International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 605-619
DOI: 10.35631/IJMOE.724042

INTERNATIONAL JOURNAL OF MODERN EDUCATION (IJMOE)
www.ijmoe.com

FOSTERING SUSTAINABLE COMMUNITIES THROUGH INTERNATIONAL SULAM PROJECTS IN ENGINEERING PROGRAMMES

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Article Info:

Article history:
Received date: 31.07.2024
Revised date: 13.10.2024
Accepted date: 26.11.2025
Published date: 16.03.2025

To cite this document:

Abdull Rahman, S. H., Mat Is, C. M., & Ab Rani. N. I. (2025). Fostering Sustainable Communities Through International SULAM Projects In Engineering Programmes. *International Journal of Modern Education, 7* (24), 605-619.

DOI: 10.35631/IJMOE.724042

Abstract:

Service-Learning Malaysia-University for Society (SULAM) integrates academic learning with community service, promoting sustainability and enhancing student development. This study examines five (5) international SULAM initiatives in Indonesia, India, and Thailand using a mixed-method approach. The qualitative component involved document reviews, while the quantitative component used entrance and exit surveys to assess the impacts of the programme in student learning outcomes' attainment in Engineers in Society course. Projects in Indonesia addressed environmental conservation and waste management, the India projects included an online symposium and classroom maintenance, and the Thailand project involved concrete structure integrity assessment. Survey results indicate significant improvements in students' problem-solving skills, environmental awareness, and ethical understanding, with marked increases in self-assessment scores across all learning outcomes attainment. Qualitative insights highlight meaningful contributions to community engagement and sustainable practices. However, limitations include a narrow sample scope, reliance on self-reported data, and absence of longitudinal tracking, which may affect the generalizability and depth of findings. Future recommendations involve expanding the sample size across diverse engineering disciplines and SULAM projects, incorporating longitudinal studies to assess long-term impacts, and enhancing data collection through objective assessments and qualitative methods such as interviews.

International Journal of Modern Education
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EISSN: 2637-0905
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Addressing these areas will enable SULAM projects to further enrich academic learning and foster sustainable community contributions.

Keywords:

Sustainable Community, Community Engagement, International SULAM

Introduction

The Service-Learning Malaysia-University for Society (SULAM) initiative integrates service-learning into university curricula to foster student engagement with community issues. Various studies highlight the positive outcomes of such initiatives. For instance, a previous demonstrated significant improvement in students' comprehension, knowledge, social responsibility, personal development, and academic achievement through community volunteer programs (Zahidi et al., 2022). Similarly, it was found that volunteering among Malaysian university students led to personal growth, skill acquisition, and reduced loneliness (Yin, 2023). Another study compared service-learning with traditional teaching methods, showing better development of social and civic skills among service-learning participants. Service-learning has also been linked to promoting sustainable development by aligning educational practices with sustainability principles (Pilar & Rosario, 2023). Furthermore, SULAM projects at UKM emphasized community involvement, particularly during the pandemic, highlighting the initiative's flexibility and community impact (Ibrahim, et. al., 2022).

While SULAM initiatives have become pivotal in linking academic learning with community service, there remains a challenge in effectively evaluating and scaling these projects to ensure consistent and sustainable impact across diverse contexts (Naufal et al., 2024). Existing international SULAM initiatives, particularly those focused on environmental conservation, waste management, and structural integrity, have demonstrated substantial contributions to student skills development and community engagement. However, the reliance on qualitative data and the variability in student and community engagement levels highlight a need for more robust evaluation methods. Additionally, the scalability of these projects poses a challenge in adapting successful models to different cultural and environmental contexts. Addressing these challenges is crucial to optimizing the benefits of SULAM initiatives for both academic and community development.

Thus, this paper focuses on the implementation of the selected SULAM projects carried at international levels to assess the key contributions of these projects to community engagement, student skills development, and environmental sustainability and determine the impact of SULAM projects on student learning outcomes' attainment in Engineers in Society course for an engineering programme in Malaysia.

Literature Review

Service-Learning

Service learning is a teaching method that enhances students' academic programs by combining structured experiential learning with community service, promoting reflection on their experiences. It enriches academic learning and fosters personal and social development (Tijsma

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et al., 2020). Students participating in service-learning show improved academic performance, personal and interpersonal skills, attitudes toward learning, and civic-mindedness (Koekkoek et al., 2021). Additionally, it provides career exploration opportunities and helps develop complex problem-solving and social skills through continuous reflection (Kaumba, 2023).

Apart from benefiting students, service learning also offers significant advantages to other stakeholders, including community partners, faculty, and the university (Tijsma et al., 2020). Community partners can expand their organizational capacity, mentor students, and gain new knowledge (Kaumba, 2023). For instance, nursing students' service-learning initiatives enhance community partners' understanding of health determinants and improve access to healthcare (Schneider et al., 2018). Faculty and universities benefit from new teaching tools, enhanced curriculum, professional development, and increased collaboration opportunities (Salam et al., 2019; Lau & Snell, 2020; Sunarti, et al, 2023).

Impacts of the Service-Learning on Sustainability Communities

Since 2015, Malaysia has formalized the integration of service learning into higher education as part of high-impact educational practices. The Service-Learning Malaysia: University for Society (SULAM) model emphasizes collaboration among universities, communities, government bodies, and industries. While many studies have examined the impact of service learning on student outcomes and soft skills development (Salam et al., 2019), there is limited research on its effects on all stakeholders involved in the quadruple helix model, particularly in Asia. Understanding these relationships is crucial for developing effective and sustainable SULAM initiatives (Naufal et al., 2024).

Community service programs can have transformative impacts on university students, fostering social responsibility, empathy, and civic engagement. By participating in meaningful projects, students develop practical skills, cultural competence, and an understanding of diverse societal issues (Kaumba, 2023 & Bellandi et al., 2021). This approach was crucial in preparing students for effective sustainability community engagement, providing them with the knowledge, skills, and attitudes needed to navigate complex community dynamics and address local needs (Sunarti et al., 2023). Essential skills include effective communication, teamwork, problem-solving, and cultural sensitivity. Experiential learning, case studies, and reflective practices are commonly used to enhance these community service programs.

Methodology

This study employed a mixed method approach by utilizing secondary data and information based on document review of Engineers in Society course in an engineering programme related to the selected international SULAM projects and an entrance-exit survey (EES) based on the student feedback on the course learning outcomes of the course.

The qualitative analysis is based on a review of the activities including, physical community projects and online symposium activities. The study reviewed the project documentation provided by the symposium organizers and College of Engineering social media. Based on document review, various international SULAM activities organized in semester March - August 2023 and 2024 were selected for this paper and discussed below.

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Complementing the qualitative analysis, a quantitative approach is utilized through structured surveys to collect student feedback on the attainment of learning outcomes. These surveys include Likert-scale questions that assess students' understanding of professional and ethical responsibilities, practical application skills, and overall readiness for engineering roles. Table 2 outlines the survey questions, while Table 3 explains the Likert scale employed. The survey data is analysed using both descriptive and inferential statistical methods to identify trends and evaluate the impact of the collaborative teaching model on student learning outcomes. This comprehensive approach aims to capture best practices and assess the overall effectiveness of incorporating industry expertise and online collaborative learning in improving engineering education.

Table 2: Entrance- Exit Survey Questions Mapped To The Course And Programme Outcomes

Question Item	Description	Course and Programme Outcomes
T-1-1	I am able to engage with the community as a prospective civil engineer in solving complex problems involving the civil engineering profession	Course Outcome 1 (CO1): Engage with the community as a prospective civil engineer in solving problems involving the civil engineering profession. Programme Outcome 6 (PO6): The Engineer and the World - Analyze and evaluate sustainable development impacts to: society, the economy, sustainability, health and safety, legal frameworks, and the environment, in solving complex engineering problems (WK1, WK5, and WK7)
T-1-2	I am able to contribute to the community by applying knowledge and skills learned in the classroom to help solve local problems.	
T-1-3	I do understand that the Service-Learning Malaysia University for Society or known as SULAM is an initiative that provides a learning experience by integrating theory and practice to expose students to real-world problem solving in the community.	
T-1-4	I do understand that SULAM is one of the important agendas in Ministry of Higher Education translated at the university level which can be considered as a noble effort by the university in producing holistic graduates by engaging them in helping the local community.	
T-2-1	I understand and comprehend the ethical and professional conduct that guide civil engineers' professional practice and service to the community.	Course Outcome 2 (CO2): Comprehend the ethical and professional conduct that guide a civil engineer's professional practice and service to the community Programme Outcome 8 (PO7): Ethics - Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (WK9).
T-2-2	I am able to adopt ethical and professional behavior that guides the professional practice and services of civil engineers to the community.	
T-2-3	I do comprehend the role of engineering ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity:	

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	economic, social, cultural, environmental and sustainability

Table 3: Likert Scale of the Survey

Scale	Indicator
1	Strongly Disagree
2	Disagree
3	Mixed Feeling
4	Agree
5	Strongly Agree

At the start and end of the semester, students in the Engineers in Society (EIS) course participated in entrance and exit surveys. These surveys were designed to assess the effectiveness of the collaborative teaching model by evaluating both cognitive and affective outcomes. The primary objective was to measure students' self-assessed knowledge and skills related to the course outcomes before and after engaging with the course content and the collaborative teaching approach.

The entrance and exit surveys included questions aimed at assessing students' understanding of the Malaysian Ministry of Higher Education's initiative aimed at producing holistic graduates by engaging students in community service, where they can apply classroom knowledge and civil engineering skills to solve complex, real-world problems and contribute meaningfully to society. In addition, there are questions to assess students' understanding and commitment of the ethical and professional responsibilities of civil engineers, including the importance of public safety, and their ability to adopt behaviours that reflect these principles while recognizing the economic, social, cultural, environmental, and sustainability impacts of engineering activities. These questions provided a thorough assessment of how well the course met the Ministry of Higher Education (MOHE) learning outcomes, focusing on Values, Ethics, Morality, Professionalism, and Management and Entrepreneurship.

Data Analysis and Discussion

Qualitative Analysis based on Document Review

International SULAM Project in Indonesia

There are two projects undertaken in Indonesia. On June 2, 2023, the College of Engineering at Universiti Teknologi MARA (UiTM) organized an international program. The first programme entitled "Envirovision: Evaluating Noise and Air Particle Assessments" was conducted in Pasar Pagi Arengka in Pekanbaru, Indonesia (see Fig. 1)

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Figure 1: Evaluating Noise and Air Particle Assessments at Pasar Pagi Arengka, Pekanbaru, Indonesia

This event, part of the Engineering in Society (ECC589) course, involved 9 UiTM students and their lecturer, alongside 10 students and 4 lecturers from Sekolah Tinggi Teknologi Pekanbaru. Supported by Yayasan VFive, Sekretariat Mahasiswa Fakulti-Pengajian Kejuruteraan Awam (SMF-PKA) from UiTM, and the Indonesian consulting firm PT. Harista Karsa Mandiri, the program aimed to conduct a comprehensive evaluation of noise levels, air quality, and visitor and seller satisfaction at the market. The primary goal of the "Envirovision" program was to gather and analyze data on environmental pollution to present a detailed report to the Riau government for effective monitoring. This international SULAM activity promotes sustainable practices and addresses environmental challenges, contributing to the betterment of society.

The second international SULAM project in Indonesia took place on the 3rd of June 2023, titled "Harnessing Sustainability Towards Engineering Technology" in Pekanbaru, Indonesia, to tackle a critical water purification challenge (see Fig. 2). This initiative brought together students and lecturers from Universiti Teknologi MARA (UiTM) and Sekolah Tinggi Teknologi Pekanbaru. Sponsored by Yayasan Vfive and supported by Harista Karsa Mandiri, the program aimed to install a water filtration system at Masjid Nurul Jannah to improve the quality of water used for ablution and daily purposes.

Figure 1: Water Purification Challenge, Masjid Nurul Jannah, Pekanbaru, Indonesia

The program involved 20 students and 5 lecturers, including participants from both UiTM and Sekolah Tinggi Teknologi Pekanbaru, and was also supported by SMFFKA UiTM Shah Alam. The successful implementation of the "Harnessing Sustainability Towards Engineering

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Technology" program demonstrates the College of Engineering's dedication to promoting sustainable practices and addressing real-world challenges. By purifying the water at Masjid Nurul Jannah, this international SULAM program highlights the importance of providing clean water and encourages other industries to adopt effective water and air filtration systems.

International SULAM Project in India

The 1st International Undergraduate Symposium on Sustainable Communities through SULAM Projects 2023 (ISCOM2023), held on June 26, 2023, from 11:00 am to 3:00 pm (MT), was hosted by the School of Civil Engineering, College of Engineering, Universiti Teknologi MARA (UiTM), Malaysia. This symposium brought together students and staff from UiTM, Presidency University (India), and Universiti Sains Malaysia, facilitating a vibrant exchange of ideas and solutions for sustainable communities.

Two esteemed keynote speakers are invited to enrich the symposium with their expertise and insights. The first speaker, Prof. Dr. Jagdish H. Godihal from Presidency University, India, delivered an enlightening keynote address on environmental sustainability, shedding light on the importance of adopting sustainable practices to preserve our environment and create a harmonious future. After the first keynote speech, two groups of students presented a proposal for the Design of a Roofed Assembly Hall for the Integrated Religious Primary School (SRAI) Tengku Ampuan Fatimah (TAF) in Batu Belah, Klang, Selangor. Under the banner of SULAM, dedicated Civil Engineering students volunteered their expertise to develop a comprehensive design proposal for the roofed assembly hall at SRAI Tengku Ampuan Fatimah, reflecting the power of structured community programs in fostering positive change.

Figure 2:1st International Undergraduate Symposium on Sustainable Communities through SULAM Projects 2023 (ISCOM2023)

The second speaker, Associate Prof. Dr. Farid Ezanee Mohamed Ghazali from Universiti Sains Malaysia (USM), captivated the audience with his speech on engineering ethics and professional conduct. The speaker emphasized the significance of upholding ethical standards

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and professional integrity in engineering, highlighting the vital role engineers play in shaping society. Following the second keynote speech, another four groups presented their community projects, known as the Guardian Against Garbage Programme. Aligned with the campaign "*Air Kita, Tanggungjawab Bersama*", this initiative showcased inspiring activities such as the Water Filter Race, River Care, Water Quality Monitoring, and Community Greening. Participants and communities near Sungai Penchala, Kuala Lumpur actively engaged, promoting environmental responsibility and creating a cleaner, greener community.

Overall, ISCOM2023 served as a dynamic platform for sharing knowledge, experiences, and ideas across institutions and countries. The collaborations established during this event promise future advancements in sustainable design and resilient community development. The symposium also envisions ongoing cultural and educational exchanges between students from India and Malaysia, enriching their learning experiences and fostering a lasting commitment to sustainable community growth.

On 11th May 2024, another collaboration with the Presidency University was organised through Trash to Treasure program at *Sekolah Kebangsaan Seafield 3* in Subang Jaya (see Fig. 4). This collaborative initiative brought together *Persatuan Ibu Bapa dan Guru (PIBG), SK Seafield 3*, Presidency University (India), and Macro Dimension Concrete Sdn. Bhd. (MDC). The objective of the program was to perform maintenance on the concrete floor in classrooms, addressing cracks and holes. This sustainable project utilized waste concrete as a replacement for normal concrete, followed by the application of SIKA215 as a finishing layer. The program was advised by Dr. Nur Izzati Ab Rani and saw active participation from 5 SULAM students.

Figure 3: Trash to Treasure Program at *Sekolah Kebangsaan Seafield 3*, Subang Jaya

International SULAM Projects in Thailand

i-SULAM: Concrete Structure Integrity Assessment program successfully conducted in Pattani, Thailand. From 27 to 31 May 2024, the School of Foundation Azizstan in Pattani, Thailand, hosted the innovative Concrete Structure Integrity Assessment program, organized by the School of Civil Engineering of UiTM. Part of the international i-SULAM initiative, this pivotal project engaged five engineering students from UiTM under the course "Engineers in Society (ECC589)" and involved the local student community of Azizstan Foundation School. The program was a collaborative effort with contributions from Nattest Lab Sdn. Bhd. and Concrete Society Malaysia (CSM), focusing on the comprehensive examination of concrete structures within the school premises.

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Figure 5: Concrete Structure Integrity Assessment program School of Foundation Azizstan in Pattani, Thailand

The program was supervised by Dr. Norazlan bin Khalid, with Prof. Ts. Dr. Hj Mohd Fadzil Bin Arshad serving as the Head of Delegation. The primary goal was to fortify collaboration between universities, industries, and community sectors. It assessed the stability of concrete structures at the Azizstan School, identified potential deficiencies or damages that could impact building safety, and formulated remediation steps and recommendations to enhance structural stability (see Fig. 5). A key part of the program was sharing knowledge through technology transfer sessions and best practices in concrete structure safety and assessment. This collaborative program benefited both UiTM students and the local community by improving their understanding and skills in maintaining and assessing structural integrity. The event also provided practical learning, with UiTM students creating a detailed structural assessment report for School of Foundation Azizstan. This hands-on experience helped strengthen the students' academic and professional skills in real-world settings. Table 1 summarizes all projects based on the countries, collaborators and other stakeholders.

Table 1: Summary of the International SULAM Projects Involvement

Name of Project	Collaboration Partners			Participants	
	Country	Communities	Collaborators		
1.Envirovision: Evaluating Noise and Air Particle Assessments	Indonesia	*Pasar Pagi Arengka* in Pekanbaru	Consultant firm: PT. Harista Karsa Mandiri Sponsorship: *Yayasan* VFive	9 UiTM students and 2 advisors, 10 students and 4 lecturers from *Sekolah Tinggi Teknologi* Pekanbaru	Semester March – August 2023
2.Harnessing Sustainability Towards Engineering Technology	Indonesia	*Masjid Nurul Jannah*, Pekanbaru			
3.1st International Undergraduate Symposium on Sustainable Communities	India	Integrated Religious Primary School (SRAI) Tengku Ampuan	Presidency University, India, and *Universiti Sains Malaysia*	6 advisors, 30 UiTM students and staff, student and lecturers from Presidency	

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through SULAM Projects 2023 (ISCOM2023)		Fatimah (TAF) in Batu Belah, Klang, Selangor and Sungai Penchala, Kuala Lumpur		University, India, and *Universiti Sains Malaysia*	
4.Trash to Treasure	India	*Sekolah Kebangsaan Seafield 3*, Subang Jaya, Selangor	Presidency University (India), and Macro Dimension Concrete Sdn. Bhd. (MDC)	Advisor and 5 UiTM students	Semester March – August 2024
5.Concrete Structure Integrity Assessment	Thailand	School of Foundation Azizstan in Pattani	Nattest Lab Sdn. Bhd. and Concrete Society Malaysia (CSM)	2 advisors, 5 UiTM students and students from School of Foundation Azizstan	

Based on the total of five (5) international SULAM project initiatives carried out in three (3) countries outlined above, these efforts integrate SULAM approaches by fostering partnerships with local communities and organizations to provide real-world contexts. In Malaysia, educators face challenges such as financial constraints and time management issues when implementing SULAM projects. These challenges emphasize the need for structured approaches to integrating service learning in academic curricula (Ashikin et al., 2021 & Naufal 2024). Singh (2017) explores community university engagement initiatives in India, highlighting how partnerships between higher education institutions and local communities create socially relevant knowledge, which fosters empowerment and sustainable livelihoods. These projects align academic goals with community needs, ensuring both relevance and impact. Students participate in hands-on projects that apply theoretical knowledge in practical settings, with regular fieldwork and site visits offering firsthand experience with engineering challenges.

The integration of community service into higher education has gained prominence as universities recognize the value of experiential learning (Ibrahim, et. al., 2022). This study compelling and suggests a clear focus on fostering long-term, sustainable development within communities through Service-Learning Malaysia University (SULAM) projects on an international scale. Harfitt (2019) emphasizes the benefits of community-based experiential learning in teacher education, promoting skills such as empathy, collaboration, and resilience. This supports the multidisciplinary approach in SULAM projects, which encourage the development of inclusive and socially connected professionals. The current implies a multidisciplinary approach involving education, community engagement, and international collaboration. It highlights the potential of SULAM projects to not only enhance students' learning experiences but also to make significant contributions to community sustainability and social innovation by leveraging diverse, global perspectives and resources (Naufal et al., 2024).

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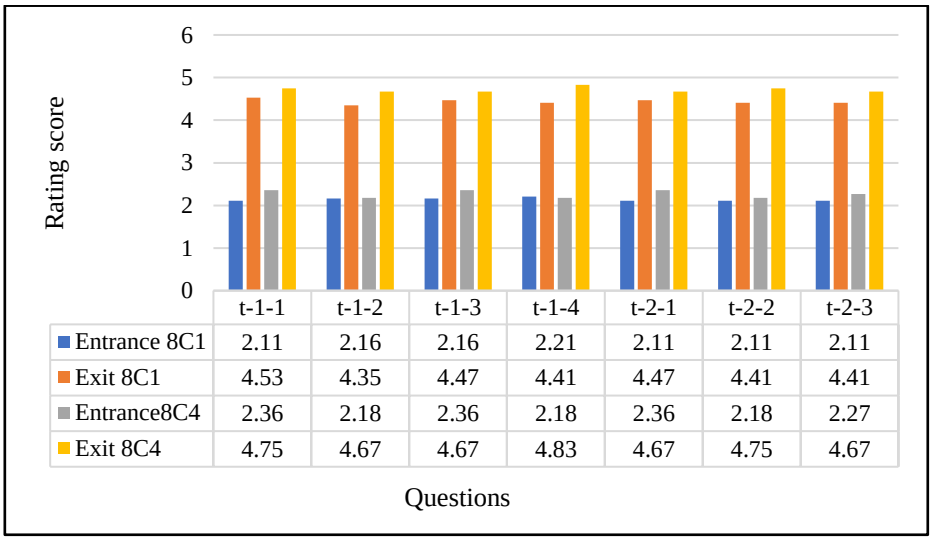
Quantitative Analysis on Entrance-Exit Survey (EES)

An entrance-exit survey (EES) consists of seven (7) items of question was administered to students involved in the international SULAM projects to assess their understanding and application of civil engineering principles within the context of the Engineers in Society course. The survey includes questions on community engagement, where items t-1-1 to t-1-4 assess course outcome 1 (CO1 – Engagement with society to solve problems) mapped to programme outcome 6 (PO6 – Engineers and the World) on the application of theoretical knowledge to solve local/international community problems. while items t-2-1 to t-2-3 assess course outcome 2 (CO2 – demonstrate ethical and professional behaviours) mapped to programme outcome 7 (PO7 - Ethics) on and comprehension of ethical and professional responsibilities in civil engineering.

Figure 6 present the average ratings from the EES for the March–August 2023 for Group 8C1 and Group 8C4. Responses were measured using a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), providing insights into students' growth and the program's impact on their learning outcomes.



	t-1-1	t-1-2	t-1-3	t-1-4	t-2-1	t-2-2	t-2-3
Entrance 8C1	2.11	2.16	2.16	2.21	2.11	2.11	2.11
Exit 8C1	4.53	4.35	4.47	4.41	4.47	4.41	4.41
Entrance8C4	2.36	2.18	2.36	2.18	2.36	2.18	2.27
Exit 8C4	4.75	4.67	4.67	4.83	4.67	4.75	4.67

Figure 6: Average Ratings from Entrance-Exit Survey for 2 Groups Involved in International Sulam Projects in Semester March-August 2023

The results indicate significant improvements in students' ratings from the entrance to the exit surveys for both cohorts, demonstrating growth in their understanding and application of civil engineering principles within the SULAM program. Specifically, for CO1-PO6 outcome attainment both groups show substantial increases from entrance to exit surveys. For instance, in question t-1-1, Group 8C1's rating increased from 2.11 to 4.53, and Group 8C4's rating increased from 2.36 to 4.75. These results suggest that students developed a stronger ability to engage with the community and a better understanding of how to apply their classroom knowledge to real-world problems. For CO2-PO7 outcome attainment, the ratings for these questions also saw marked improvements. For example, in t-2-1, Group 8C1's scores increased from 2.11 to 4.47, and Group 8C4's scores increased from 2.18 to 4.75, indicating an enhanced understanding of civil engineering ethics and the importance of professional behaviour in community service. Overall, the exit survey ratings are consistently high (around 4.41 to 4.83), reflecting those students felt more capable of adopting ethical and professional behaviours in their practice by the program's end.

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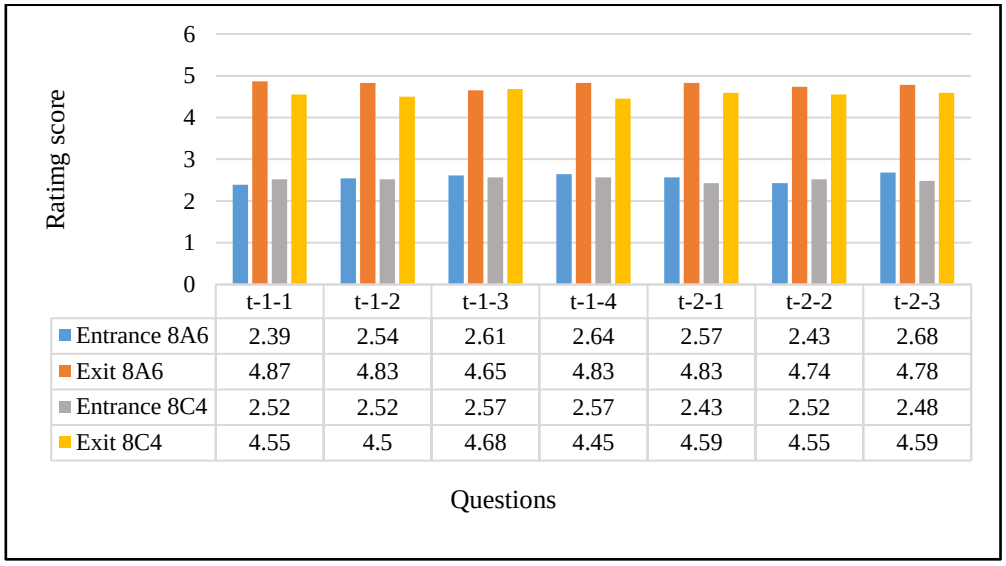
Figure 7 shows the ratings for the EES ratings for another two groups, Group 8A6 and Group 8C4. The results reflect significant improvements in students' ratings from EES for both groups, indicating enhanced understanding and application of civil engineering principles and ethics through the program.



	t-1-1	t-1-2	t-1-3	t-1-4	t-2-1	t-2-2	t-2-3
Entrance 8A6	2.39	2.54	2.61	2.64	2.57	2.43	2.68
Exit 8A6	4.87	4.83	4.65	4.83	4.83	4.74	4.78
Entrance 8C4	2.52	2.52	2.57	2.57	2.43	2.52	2.48
Exit 8C4	4.55	4.5	4.68	4.45	4.59	4.55	4.59

Figure 7: Average Ratings from Entrance-Exit Survey for 2 Groups Involved in International Sulam Projects in Semester March-August 2024

Specifically, for CO1-PO6 outcome attainment on the community engagement and understanding of SULAM, both groups show clear increase from entrance to exit ratings. For instance, the Group 8A6's rating improved from 2.39 to 4.87, and Group 8C4's rating rose from 2.52 to 4.55. These results suggest that students developed a greater ability to engage with the community and better understood the role of SULAM in applying classroom knowledge to solve real-world problems. For CO2-PO7 outcome attainment on ethics and professional conduct, ratings in these areas also saw significant increases. For example, the Group 8A6's scores improved from 2.57 to 4.83, and Group 8C4's scores increased from 2.43 to 4.59, indicating an enhanced understanding of ethical responsibilities and professional conduct in civil engineering. Overall, the exit ratings are consistently high (around 4.55 to 4.87), indicating that students felt more capable of adopting ethical behaviours and understanding their role in community safety by the end of the program.

Based on the quantitative analysis, for both semesters March-August 2023 and March August 2024, all groups demonstrated significant improvements from the entrance to the exit surveys across all survey questions. Entrance scores varied slightly among all groups, but exit scores were consistently high across all groups, indicating that the program effectively brought students to similar competency levels by its conclusion. All groups showed substantial outcome attainment of CO1-PO6 on in their ability to engage with the community as future engineers and apply their classroom knowledge to solve local and international problems. This suggests that the program effectively strengthened students' awareness and involvement in community-focused engineering practices. Studies have shown that ethics education in civil engineering enhances students' understanding of professional standards and ethical conduct. Programs that emphasize ethical decision-making frameworks are particularly effective in preparing students

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for real-world challenges (Ataei & Salem, 2016). The current study shows that outcome attainment of CO2-PO7 on ethics and professional conduct also marked improvements in understanding and applying ethical and professional standards. By the end of the program, students in all groups reported a higher ability to adopt ethical behaviours and comprehend the civil engineer's role in ensuring public safety and sustainability. Implementing SULAM projects has positively impacted students' skills, ethics, and professionalism. Students involved in SULAM projects have reported enhanced functional work skills and a deeper understanding of community issues (Hanum et al., 2021 & Naufal et al., 2024).

Collectively, the findings indicate that the international SULAM programs had a positive and measurable impact on students' abilities to apply their civil engineering knowledge in real-world contexts. Service learning integrated within engineering programs, such as SULAM, has been shown to positively influence students' professional ethics and community engagement (Wahab, 2024). For instance, programs that combine volunteer work and academic study align well with professional ethical standards, promoting student involvement in community service (Pritchard, 2000 & Wahab, 2024). The program also reinforced their understanding of professional ethics and community service, aligning well with the outcome attainment of the course. This reflects the program's success in fostering well-rounded civil engineers who are equipped with both technical skills and a strong ethical foundation. The integration of professional ethics into engineering curricula fosters ethical responsibility among students (Wahab, 2024). Studies suggest that a structured approach to ethics in civil engineering programs strengthens students' ethical reasoning skills and prepares them for professional challenges (Bero & Kuhlman, 2011).

Conclusion

The study reveals that international SULAM projects significantly enhanced students' community engagement, practical engineering skills, and understanding of professional ethics within the Engineers in Society course. Document reviews highlight diverse community-focused initiatives, such as environmental conservation and waste management, that exposed students to global civil engineering challenges and reinforced sustainable practices. Survey data shows marked improvements in students' learning outcomes attainment, indicating the program's effectiveness in fostering their ability to address complex problems, adopt ethical behaviours, and understand engineering's broader impacts. Overall, the alignment of qualitative and quantitative findings emphasizes SULAM's role in equipping students with essential technical and ethical competencies, proving it to be a valuable educational approach in engineering.

Limitations and Recommendations for Future Research

While the study offers valuable insights into the impact of international SULAM projects on civil engineering students, several limitations should be noted. First, it focused on specific projects and student groups in one engineering course, which may limit the generalizability of findings to other contexts. Additionally, the quantitative data relied on self-assessment surveys, potentially introducing response bias. The study also lacked longitudinal data, making it difficult to assess the long-term impact of SULAM on students' careers. Finally, the qualitative analysis was based on document reviews, which may not fully capture students' personal growth and experiences; in-depth interviews or focus groups could have provided more detailed insights. Future studies should include a larger and more diverse sample of students across different engineering disciplines and SULAM projects to improve generalizability.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 605-619
DOI: 10.35631/IJMOE.724042

Combining self-reported surveys with objective assessments, such as faculty evaluations or project metrics, and adding qualitative methods like interviews could provide a more comprehensive understanding of student development. To assess the long-term impact, follow-up studies should track participants after they enter the workforce to see how well SULAM skills are retained and applied. Additionally, comparing SULAM participants with non-participants, as well as international and local projects, could offer insights into the unique benefits and contextual differences in service-learning outcomes.

Acknowledgement
The authors would like to express their gratitude and thanks to Universiti Teknologi MARA for supporting this research.

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