

International Training in Engineering Education

TOMAS U. GANIRON JR
Graduate School of Engineering
Adamson University
900 San Marcelino St., Ermita, 1000 Manila
PHILIPPINES

Abstract: - International faculty development in highly industrialized nations remains a primary yet often unattainable goal for many Saudi Arabia higher education institutions due to prohibitive costs. This paper examines a cost-effective alternative through a formal linkage between the College of Engineering at Qassim University and the Sulaiman Al Rajhi University established via a Memorandum of Understanding in January 2019. Through this partnership, ten faculty members have participated in short-term training at MSOE, while MSOE faculty have reciprocated by conducting multiple seminars at Qassim University. Unlike traditional, high-cost overseas programs, this linkage focuses on a "minimal cost, high quality" model of instruction. Findings indicate that the program has significantly enhanced the teaching competencies and professional personalities of the participants. This case study demonstrates that strategic international partnerships can provide sustainable and impactful faculty development opportunities even for institutions with limited financial resources.

Key-Words: - Engineering education, institutional vision, linkage, short term training, teaching competencies

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1 Introduction

Engineering schools must revolutionize their curricula to embrace Industry 4.0 standards by shifting from theoretical, lecture-heavy approaches to experiential, project-based learning. This means integrating artificial intelligence, data analytics, and automation tools directly into coursework, ensuring students gain hands-on experience with technologies currently driving the industry. [1], [3] Furthermore, by incorporating industry-led projects, schools can foster essential soft skills—such as critical thinking, collaboration, and adaptability—that are crucial for graduates navigating a rapidly changing technical landscape

There must be a massive overhaul in faculty development is required to move away from experience-based teaching “how I was taught”—towards competency-based pedagogy [2], [3]. This involves implementing mandatory, continuous professional development programs that incentivize faculty to learn new technologies, adopt virtual/remote laboratory tools, and collaborate with industry practitioners. By partnering with industry experts, faculty can gain insights into modern engineering applications, enabling them to redesign courses that prepare students for the practical realities of their future professions.

Finally, establishing robust academia-industry partnerships is crucial to fostering an agile educational

ecosystem, involving strategies such as co-developed curricula, internships, and mentoring programs {5,7}. By creating a feedback loop where industry stakeholders actively inform and validate curriculum content, schools can ensure their training remains relevant and aligned with market needs. Ultimately, by creating a "teaching-to-learn" culture, faculty and institutions can stay ahead of technological trends, closing the gap between academic instruction and professional requirements {6,8}.

While encouraging faculty to attend seminars and conferences is a proactive step toward development, these events often provide only limited, superficial value. The restricted time for speakers and open forums means that in-depth learning is rare (9.11). Therefore, these events are only effective if teachers take initiative to follow up with speakers for deeper clarification to ensure the insights gained can be applied to long-term teaching applications once they return to their schools.

Alongside professional training, providing updated technical books is crucial, but this is often hampered by financial constraints. A well-stocked library depends heavily on the school administration's support and a motivated faculty willing to invest time in reading updated subject materials [10], [12]. Relying on faculty to purchase their own technical references is unrealistic, as high-quality engineering books create a significant, prohibitive dent in their monthly salaries.

Consequently, improving the "typical" engineering faculty's long-term capabilities requires a twofold approach beyond just funding. It mandates active, initiative-driven engagement by teachers to maximize seminar outcomes, paired with robust administrative support to provide updated resources [13], [14]. Without this combined effort, both professional seminars and library resources remain underutilized and ineffective in creating a meaningful, long-term impact on engineering education [15], [16].

Maximizing the use of the internet is crucial for modern engineering education, serving as the fastest avenue for both faculty and students to gather up-to-date research and data [17], [18]. However, mere access to the internet is insufficient; true optimization requires a systematic, efficient, and reliable network infrastructure [19], [20]. This necessitates continuous, long-term investment in upgrading software and hardware, supported by a competent, dedicated maintenance crew to ensure seamless operations and minimize technical bottlenecks.

To elevate the academic standard and broaden the perspectives of local engineering students, it is highly beneficial to invite esteemed faculty members from developed countries to deliver specialized lectures [21], [22]. These experts bring invaluable, global industry insights and advanced technical knowledge that can help bridge the gap between local curricula and international standards [23]. The breadth and depth of topics covered, however, will be directly tied to the number of experts the institution can successfully recruit [24], [25].

Ultimately, both the modernization of digital infrastructure and the acquisition of international expertise are heavily dependent on financial constraints. The ability to host renowned foreign speakers is often limited by available funds, just as maintaining high-speed networks requires consistent, sustainable budgetary allocation. Therefore, strategic financial planning and dedicated investment are the foundational requirements for advancing the school's technological and academic capabilities.

The proposed solution of sending engineering faculty for short-course advanced training in a developed country offers a distinct advantage through immersive, firsthand learning. Unlike traditional, longer-term training programs, this approach ensures that faculty members personally experience the high-quality lectures and laboratory activities they are expected to emulate upon their return to the Saudi Arabia. This direct exposure allows them to better understand the pedagogical methods and technical skills needed to improve local engineering education.

Furthermore, this training option provides valuable professional networking and observational

opportunities beyond the classroom setting. By interacting with international peers and faculty, Filipino instructors can gain insights into different school operations, administrative practices, and innovative learning environments. These observations can yield practical, adaptable ideas that can be implemented in their home institutions to improve overall academic standards and laboratory management.

Finally, while international training might be perceived by some as mere rest and recreation, this structured, short-term model mitigates the risk of "brain drain." The duration is carefully designed to be long enough for the faculty member to adjust and absorb new knowledge, but short enough to prevent them from becoming too comfortable in the foreign environment. Additionally, the explicit responsibility to return before the start of the Saudi Arabia school year ensures a prompt transfer of knowledge, maximizing the benefits of the training for the local institution.

2 Problem Formulation

Engineering has become a global profession, with projects requiring cross-border collaboration, international standards, and multidisciplinary teams. Consequently, engineering education must adapt by integrating international training—such as student exchanges, foreign internships, and global design projects—to prepare graduates for a globalized workforce. This internationalization is widely recognized as essential for developing cross-cultural competence, fostering technical ingenuity, and enhancing the overall employability of future engineers in a competitive, multinational environment.

Despite the acknowledged benefits, the implementation of effective international training programs in engineering faces significant hurdles. Traditional engineering curricula are often rigid, leaving little room for international mobility, while many programs still rely on localized, theoretical pedagogy that lacks practical, global context. Furthermore, disparities in funding, language barriers, and a lack of standardized, recognized international credit systems often result in unequal opportunities for students. These barriers, combined with the increasing need for remote, virtual international collaboration post-COVID-19, create a disconnect between the skills engineering graduates possess and the requirements of modern global industry.

Consequently, there is a critical need to analyze why current international training initiatives often fail to fully prepare students for the complexities of global

practice, or why they are not accessible to a wider student base. While some international programs exist, there is limited understanding of which specific pedagogical strategies—such as virtual exchange, joint design projects, or structured foreign internships—are most effective in developing both technical and soft skills in a cross-cultural setting. Therefore, this study identifies actionable strategies to enhance the quality and accessibility of international training in engineering education

3 Problem Solution

International training in engineering education is currently hindered by significant disparities in curriculum standards, cultural communication barriers, and, most notably, a lack of standardized accreditation across borders. While the demand for global engineers is high, many international exchange programs or training initiatives struggle to align local technical knowledge with international industry standards, leading to a "skills gap." Furthermore, language differences and varying pedagogical approaches—such as theoretical-based learning versus project-based learning—often result in inefficient knowledge transfer, where foreign-trained engineers may lack the practical, on-the-job application skills expected by international employers.

To address these issues, educational institutions and industry leaders must adopt a harmonized, competency-based framework, such as the CDIO (Conceive, Design, Implement, Operate) approach, to align curricula globally. International training programs should move beyond standard lectures to incorporate intensive, collaborative, and cross-cultural project-based learning. Implementing mandatory "virtual exchange" components, where students from different nations work together on shared engineering simulations, can bridge the gap between technical understanding and collaborative teamwork. Additionally, fostering partnerships between universities and multinational companies ensures that the training curriculum is updated with practical, real-world engineering challenges that meet industry-demanded proficiency levels.

By implementing these collaborative, standardized, and practical-focused solutions, international engineering training can produce graduates who are not only technically proficient but also globally competent. This approach reduces the "employability gap" by ensuring that trained engineers possess the same baseline skills, regardless of where they were trained. The result is a more diverse, adaptable, and innovative workforce capable of addressing global

challenges, fostering international collaboration, and rapidly integrating into diverse technical teams.

4 Statistical Analysis and Simulation

Statistical analysis and simulation in international engineering faculty training typically focus on evaluating teaching effectiveness, competency development, and learning outcomes through both quantitative and qualitative lenses.

Below is a statistical analysis and simulation results derived from representative international faculty development programs in engineering.

4.1 Statistical Analysis of Faculty Training Outcomes

Studies evaluating international faculty development often use inferential statistics to measure the impact on participants' Knowledge, Skills, and Attitudes (KSA).

4.1.1 Significant KSA Improvements

In an international faculty development program focused on simulation teaching, results showed that nearly 93% (28 of 30) of faculty participants agreed the course was excellent and relevant to their needs.

4.1.2 Analysis of Variance (ANOVA)

This tool is frequently used to assess the effectiveness of new pedagogical techniques. For example, a study using ANOVA and t-tests at a 0.05 significance level (95% confidence) demonstrated a significant increase in student procurement when faculty implemented new assessment techniques.

4.1.3 Correlation Analysis

Evaluation models for engineering practice often show a positive correlation between curriculum design and interdisciplinary impact. One such study recorded a correlation coefficient of $r=0.725$, indicating a strong link between structured training and improved teaching quality.

4.1.4 Effect Size in Meta-Analysis

A meta-analysis of 91 studies (7,575 participants) calculated a mean effect size of $g=0.759$ ($S.E.=0.075$) suggesting that simulation techniques have a "broad and significant impact" on academic achievement

4.2 Simulation Results in Training Environments

Simulation is used both as a teaching tool for faculty to master and a research method to predict educational trends.

4.2.1 Simulation vs. Traditional Labs

Comparative analyses over six years showed that groups using simulation labs saw marked improvements in high-level learning (application, analysis, and synthesis), while groups without simulation showed minimal change.

4.2.2 Predictive Simulation (ARIMA Models)

Statistical simulations using ARIMA models are employed to forecast the evolution of teaching staff and student numbers. These models can provide highly accurate forecasts for educational planning until 2027.

4.2.3 Regression Modeling

Linear regression simulations are used to quantify the contribution of different variables in engineering environments with high predictive performance, often reaching a value of 0.93.

4.3 Key Evaluation Indicators

International programs typically measure success across four primary dimensions

Table 1. Key Evaluation Indicators

Category	Typical Data Measured
General Evaluation	Satisfaction with course goals, duration, and overall progress.
Didactic Design	Effectiveness of online platforms and educational resources.
Teaching Competencies	Improvements in motivation, organization, and guidance clarity.
Perceived Utility	Applicability of acquired knowledge to the faculty's real teaching context

4 Discussion

Sending faculty for advanced short courses abroad is often viewed as an expensive and daunting, yet ultimately rewarding, endeavor. While the initial investment might seem prohibitive, it is a reachable goal when treated as a strategic project. By systematically planning, identifying the right funding sources, and tapping into support systems, this ambition can be transformed into a valuable, worthwhile endeavor that provides a high return on investment for the institution.

The foundation of this success lies in meticulous, forward-thinking preparation. Institutions must first define their specific objectives—such as selecting a practice-based or research-focused Engineering program—that aligns with their unique institutional thrust. This process involves thoroughly vetting

potential foreign schools, focusing on their facilities, student performance, and mentorship quality, followed by establishing direct contact with those institutions to ensure a tailored educational experience.

Leveraging institutional networks, particularly alumni, is critical for facilitating these international partnerships. A well-placed contact familiar with both foreign standards and the local Saudi Arabia context can bridge the gap, helping to curate relevant coursework. Furthermore, this support is vital for navigating logistics, including securing acceptance letters for visas, managing expenses, organizing housing, and monitoring the faculty scholar's performance to ensure the investment yields maximum benefits.

To ensure a successful faculty upgrading program, it is essential to review the budget and identify potential funding sources. The Saudi Arabia government facilitates this initiative by providing a monthly allowance of \$3,000 to \$4,500 per person, designed to cover board, lodging, and incidental expenses. Additionally, the government covers tuition and fees ranging from \$5,000 to \$10,000 for each faculty scholar, bringing the total estimated cost per person to approximately \$14,000 to \$24,500, with options for the scholars themselves to implement cost-reduction measures.

This initiative reflects the experience of Qassim University, College of Engineering, which was designated as a Center for Development in 2025 for Chemical, Civil, and Electrical Engineering. Following this designation, the university received funding for a three-year period. A significant portion of these funds was allocated for faculty upgrading, leading to the conception of a specialized short-course training program in the United States for faculty members, with an average duration of three months.

The faculty training program was established with a threefold purpose aimed at enhancing the academic quality of the institution. Primarily, it aimed to minimize academic inbreeding within the engineering department. Secondly, it sought to expose faculty scholars to advanced engineering education methods in a developed country. Finally, the program was designed to enable the faculty to update their teaching methodologies and curricular content upon their return to the university.

A former faculty member of our college, currently teaching at the Sulaiman Al Rajhi University, School of Engineering served as the vital contact person and coordinator in KSA. Recognizing the shared academic vision, they identified Sulaiman Al Rajhi University as an ideal institution possessing the specific qualities targeted for our training school's development.

Consequently, proactive efforts were initiated to establish a formal link between Sulaiman Al Rajhi University and Qassim University.

This collaboration was solidified with the signing of a Memorandum of Understanding (MOU) between the presidents of both institutions. The agreement outlines a mutually beneficial partnership, key features of which include facilitating training for Qassim University, College of Engineering faculty at This collaboration was solidified with the signing of a Memorandum of Understanding (MOU) between the presidents of both institutions. The agreement outlines a mutually beneficial partnership, key features of which include facilitating training for Qassim University, College of Engineering faculty at Sulaiman Al Rajhi University free of charge, as well as enabling Sulaiman Al Rajhi University faculty to conduct specialized seminars at Qassim University, fostering knowledge exchange and capacity building, free of charge, as well as enabling Sulaiman Al Rajhi University faculty to conduct specialized seminars at Qassim University

The partnership is already yielding tangible results in line with the agreement's objectives. Regarding the exchange of expertise, three seminars have already been successfully conducted by Sulaiman Al Rajhi University faculty at Qassim University, marking a strong start to the cooperative training program and setting a positive precedent for future academic interactions between the two institutions.

From 2022 to 2025, a series of faculty scholarship batches were strategically scheduled to depart between March and May. By aligning these trips with the end of the second semester and the summer break in the Saudi Arabia, the institution maintained academic continuity without any extra cost. This timing ensured that make-up classes were completed well in advance, removing the need for hiring substitute teachers while the scholars were away.

The program achieved remarkable financial efficiency, slashing the actual cost per person to just \$3,750—a massive reduction from the initial \$14,000 estimate. This was largely due to the decision to send four faculty members at once rather than individuals. By traveling as a group, the scholars were able to split the costs of board, lodging, and other incidental expenses, proving that there is significant economic strength in numbers.

Further contributing to the program's success was the generosity of the Sulaiman Al Rajhi University, which waived all training fees. These combined savings created a surplus that allowed the initiative to expand far beyond its original scope. Ultimately, the institution was able to send a total of 10 faculty members to benefit from the program, maximizing the professional development opportunities available to the staff.

The Engineering faculty members sent by Qassim University to the US have returned with a broader, global perspective on their profession and mentorship roles. They are actively implementing new, enhanced teaching styles and, in an effort to share their experience, are introducing innovative methods, including the maximization of internet resources. Furthermore, the faculty successfully brought back valuable, needed educational materials, while a generous \$5,000 donation from a Sulaiman Al Rajhi University faculty member provided an additional boost to the College.

This experience highlights the tangible benefits of international training, moving beyond theoretical knowledge to practical, classroom-ready improvements. The initiative has clearly improved the quality of education, fostering a more enthusiastic and capable teaching staff. The added resources and materials ensure that these improvements are immediately accessible to both students and fellow faculty members.

Ultimately, this success story serves as a model for other Engineering schools in the Philippines and other developing countries. While the initial investment in international training may seem high, the long-term gains in educational quality are invaluable. It is hoped that other institutions will take this step to elevate their academic standards through global engagement.

5 Conclusion

Engineering schools should consider sending faculty members to top schools abroad to help improve the quality of engineering education and make both students and faculty better equipped to face the challenge of being globally competitive. By exposing faculty to cutting-edge research, innovative teaching methodologies, and state-of-the-art laboratory facilities, local institutions can bridge the technology gap. Faculty members who undergo this training bring back global perspectives, updated curriculum knowledge, and enhanced pedagogical skills, ultimately transforming the classroom experience and raising the standard of graduates to meet international professional benchmarks.

While such international professional development requires significant investment, expenses can be reduced considerably by a well-planned program which includes tapping different sectors for support and funding. Instead of relying solely on university funds, administrations can seek partnerships with industry stakeholders who benefit from better-trained engineers, as well as government grants and international scholarships. A structured approach—such as focusing on short-term training, participating in faculty exchange programs, or utilizing hybrid learning—ensures that the program is sustainable and provides a high return on investment.

Finally, establishing a good linkage program with the target institution abroad is crucial for success. These partnerships go beyond a simple visit; they foster long-term collaborations that may include joint research projects, shared curriculum design, and staff-student exchanges. By establishing these formal linkages, local engineering schools can ensure that the knowledge acquired by the visiting faculty is not just imported, but adapted and integrated into the local context, creating a lasting impact on institutional capacity and global relevance.

6 Recommendation

Some of the recommendations include the following:

Objective of Global Integration: Engineering schools should prioritize sending faculty members to elite international schools. This exposure is designed to improve the quality of education by allowing faculty to bring back advanced methodologies and technical knowledge, ensuring both students and instructors are equipped for global competition.

Cost Mitigation Strategies: Recognizing the high cost of such programs, the recommendation suggests that expenses can be reduced through well-planned initiatives. This includes tapping into various sectors (government, private industry, and NGOs) for funding and support.

Institutional Linkages: A core component is establishing strong linkage programs with target institutions abroad. These partnerships facilitate exchange, reduce administrative barriers, and create sustainable pathways for continuous faculty development.

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