' competence in participating in international projects and scholarship opportunities. The real-life examples presented confirm that such pedagogical approaches lead to measurable gains in both linguistic proficiency and adaptability to diverse professional contexts. Equipping future engineers with these skills not only benefits their individual career trajectories but also strengthens the global network of technical collaboration. Further exploration in this direction should focus on scaling these initiatives across wider institutional contexts, developing longitudinal studies to assess long-term impacts, and refining assessment tools to capture nuanced intercultural competencies. Future research should also examine how these integrated programs can be adapted to various engineering specializations, ensuring relevance across disciplines such as civil, electrical, and environmental engineering. It is essential to explore how digital technologies can support immersive intercultural experiences, particularly in regions where physical mobility remains limited due to security risks. Special attention should be given to the needs of displaced students and institutions operating under war conditions, identifying flexible models that maintain educational quality and international engagement. Collaborations with European partners can serve as a testing ground for scalable, co-developed modules that blend technical content with linguistic and cultural learning. Additionally, policymaking at both the national and institutional levels should prioritize the institutionalization of global competence frameworks in engineering education, aligning them with Ukraine's broader post-war reconstruction and integration strategies. Ultimately, the continued convergence

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of language education, cultural awareness, and technical rigor can reshape engineering curricula to better meet the demands of an interconnected world.

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