2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC
Host Sponsor UNC Charlotte
Paper ID #50931

Bridging Cultures and Classrooms: Insights from Two Decades of International Capstone Projects

Dr. Namita Shrestha, Rose-Hulman Institute of Technology

Dr. Namita Shrestha earned her PhD in Civil/Environmental Engineering from South Dakota School of Mines and Technology; Master of Science in Civil/Environmental Engineering from South Dakota School of Mines and Technology. Her research interests include bioelectrochemical systems, microbial electrochemistry, resource recovery from waste/wastewater, waste treatment and nanomaterial for bioelectrochemical application. She is passionate about research-based learning and student-centered pedagogy. She serves as a member of the American Society of Civil Engineers (ASCE), Association of Environmental Engineering and Science Professors (AEESP), Environmental & Water Resources Institute (EWRI) and ASEE.

Dr. John Aidoo, Rose-Hulman Institute of Technology

Dr. Aidoo is currently a Professor of Civil Engineering Department at Rose-Hulman Institute Technology. Prior to this appointment, he worked as the Bridge Design Engineer at South Carolina Department of Transportation.

Dr. Timothy Chow

Timothy Chow serves as the Director of Institutional Research in the Office of Institutional Research, Planning, and Assessment (IRPA) at Rose-Hulman Institute of Technology. He is a member of Rose-Hulman's Data Governance Committee and the Quality of Education Committee. Timothy is a longtime member of the Association for Institutional Research (AIR), Indiana Association for Institutional Research (INAIR), and Overseas Chinese Association for Institutional Research (OCAIR), and he currently serves as a member of the ASEE Data Collections Advisory Board, as well as a Peer Reviewer for the Higher Learning Commission (HLC) and for the OAAAQA Register of External Reviewers . Timothy has a PhD from Indiana State University in Technology Management with specialization in Quality Systems.

Mitchel Daniel, Rose-Hulman Institute of Technology
Kishor Bagale Thapa

Bridging Cultures and Classrooms: Insights from Two Decades of International Capstone Projects

I. Introduction

As engineering practice increasingly operates across national, cultural, and regulatory boundaries, global learning has become an essential component of undergraduate STEM education. Engineers are now expected not only to demonstrate strong technical competence, but also to collaborate effectively with diverse stakeholders, navigate unfamiliar socio-cultural contexts, and design solutions that are both technically sound and socially responsible. In response, engineering programs have sought to integrate global learning experiences that prepare students to address complex, real-world problems in an interconnected world.

One effective approach to embedding global learning within the undergraduate curriculum is the incorporation of international capstone design projects. These projects engage student teams in addressing authentic infrastructure, water, and environmental challenges in partnership with international communities, non-governmental organizations, and professional clients. These experiences provide students with opportunities to apply engineering design principles in contexts that differ markedly from domestic projects in terms of resources, constraints, standards, and stakeholder expectations. International capstone projects offer distinct educational value beyond traditional design experiences. By working in global settings, students gain exposure to different cultural norms, communication styles, and professional practices, fostering intercultural competence and ethical awareness. These projects often involve incomplete data, evolving client needs, and non-standard design constraints, closely mirroring professional engineering practice in global and humanitarian contexts. At the same time, international projects can produce tangible benefits for partner communities, reinforcing the societal role and responsibility of engineers. These projects also present challenges, including coordination across time zones, cultural and language barriers, logistical complexity, and increased demands on faculty and clients.

The goal of this research is to examine two decades of experience with international capstone projects in civil and environmental engineering at Rose-Hulman Institute of Technology. Using selected case study examples, the paper analyzes qualitative and quantitative feedback from students, faculty advisors, and project clients to evaluate educational outcomes and implementation considerations. Specifically, this work presented here addresses the following research questions:

1. How do international capstone projects impact student learning, professional skill development, and global awareness?
2. What challenges and opportunities do faculty, and clients encounter in supporting and sustaining these projects?

By synthesizing long-term experience and stakeholder perspectives, this paper aims to provide practical insights and evidence-based guidance for engineering programs seeking to incorporate or expand international design experiences within their curricula.

II. Literature Review

Global competence is now a key goal of engineering education because engineers increasingly work on projects that cross national borders, involve international teams, and address environmental challenges that affect the world as a whole [1] [2]. National and international organizations emphasize the need for engineers who can operate effectively in global and societal contexts [3]. ABET explicitly highlights the importance of understanding the global, economic, environmental, and societal impacts of engineering solutions, while the National Academy of Engineering underscores the role of engineers in addressing complex global challenges [4] [5].

In response, engineering programs have adopted a range of international learning experiences, including study abroad programs, service-learning initiatives, global internships, and international project-based collaborations [6] [7]. Prior research indicates that these experiences can enhance students' intercultural awareness, communication skills, ethical reasoning, and appreciation of the societal context of engineering practice [1], [2]. However, participation in traditional study abroad programs remains limited for many engineering students due to financial constraints, rigid curricula, and time-to-degree concerns [6]. These challenges have motivated educators to explore approaches that embed global learning directly into required coursework.

Capstone design courses are widely recognized as a high-impact pedagogical practice in engineering education. They provide students with opportunities to integrate technical knowledge, apply the engineering design process, and develop professional skills such as teamwork, communication, project management, and ethical decision-making [8] [9]. Capstone experiences are often client-driven and open-ended, closely resembling professional engineering practice.

The incorporation of international contexts into capstone design projects has been shown to further enhance these learning outcomes. International capstone projects introduce students to nontraditional constraints such as limited data availability, differing regulatory frameworks, cultural considerations, and resource limitations [10] [11]. Studies report that students involved in international capstone projects demonstrate increased adaptability, creativity, and awareness of the social and ethical dimensions of engineering design [10] [12]. These projects also promote a sense of global citizenship and reinforce the societal responsibilities of engineers.

Despite their benefits, international capstone projects present notable challenges. Faculty face increased coordination efforts, communication across time zones, and the need to manage cultural and logistical complexities [2] [12]. Additionally, sustaining international partnerships requires long-term institutional commitment and alignment between educational goals and client needs.

Although the literature documents positive outcomes associated with global learning and international capstone experiences, significant gaps remain. Much of the existing research focuses on short-term programs or single-course implementations and relies heavily on self-reported student outcomes collected immediately following participation [6] [2]. There is limited longitudinal research examining the sustained impact of international capstone projects across multiple cohorts or over extended time periods. Furthermore, existing studies primarily emphasize student learning outcomes, with comparatively less attention given to faculty workload, program sustainability, and client perspectives [9] [12]. Few studies adopt a multi-stakeholder approach or draw on long-term institutional experience to evaluate how international capstone programs evolve and mature over time.

This study addresses these gaps by examining two decades of international capstone design projects in civil and environmental engineering at Rose-Hulman Institute of Technology. By integrating case study examples with feedback from students, faculty, and project clients, the paper contributes a longitudinal and holistic perspective to the engineering education literature and provides practical insights for programs seeking to implement or sustain international capstone initiatives.

III. Program Overview

History of International Capstone Projects at Rose-Hulman Institute of Technology

The international capstone design program in the Department of Civil and Environmental Engineering at Rose-Hulman Institute of Technology was initiated in 2005 as a means of integrating global learning experiences into the required senior design curriculum. The program was developed to provide students with authentic engineering design opportunities that extend beyond domestic contexts while maintaining the structure and expectations of a traditional capstone course. Over the past two decades, the program has evolved through iterative refinement of project selection, partner engagement, and instructional support, resulting in a sustainable model for delivering international design experiences within an undergraduate engineering program. Our international collaborative efforts have included partnerships with Kwame Nkrumah University of Science and Technology (KNUST) in Ghana as well as engagements with various non-technical clients across Africa, Asia, and Central America. So far, a total of 118 civil engineering seniors have worked on 28 international capstone design projects in 10 countries: Ghana, Haiti, India, Kenya, Nepal, Pakistan, Sudan, Trinidad, Uganda and Zimbabwe [13]. A detailed list of the completed international capstone design projects can be found in the paper by Shrestha et al. [14].

International projects are offered alongside domestic industry-sponsored projects, allowing students to select design experiences aligned with their interests while ensuring equitable

academic expectations across all capstone teams. Projects are typically identified through long-standing relationships or trusted intermediaries with knowledge of local needs and conditions. Emphasis is placed on developing mutually beneficial partnerships in which student design efforts address real community or client needs while respecting local practices, constraints, and priorities. Many partnerships have been sustained across multiple years, enabling continuity in project development and deeper institutional learning.

Project scopes are intentionally open-ended and reflective of real-world conditions. Students frequently encounter challenges related to limited site data, evolving client requirements, material availability, and non-standard design codes. These constraints encourage creative problem-solving and highlight the importance of professional judgment, adaptability, and ethical decision-making in global engineering practice.

Evolution of the Capstone Collaboration Model

International capstone design projects have taken a variety of forms over the past two decades: joint project, travel overseas and stay at home. The advantages and limitations of each model are discussed by Hanson et al., 2006 [15].

The first international collaboration with KNUST during the 2006-2007 academic year adopted the *Stay-at-Home Project Model*. Under this approach, each institution pursued its own design itinerary, while working from a shared problem statement and common design objectives. Student feedback revealed a notable shortcoming: limited cultural interaction and engagement between students at the two institutions.

Consequently, the collaboration transitioned to a *Parallel Design Project Model*. In this format, the student teams from both institutions worked independently on the same project, but they were encouraged to share and discuss data and ideas throughout the process.

Seeking deeper cross-cultural engagement, we implemented a *Joint Project Model.* In this model, RHIT students were paired directly with KNUST students to function as a single, integrated team working on a project in Ghana. While this model fostered sustained dialogue, it also introduced significant logistical and coordination challenges.

The evolution of the collaboration model, as well as the strengths and limitations of the *Joint Project Model,* are discussed by Aidoo et al., 2014 [16].

Structure of the Year-Long Capstone Project

International capstone projects follow the same year-long structure as all senior design projects within the department, typically spanning three academic quarters. In the initial phase, students engage in problem definition, background research, stakeholder communication, and preliminary design development. This phase emphasizes understanding the social, cultural, environmental, and economic context of the project location.

The second phase focuses on detailed technical analysis and design, including modeling, code evaluation, and evaluation of alternative solutions. Students work closely with faculty advisors and project clients through regular design reviews and progress updates. Communication often occurs virtually, requiring students to navigate time zone differences and cross-cultural collaboration.

The final phase culminates in a comprehensive design package, including drawings, calculations, cost estimates, and written reports, as well as formal oral presentations. Throughout the year, students are assessed on both technical outcomes and professional skills, ensuring that international capstone projects meet the same academic standards as domestic projects while providing an enriched global learning experience.

IV. Case Studies

The international capstone projects span a diverse range of civil and environmental engineering applications. Structural projects have included the design of churches, community centers, hotels, and pedestrian footbridges. Infrastructure and environmental projects have encompassed ports, water supply systems, and water and wastewater treatment facilities. These projects often require students to integrate multiple sub-disciplines, such as structural, geotechnical, transportation, environmental, and construction engineering, within a single design effort.

Summaries of four international capstone design projects are provided in the following sections. These projects are representative of the types of service-learning/humanitarian projects in which our student teams have been engaged over the past 20 years.

1. Design of a Mission Compound, Trinidad-(2006)

Project Background and Partnership Context

This was the first international project that was undertaken by the CEE department with an international client. This project involved the design of a mission compound in Las Lomas, Trinidad. The client, Missions International, is an interdenominational organization that serves vulnerable populations in the Caribbean by providing food assistance, free medical services, and other forms of humanitarian relief.

Project Scope and Community Objectives

The student team was tasked with designing a medical facility, orphanage, battered women's shelter, soup kitchen, and a house for visiting missionaries. The goal of this project was to design a mission compound comprising a medical facility, a shelter for battered women, an orphanage for forty children, a soup kitchen, and an eight-bedroom guesthouse for visiting missionaries. Each facility was designed to address a specific need within the Las Lomas community. Healthcare in Trinidad is delivered through both public and private systems, and the client sought to provide services that exceeded those typically available at the public health clinics, including free medical care and surgical procedures. In addition, there was a critical need for a safe shelter

for women experiencing domestic abuse. The HIV/AIDS epidemic also had a significant impact on the island, with approximately 28,000 children having lost one or both of their parents. Although the orphanage was designed to house only forty children, it offers these children the opportunity to grow in a safe, supportive and healthy environment free from abuse [17].

The student team was faced with several challenges as discussed in Hanson et al., 2006 [15]:

Contextual Technical Challenges

(a) Communicating with the Client

During this period, the client could only be contacted by phone, which proved to be difficult. A site visit was not possible until later in the quarter and a face-to-face meeting via videoconferencing was also not feasible. As a result, the team relied primarily on email for communication, with the client typically taking three days to respond.

(b) Understanding the Cultural and Economic Context of the Country

The student team took the initiative to learn about the cultural and economic context of Trinidad for this project. They began by engaging the client with targeted questions and supplementing this information through published sources and other human resources.

(c) Obtaining Site-Specific Engineering Information from Local Courses

Since the client was not an engineer, the team had to obtain relevant engineering data from other sources familiar with local conditions. Finding design data such as seismic activity, rainfall amounts, wind speeds for this project required additional effort.

2. Design of an Agricultural Training Facility, Ghana-(2007)

Project Background and Partnership Context

This was the second international collaboration undertaken by the CEE department with an international client. This project involved the design of an agricultural training facility in Obodan, Ghana, intended to provide participatory learning experiences that promote rural development.

Project Scope and Community Objectives

The facility was planned for a four-acre site in Obodan, northwest of Accra, the capital city. The student team was tasked with designing a conference center, hostel, office building, caretaker house, and executive chalets. The overarching goal for this facility is to establish a center of excellence for integrated rural development that reduces poverty while increasing human resource capacity and agricultural productivity. In addition, the facility will host classes and development conferences, generating revenue for the village of Obodan and surrounding communities [18].

Contextual and Technical Challenges

For this project, to avoid some of the challenges encountered during our first international project in obtaining site-specific engineering data, the team collaborated with Rose-Hulman Institute of Technology Engineers Without Borders (RHIT-EWB) student chapter and Kwame Nkrumah University of Science and Technology, (KNUST), Ghana. While in Ghana, RHIT-EWB team was tasked with collecting site specific soil data and relevant design information, including previous land use, applicable design codes, rainfall data, common building materials, and local construction techniques and practices. The team also documented site conditions through photographs.

Most importantly, soil samples were collected from specific locations on the site and sent to KNUST laboratory for testing. This approach was critical given the challenges associated with transporting soil samples from another country to the United States. Through these collaborative efforts, most of the required engineering data was obtained before the student team began work on the technical designs of the project [19].

3. Develop a Footbridge Manual for Rural Kenya (2012)

Project Background and Partnership Context

This was the CEE Department's first international collaboration with an international client in Kenya. The client, Bridging the Gap Africa is a non-profit organization improving access and safety in rural Kenya through the design and construction of pedestrian bridges. These bridges enable communities to reach education, healthcare, and employment more easily while reducing the dangers of crossing rivers with high water, strong currents, and hazardous wildlife. The organization engages local populations in construction, fostering community ownership, and enhancing quality of life. Many project sites are far from major cities, which presents challenges such as limited labor, materials, and equipment. To address these constraints, most construction materials are donated, and bridges are built using simple, labor intensive methods without heavy machinery. Through these efforts, Bridging the Gap Africa combines practical engineering solutions with community involvement to create lasting infrastructure that supports safer and more connected rural communities.

Project Scope and Community Objectives

The student team was tasked with developing a footbridge manual for the design and construction of suspension bridges in rural Kenya. The overall goal is to produce a manual for Bridging the Gap Africa that addresses the needs of the local communities while accounting for their construction and material limitations. The bridge type described in the manual is a suspension bridge with timber decking supported by steel hangers and steel cables. The use of timber decking enables communities to rely on locally available resources and facilitates long-term maintenance by residents. The design and construction approach for the suspension bridge

is standardized for spans ranging between 60 and 400 feet, with dimensional variations provided to accommodate incrementally longer spans.

Contextual and Technical Challenges
Significant challenges arose from the remote project sites, limited availability of materials, and the absence of heavy construction equipment. Designs had to be adapted to rely on locally available resources, and simple labor-intensive construction methods. The student team also needed to understand community capabilities and maintenance practices to ensure that the manual would be practical and could be implemented by local populations.

4. Design of a Mission Compound, Zimbabwe-(2015)
Project Background and Partnership Context
This project involved the design of a mission compound intended to provide religious, educational, medical, and housing services to improve the quality of life for the Shona people living near the proposed site. The approximately 140-acre site was leased by the client from the Zimbabwe Ministry of Lands and Rural Development and is found in the northernmost part of the Gutu District within the Masvingo Province, about 75 miles south of the capital, Harare.

Project Scope and Community Objectives
The student team was tasked with designing a medical clinic, secondary school, and a church. The overall vision of the client, Hippo Valley Christian Mission is to establish a new facility in Gutu, Zimbabwe that delivers integrated healthcare, educational, and spiritual services to the surrounding communities.

Contextual and Technical Challenges
A key challenge for the student team was integrating economic, environmental, and social considerations into a holistic design philosophy. Because Hippo Valley Christian Mission relies heavily on potentially unsustainable donor funding, the team identified strategies to reduce energy and utility usage, material expenses, and labor costs. Local construction materials were selected, and the buildings were strategically oriented to minimize direct placed to reduce direct sunlight exposure while maximizing natural ventilation, thereby lowering both construction and long-term operational costs. The design also incorporated local building practices, materials, and architectural styles, ensuring feasibility, sustainability, and cultural acceptance.
The site layout aligned buildings along the existing footpaths to minimize the need for new paths. Additionally, the overall layout accounted for community lifestyle patterns and cultural behaviors to support long-term use and integration within the local context [20].

V. Methods

From the 2023-2024 academic year onward, we have followed the Global Service-Learning (GSL) model in our assessment of the international capstone design project. We have focused our assessment on capturing reflection and quantitative and qualitative feedback from students to gauge impact in terms of personal growth and development of knowledge and skills. We initially

designed a confidential feedback survey sent to students during the spring quarter of their final year in the program, administered by the Office of Institutional Research, Planning, and Assessment and approved by the Institutional Research Board. The 18 survey questions consisted of a mix of open-ended and Likert-type questions [14]. Likert-type questions asked about students' self-perception of the impact of their experiences in the course on their career opportunities, perspective on engineering and international work, and 'soft skills' including time management, organization, and initiative. Open-ended questions were used to obtain feedback from students about strengths and areas for improvement. IRPA provided anonymized and aggregated survey results to the capstone design project team for review at the conclusion of the spring quarter. Results from quantitative questions were visualized using box plots and frequency tables.

Open-ended responses were analyzed using an inductive, grounded-theory-informed approach applying axial, and selective coding processes [21] [13]. The coders reviewed the responses and conducted initial open coding to identify recurrent ideas in the data. Through iterative review, codes were refined, defined in a codebook, and applied across the full dataset. Related codes were then grouped into higher-order themes based on conceptual similarity and frequency of occurrence. Themes were considered salient if they appeared across multiple respondents rather than as isolated comments. Two members of the research team reviewed the responses from different cohorts (<Institutional Research Director>: 2023 – 2025; <Assessment Director>: 2024-2026). Sequential coding was used for the 2024-2025 cohort and discrepancies in coding and theme assignment were resolved through consensus. The coders were not instructors of record for the course.

In addition to surveying students, we obtained feedback from faculty technical mentors and clients. We administered the same, brief surveys for both faculty and clients. These surveys consisted of three open-ended questions asking respondents to share challenges encountered with the projects, recommendations to address these challenges, and any additional feedback they could provide (see Appendices B & C of [14]). The faculty survey was administered shortly after the end of the winter quarter in which faculty provided technical feedback and consultation to student project teams. We sent out the client survey at the conclusion of the spring quarter, shortly after completion of the project and clients observing student final presentations. As with the student surveys, we used grounded theory to analyze the responses and shared anonymized, aggregated results with the project team.

Beginning in the 2024-2025 academic year, we streamlined question wording and split the student survey into two parts to acquire feedback in a timelier manner. We sent out part 1, which focused on competencies directly related to fall quarter activities, in the final week of that quarter. Part 2, which focused on technical skills developed in the winter quarter and presenting to the client, was sent out near the end of that spring quarter.

VI. Findings & Discussion

1. Student Perspectives

Presently, we have completed part 1 of the 2025-2026 student feedback survey. We achieved a higher response rate (4/4; 100%) compared to previous years (e.g., 4/7; 57% in 2024-2025 and 5/8; 63% in 2023-2024) which we attribute to multiple reminders both via email from the survey administrator and in person from the instructor. The number and length of responses to the open-ended questions were comparable across years, suggesting that response quality was similar even for students that required multiple reminders before completing the survey.

Responses to the Likert-type questions suggested most students self-perceived growth in all areas of assessment, and the greatest self-perceived growth was for flexibility, planning, and perseverance. (Figure 1).

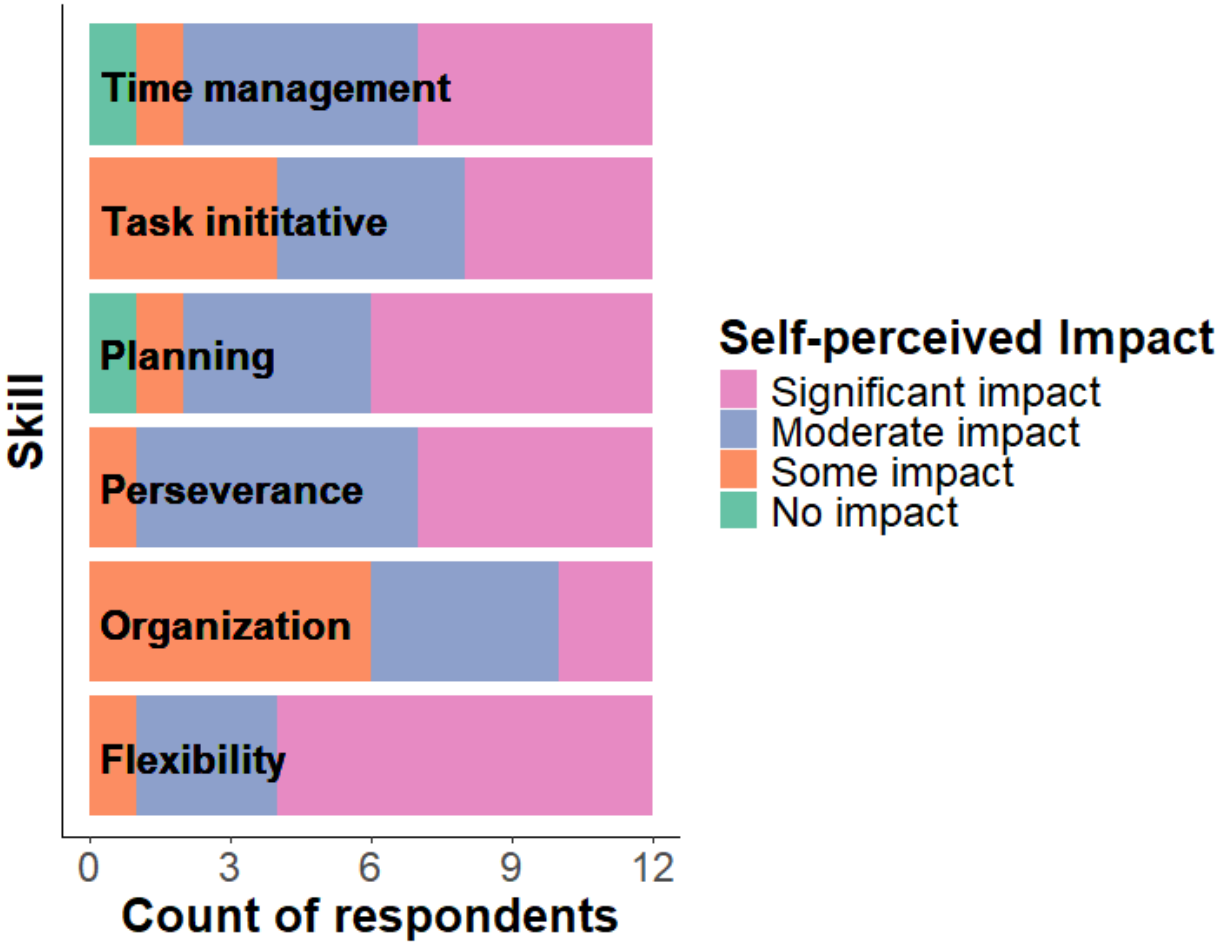

Figure 1. Distributions of responses to Likert type questions asking, "What impact has the international capstone experience had on the skills listed below?" Responses are from all three years combined.

Like in the previous two years, students reported growth in the following areas:

Academic

- Increased awareness of differences in engineering and professional standards, processes, units, and communication styles across culture
    - *E.g., "I was able to continue to learn how things work differently in different parts of world. Whether it be different communication styles, different expectations, etc."*
- Greater professional communication over email and in virtual meetings
    - *E.g., "The distance and language barriers make the importance of communicating clearly, concisely, and getting all the information you need in the first conversation, to avoid having to go back and forth to understand things."*
- Enhanced resourcefulness in obtaining data and other information from clients
    - *E.g., "International projects have greatly improved my ability to be resourceful ... to be willing to dig deeper for things and forced me to figure out codes by digging in and reading as there wasn't someone easily accessible who was familiar with the codes."*
- Improved ability to adapt to different schedules and work habits
    - *E.g., "Handling different time zones and schedules. Learning how to handle not having access to all the information we needed right away."*
- Deeper understanding of CEE concepts and their hands-on application in different environments
    - *E.g., "This project allowed me to understand the coursework I have taken in the past 4 years on a fundamentally different level. It has allowed me to understand what aspects of the civil engineering profession extend worldwide, but also how it differs. For example, structural codes in Nepal and the US may have speciic written differences, but the concepts of analyzing for dead load, live load, wind, seismic, etc. remains the same. It also impacted how I thought about the ASCE Code of Ethic and how that extends to my work internationally."*

Personal

- Expanded network and communication skills
    - *E.g., "I have been forced to learn how to communicate in multiple different ways (text, speech, figures/graphics) in a way that makes sense to multiple groups of people."*
    - *E.g., "It can provide connections with persons outside of the US.:*

- Greater awareness of cultural differences and social expectations
    - *E.g., "I learned a lot about the cultural practices and norms of people in Kumasi, Ghana."*
    - *E.g., "The most impactful aspects was learning some new things about a different culture... I did some individual resource on the colleges near our project and it was very interesting to learn about their traditions."*
- Improved competitiveness for jobs because of international project experience
    - *E.g., "The best part was the technical design portion because it gave me great design experience for future career opportunities."*
    - *E.g., "It has helped immensely with job prospects, being able to discuss skills as collaboration, global engagement, critical thinking, etc."*

This year, students newly reported growth in the following areas:

- Increased appreciation for importance of flexibility and planning to make the most of limited data, delays in communication, and limited time with the client
    - *E.g., "Perseverance and flexibility have been more important in this project because I had to continue working when there was no information and little guidance to help me work."*
    - *E.g., "Planning, organization, and time management have been impacted by the fact that our group has to make the most of each of our client meetings since we are unable to meet as often or for as long as many of the domestic groups."*
- Careful word choice to avoid misunderstandings or translation errors
    - *E.g., "I learned people in Nepal have a different communication style. I have been forced to think more deeply about the words I use to that things are misunderstood."*
- Exposure to more diversity of methods and habits of successful people
    - *E.g., "It further exposes the team to issues and norms of communities and successful peoples. Overall, it is an enlightening experience that helps open the mind."*
- Greater perseverance and patience to obtain data from clients who do respond quickly
    - *E.g., "Perseverance was greatly impacted because of the difficulty in communication. Getting ahold of information and the client has been very difficult."*
- Increased awareness of need to reduce barriers to international work, such as standardizing units/processes, smoother communication technology and data sharing practices, and not requiring the client to adhere to North American work hours
    - *E.g., "How can communication and standards be made clearer between different groups so that project work may be streamlined."*

As in previous years, students in 2025-2026 reported that, despite the challenges, the international capstone design project helped them broaden their knowledge of engineering processes, deepened their understanding of cross-cultural work, and enhanced their collaborative and professionalism skills in valuable ways relevant to their future careers.

2. **Faculty Perspectives**

We obtained feedback from six faculty mentors in 2023-2024 and 2 faculty mentors in 2024-2025. The faculty articulated challenges several challenges, such as lack of "familiarity and access to relevant codes for that country/region [for] determining appropriate environmental loads", the difficulty of "coaching multicultural competencies along with the rest of the learning goals for the course", and "not having familiarity myself with local construction practices and approaches." In discussing how to overcome these challenges, faculty described "select[ing] a similar location in the US to obtain loads, [and] substituting US codes", and suggested that the instructors "make sure the project has an active client that is committed to communication with the team", and "have technical mentors that are familiar with the project location".

We extracted three main themes from the challenges and suggestions that faculty provided:

Challenge 1. Gaining familiarity with, and access to, relevant codes and data specific to the country/region.

Suggestion 1. Identify analogous location(s) in the US with accessible data/codes to act as substitutes where necessary.

Challenge 2. Balancing the teaching of multicultural competencies alongside the technical learning goals of the course

Suggestion 2. Ensure client is committed to active communication with the team.

Challenge 3. Faculty mentors are not familiar with local construction practices and processes.

Suggestion 3. Select faculty mentors that have experience with the project location.

The faculty mentors emphasized the value of international project experience for students and were enthusiastic about the continuation of the program.

3. **Client Perspectives**

We received feedback from two clients per academic year in 2023-2024 and 2024-2025. Client describing the challenges encountered in the project as centering around "collecting data for the students... [and] communication problems caused by unstable networks." Another client suggested that problems with obtaining data and other information could be ameliorated with a

“visit to the proposed site by the design team to be familiar with the project site and the overall project environment so that the design team can prepare more design alternatives.”

From the client feedback we received, we identified the following central challenge and suggestion for improvement.

Challenge 1. Difficulty obtaining data in a timely manner and answering student questions because of unstable networks.

Suggestion 1. When feasible, have students visit project sites to assess data sources and then ask questions in person.

VII. Conclusion

This study examined two decades of international capstone design projects in civil and environmental engineering at Rose-Hulman Institute of Technology using case studies and feedback from students, faculty, and clients. Although our sample sizes were relatively small, we noticed several prominent themes in the feedback. Students reported increased learning, professional skill development, and global awareness, while maintaining the standards of traditional capstone design experiences, suggesting potential benefits that warrant further investigation with larger samples.

As engineering practice becomes increasingly global, international capstone projects provide a scalable and impactful approach to preparing students for professional practice. This work contributes a longitudinal, multi-stakeholder perspective to the engineering education literature and offers practical guidance for institutions seeking to embed global learning into core design courses.

Future work may include alumni-based assessment, interdisciplinary expansion, and hybrid engagement models that further strengthen global engineering education.

VIII. References:

[1] G. L. Downey *et al.*, “The globally competent engineer: Working effectively with people who define problems differently,” *J. Eng. Educ.*, vol. 95, no. 2, pp. 107–122, 2006.

[2] B. K. Jesiek, Y. Haller, and J. Thompson, “Developing Globally Competent Engineering Researchers: Outcomes-Based Instructional and Assessment Strategies from the IREE 2010 China Research Abroad Program.,” *Adv. Eng. Educ.*, vol. 4, no. 1, p. n1, 2014.

[3] A. D. Chan and J. Fishbein, “A global engineer for the global community,” *J. Policy Engagem.*, vol. 1, no. 2, pp. 4–9, 2009.

[4] ABET, “Criteria for Accrediting Engineering Programs, 2022 – 2023.” Jul. 2024. [Online]. Available: https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2022-2023/

[5] N. A. of Engineering and N. A. of Engineering, *The Engineer of 2020: Visions of Engineering in the New Century*. Washington, DC: The National Academies Press, 2004. doi: 10.17226/10999.

[6] A. Parkinson, “The rationale for developing global competence,” *Online J. Glob. Eng. Educ.*, vol. 4, no. 2, p. 2, 2009.

[7] J. R. Lohmann, H. A. Rollins, and J. Joseph Hoey, “Defining, developing and assessing global competence in engineers,” *Eur. J. Eng. Educ.*, vol. 31, no. 1, pp. 119–131, 2006.

[8] A. J. Dutson, R. H. Todd, S. P. Magleby, and C. D. Sorensen, “A review of literature on teaching engineering design through project-oriented capstone courses,” *J. Eng. Educ.*, vol. 86, no. 1, pp. 17–28, 1997.

[9] S. Howe and J. Wilbarger, “2005 national survey of engineering capstone design courses,” presented at the 2006 Annual Conference & Exposition, 2006, pp. 11–4.

[10] A. Bielefeldt, K. Paterson, and C. Swan, “Measuring the impacts of project based service learning,” presented at the 2009 Annual Conference & Exposition, 2009, pp. 14–873.

[11] K. Paterson and V. Fuchs, “Development for the other 80% engineering hope,” *Australas. J. Eng. Educ.*, vol. 14, no. 1, pp. 1–12, 2008.

[12] K. Litchfield, A. Javernick-Will, and A. Maul, “Technical and professional skills of engineers involved and not involved in engineering service,” *J. Eng. Educ.*, vol. 105, no. 1, pp. 70–92, 2016.

[13] A. Thompson *et al.*, “Our first collaboration with an international consulting firm on capstone design project,” presented at the Proc., Capstone Design Conf, 2022.

[14] N. Shrestha, “Work in Progress: International Capstone Design: Insights from Students, Faculty, and Clients”.

[15] J. Hanson, R. Houghtalen, J. Houghtalen, Z. Johnson, M. Lovell, and M. Van Houten, “Our first experience with international senior design projects–lessons learned,” presented at the 2006 Annual Conference & Exposition, 2006, pp. 11–976.

[16] J. Aidoo, S. Sipes, J. H. Hanson, and K. Sutterer, “Overcoming challenges associated with the joint project model,” presented at the Proc., Capstone Design Conf., Capstone Design Community, 2014.

[17] Jesse Houghtalen, Matt Lovell, Zach Johnson, and Maria Van Houten, “Final Report Mission Compound in Trinidad,” Rose Hulman Institute of Technology, Senior design report, Apr. 2006.

[18] Joel Anderson, Yaw Aning, Matt Childs, Richard Franko, and Kristin Miller, “Obodan Sustainable Development Center,” Rose Hulman Institute of Technology, Senior design report, May 2007.

[19] J. Aidoo, J. Hanson, K. Sutterer, R. Houghtalen, and S. Ahiamadi, “Our Second International Senior Design Project,” presented at the National Capstone Design Course Conference, 2007.

[20] Anne Pierce, Isaac Gehman, Paul Hintz, and Sanders Park, “Gutu Project Final Design Report,” Rose Hulman Institute of Technology, Senior design report, Apr. 2016.

[21] J. Cresswell, “Qualitative inquiry & research design: Choosing among five approaches.,” 2013.