Engagement in Practice: Exploring Student and Instructor Perspectives in a Global Service Learning Experience towards a More Reciprocal and Decolonialized Partnership

Danielle N. Wagner, Purdue University, West Lafayette

Danielle is interested in enabling transparent communication between different members of society, often with an environmental focus to increase access to natural resources. She is currently a graduate student in the Lyles School of Civil Engineering at Purdue University pursuing a PhD in Architectural Engineering with a focus in indoor air quality. She has had several opportunities to engage in education with undergraduates and community members, and has recently been honored to be able practice advising undergraduate service learning teams in EPICS after mentoring and TA'ing teams for several years. Having community-oriented discussions at Purdue, working with human-centered design in her own research, and mentoring student teams inspirited her drive to center community member and partner voices within academic discussions. She is excited to be able to learn from this Engagement in Practice conversation through discussions with partnering IIT institutions, EPICS leadership, and the students.

Dr. William "Bill" C. Oakes, Purdue University, West Lafayette

William (Bill) Oakes is a 150th Anniversary Professor, the Director of the EPICS Program and one of the founding faculty members of the School of Engineering Education at Purdue University. He has held courtesy appointments in Mechanical, Environmental and Ecological Engineering as well as Curriculum and Instruction in the College of Education. He is a registered professional engineer and on the NSPE board for Professional Engineers in Higher Education. He has been active in ASEE serving in the FPD, CIP and ERM. He is the past chair of the IN/IL section. He is a fellow of the Teaching Academy and listed in the Book of Great Teachers at Purdue University. He was the first engineering faculty member to receive the national Campus Compact Thomas Ehrlich Faculty Award for Service-Learning. He was a co-recipient of the National Academy of Engineering's Bernard Gordon Prize for Innovation in Engineering and Technology Education and the recipient of the National Society of Professional Engineers' Educational Excellence Award and the ASEE Chester Carlson Award. He is a fellow of the American Society for Engineering Education and the National Society of Professional Engineers.

Mr. Ashish, Indian Institute of Technology, Delhi, India

Ashish had been working with RuTAG IIT Delhi as a P.A. Tech. for the past five years. He has conducted extensive research on rural problems and worked on community-based projects aimed at improving the livelihoods of marginalized people. Ashish's commitment to community development has allowed him to develop strong bonds with the communities he works with, which motivates him to continue contributing to their betterment. Under the guidance of Prof. Saha, he has also mentored over 450 undergraduate and graduate students for their internships at RuTAG during 2021 and 2022, helping to foster the next generation of community-minded engineers. Ashish's work at RuTAG has given him a deep understanding of the challenges faced by rural communities, and his research aims to provide sustainable solutions that address issues such as social acceptance, women's empowerment, and economic and ergonomic improvements. His recent interactions with Purdue's EPICS teams have inspired him to explore global institutional collaborations as a means of solving complex social problems with his commitment to community development and his drive to create positive change.

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Abstract
International academic collaborations enable sharing of technological, regional, and cultural wisdom, which may benefit partners unevenly. This pilot assessment explores notions of partnerships, reciprocity, and post-colonialism in a global service-learning context in a partnership between universities in India and the U.S., with the intention of enhancing the reciprocity of the collaborations. Current projects led by students in both India and the U.S. involve designing interactive educational modules and products to enhance occupational ergonomics in rural India. Student teams are advised at their respective universities, and receive feedback on designs from community partners and university staff and faculty. These partnerships continued and were deepened during the pandemic with new dimensions being added even when remote.

Introduction: Reciprocity and Collaborations

International collaborations invoke a high degree of potential for innovation via shared resources such as regional knowledge, technology, and project strategies. Partnerships may develop between communities, academia, organizations, or with any combination of these. Reciprocity in collaborative partnerships implies mutual respect, trust, benefit-sharing, and growth [1]. Traditionally, groups that are considered to have more resources are allotted a higher degree of power, leading to non-reciprocal collaborations. Often driven by historical colonial relations, these disparities can have harmful results such as uneven stakeholder benefits, unidirectionality, and perpetuating oversimplified stereotypes, and can continue without critique due to hidden assumptions of prestige in resources despite evidence to the contrary. Partnership imbalances can yield inequities, despite good intentions. To achieve mutual benefits, it's imperative to identify and challenge any dynamics that can hinder a collaboration.

Much of the work addressing decolonization, anti-colonizing, and reciprocity focuses on community members collaborating with NGO's, academia, and other institutions. Global health organizations have also paved the way in assessing mutualism and respect by shifting to participatory programs and reevaluating collaboration dynamics [1]–[3]. Since community-based service-learning has grown in higher education, it also offers infrastructure for examining colonial elements within institutions and their collaborations to focus on community impacts [4]–[7]. These case studies and perspectives present concepts that are transferable to assessing power distributions in various local and global contexts, allowing existing partners to evaluate their relationships, and pursue strategic action to ensure mutual benefaction. Decolonizing strategies emphasize bidirectionality [8] and recognizing strengths and assets of each stakeholder [2], [3]. Common pitfalls trending toward non-reciprocity may include one-sided focus that incur uneven burdens and benefits, with unidirectional expertise, often unknowingly [6], [9].

It has been well demonstrated that service-learning creates meaningful educational experiences for students by combining community-based service with academia [10]. International service-learning offers an exciting opportunity for global collaboration, yet there is a a lack of self-analyses to assess reciprocity in ongoing partnerships despite the many recommendations for international

partnerships [7], [10]. Before establishing new projects and partnerships among stakeholders on a global service-learning team, this engagement in practice is intended to gauge the reciprocity and contributing factors to ongoing academic partnerships between Purdue University and Indian Institute of Technology (IIT) Delhi (IITD), and IIT Tirupati (IITT). The Purdue service-learning design team- referred to as "EPICS India"- collaborates on projects with teams at IITD and IITT aiming to improve access to education and livelihoods in rural India through innovation. The IITD, IITT, and Purdue teams are each comprised of undergraduates and structured differently. Student interactions stem from initial collaborations of faculty and staff leading teams in each university. This paper utilizes perspectives from students, faculty, and staff in such partnerships to discuss the partnerships.

Background: Service-Learning Teams and Partnership Structures

Purdue Team: "EPICS India"

Purdue EPICS students are enrolled in a class for at least a semester and receive 1-2 tech credits counting towards their disciplinary coursework. Class structures and program information are well-documented [10] and can include students from engineering, education, or business. Each class meets weekly in person except during a period throughout the COVID-19 pandemic, when they were moved online. The class time was established to overlap with evening hours in India to facilitate interactions despite the 9.5 to 10.5 hour time difference. Student projects aim to innovate design intended for delivery by centering a community partner's criteria throughout the design process, and are guided by a faculty instructor and teaching assistant. Students can enroll in any academic year and can continue on teams for multiple semesters providing continuity for long-term partnerships. Based on student feedback, the EPICS India team has a supportive and inclusive culture, where returning members mentor newer ones and share their experiences, creating a positive environment that benefits all students and fosters learning and growth.

IITD Partnership: Team 1

One of the EPICS India subteams is partnered with IITD through the Rural Technology Action Group, (RuTAG), a central program initiated and maintained by the Office of the Principal Scientific Advisor to the Government of India. This program was established in 2004 to bridge the gap between premier institutes like IITs in India and rural communities, as well as to provide STEM solutions to improve the livelihood of people through demand-driven technologies. They undergo a formal process for initiating projects, involving a local NGO and dedicated design staff. NGO partners help to conduct field visits, test prototypes in-situ, and gather users' feedback. The IIT Delhi RuTAG program provides an internship for engineering students using Team-based Online Projects (TOP), where students evaluate other teams' work. This develops mentorship and motivates students to continue project engagement. The EPICS India team identified a project through discussions with IITD faculty leading their RuTAG, where they could add value aligning with potential engineering expertise - by designing a more ergonomic tractor. While the student team operates solely at Purdue, IITD staff and faculty provide technical guidance and answer community questions, or revisit user criteria. Regular communication occurs online on an as-needed basis.

During the pandemic, RuTAG initiated a series of online meetings when students in India were fully remote. For one of these, RuTAG and EPICS India teams started meeting bi-semesterly for WeLD-ER ("We learn through discussion - EPICS and RuTAG"), which have continued based on

positive feedback from both institutions. Teams share project updates and exchange feedback on community-based problem-solving methods. Though students have applied others' advice, they often need encouragement to interact and ask questions, especially early in the semester.

IITT Partnership: Team 2

A group of 4-5 undergraduate engineering students from IIT Tirupati are working with a second EPICS India subteam to develop mobile science labs, or portable hands-on educational demonstrations, for rural schools in India. The IITT students are often recruited by older peers, and are committed to the project for at least 1-2 semesters. They are volunteers who are committed to the project for at least 1-2 semesters and are led by a professor who is dedicated to establishing education initiatives in rural schools in India. The IITT students and second EPICS subteam have weekly video meetings, and maintain an active WhatsApp chat. The EPICS team focuses on designing experiments, storage, and transportation logistics, while the IIT Tirupati team focuses on demonstrations and localization. The IIT Tirupati students have coordinated several pilot demonstrations in more than 5 different elementary schools, and are able to interact directly with teachers and students, as well as organize other student volunteers to implement STEM experiments. The EPICS team has been primarily focused on planning and creating infrastructure, but has found it difficult to receive enough feedback to gauge the success of experiment and material delivery designs due to the IIT Tirupati students' responsibility for translation, delivery, assessment, and communication back to the EPICS students.

Teams have a shared long-term goal to realize the necessary components of a scalable mobile science lab system that is sustainable and adaptable for each region. Rather than learning concurrently, however, there is a division of labor in piloting hands-on experiment delivery. While the EPICS team works to create experiments and conceptually design storage and transportation logistics, the IITT team focuses on demonstrations and localization. During their weekly check-ins, they can ask each other questions about their design strategies; however, meetings are less discourse-based, where knowledge is co-created; instead, questions are answered and then brainstorming happens outside of those meetings.

Areas of Improvement to Increase Reciprocity:

The question of unidirectionality arises amongst the collaborations when considering that each group of stakeholders (at Purdue, IITD, and IITT) design towards improving lives of people in rural communities in India. Inherently, this situation implies that student teams in each location get to design something that ends up being useful in India. Bidirectionality would involve an between academia and communities, where both parties play an active role in creating knowledge and considering user situations in each location. This approach would involve equal participation from NGOs and other organizations [8].

IITT Partnership

As a result of clear task division between the students at different universities, there are challenges getting the Purdue students to understand the larger context, challenges, and opportunities. The IITT students were motivated to join the mobile science team to become more well-rounded engineers and to gain field and application experience. Thus, they are gaining experience as initially desired; however, they may be more focused on implementation and not as actively

working on design. Interestingly when asked about project scaling, the IITT students appeared to actively consider it when focusing on more immediate project objectives. It is possible that IITT students interacting with teachers have informal discussions that build their higher-level awareness and understanding of project scopes. A takeaway of this snapshot is that knowledge may be bidirectional in Tirupati between students, volunteers, and teachers, but there may need to be developments to better incorporate the Purdue students into system of more collaborative learning.

IITD Partnership

Similarly to IITT, the IITD RuTAG students and staff have more direct interactions in the local design application. Though they do not yet need to perform translation work, they may eventually need to localize the design and user instructions. Having RuTAG faculty and staff advise the Purdue team helps to ensure that knowledge is exchanged between the institutions, rather than transferred one way. However, the only real-time discussions happen during WeLD-ER.

Major areas of Reciprocity:

Despite challenges including time zones and uncertainty during the COVID-19 pandemic, communication between each of the student teams has continued with fortitude, enabling progress even when schools went fully online. A likely contributing factor to this is based on the equal utilization of existing infrastructure. First, teams already had established systems of regular meetings, and were able to incorporate their new partner meetings into those systems. Furthermore, when the pandemic shifted everyone online, these teams already had strong structures of online communication and were able to continue in a similar way without needing much adaptation.

In addition to the excitement of international partnerships, students from each of the teams are also highly motivated to participate in human-centered design that is meant to improve livelihoods for people in rural India. The students are also aware of the benefits of having a real project as part of their undergraduate experience, including cost-constraints, the need to consider adaptability, and iteratively tailoring components to users. The students are also able to work on multi-disciplinary teams and are in charge of their own progress and design iterations, with faculty and staff guidance. Students have access to faculty expertise within and across universities for making project progress, as well as engineering and design software. Each group of students also noted that a major advantage of their participation is due to having returning students as peer mentors.

Faculty and staff are important elements of collaboration infrastructure, with a high factor of influence in not only the students' outcomes and guidance, but also to the partnerships. By having a shared dedication to community work, they contribute by guiding students to maintain high standards, helping to ensure continuity with ethical and functional designs. The faculty are also committed to understanding each other's long-term institutional goals. Rather than seeing them as external objectives, the willingness to support looks like integrating those visions into their own systems and goals, with joint initiatives. Each of the IIT professors understands the excitement for EPICS students to work on international projects and enable these experiences by incorporating them into their design challenges. The Purdue faculty is dedicated to working with other universities to support their goals and implement an infrastructure similar to that of EPICS.

Actionable changes for leveraging strengths - Between partnerships:

Partial incentives for students on each partnership were to engage internationally. Overall, a central focus would be to create more opportunities for bidirectional international engagement for both teams. Currently the EPICS students get both the experience to interact with international peers, and learn about community members in India by centering them in design missions. Creating a new integrated design team that has a community partner local to the U.S. to center a need would acknowledge the fact that there are communities in need in the U.S., as well as allow students in India to further engage in an international opportunity. Furthermore, local engagement would likely benefit Purdue students, by having a more direct community interaction and being able to practice logistical implementation This local development would also aid in creating an awareness of the tasks accomplished by institutions local to the communities in India, including coordination, outreach, implementation, and gathering feedback to gauge success. In these partnerships until now, there has only been travel to each university by faculty and staff. In the event that the institutions plan to carry out study abroad opportunities, having community partners in each location also allows for justification for travel for students in both the U.S. and India.

Actionable changes for leveraging strengths - within or between teams, or in curricula:

In addition to questioning short-term interactions and dynamics, and with the intent of challenging unjust systems toward "critical service learning," [11] it may be helpful to establish social justice and global relationship-based reflections [6], [7] toward systemic change. It is well established that students cultivate empathy through partner interaction in service-learning projects, which is assessed by regular reflections [12]. Currently, students on the U.S. team are asked to reflect on academic, professional, social, and ethical project-based components and have the option of using suggested prompts. Extra guidance would help to enhance students to cultivate ideas about potential long-term effects of project engagement for all parties involved, outside of the traditional "helping a community" rhetoric that motivates many incoming students. To this effect, it may be beneficial to have at least 1 prompt to provoke reflection about partner dynamics, incentives, skills and a later follow up to assess any changes that have occurred throughout the semester. Prompts may even be as simple as considering who tends to be prioritized when meeting times are chosen, and thinking about how such dynamics could be reversed to yield priority to the partners [3], [13]. Facilitated real-time discussions may also occur with or between teams.

Conclusions: Key takeaways of reciprocity and international partnership sustainability

This work is the first assessment of many in critiquing disparities and celebrating accomplishments in a global academic partnership in a service-learning context. Frameworks of reciprocity derived from global health and international service-learning studies inspired questions in looking at perspectives from student teams in India and the U.S. We aim to use discussions from this work in the near future to inform team developments such that knowledge is co-created amongst partnerships, with a hope that other institutions with similar partnerships will question their interaction styles. We have highlighted several ways students may be affected by the partnerships, especially by their participation incentives, varying outcomes, and beliefs about where community help is needed. Examples of partnership resilience have been identified. A major understanding that arose is that mutual support for a partnering institution's long-term capacity building missions is likely a key factor in reciprocity. This commitment to support likely contributes relationship

resilience and sustainability, helping to overcome challenges such as those recently experienced during COVID-19. In supporting long-term goals, it also reinforces short-term project objectives and student outcomes, and partners may also be more communicative and seek to establish clarity.

Though this paper includes co-authors from IITD and Purdue, limitations are inherent due to examining one's own team structure. It is also difficult to critically examine other institutes, and may benefit from an outside author. We do not include a discussion of anti-colonialization with respect to the partnering communities but acknowledge that it is imperative to the larger discussion of decolonialization. Though anti-colonial objectives will enable a higher degree of reciprocity and mutuality, ongoing work is needed to continue deconstructing deeply-rooted systems.

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