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Vertically Integrated Engineering Service-Learning: Program Design

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Vertically Integrated Humanitarian Engineering Program Design

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Abstract

The Villanova Engineering Service-Learning program was established in 2011 and transitioned into the Center for Humanitarian Engineering and International Development, in 2020. At the present time, the Center (C4HE) has 16 partners in 12 countries globally, and the program has pivoted from providing field immersion experiences to providing remote technical assistance that includes students, faculty and professional mentors volunteering expertise to assist with humanitarian projects in developing communities. This paper provides an overview of the program design with an emphasis on the vertical integration of projects across undergraduate and graduate engineering programs. Details on the curricular aspects of the program as well as a participatory framework that includes depth and breadth of opportunity is provided. The motivation for this paper is to demonstrate best-practices in engineering service-learning with the objective of highlighting the role of academic institutions when engaging with humanitarian organizations internationally.

The design and execution of the humanitarian engineering program at Villanova is presented with an emphasis on lessons learned during the provision of technical support to international non-government organizations. A qualitative review of success and failure is discussed based on program partner feedback, discussions with faculty, students, and communities. Conclusions from this paper raise some important ethical questions about the role of academic institutions when engaging with community partners. In addition, program design that employs the ethical engagement framework is described wherein, the importance of contextual awareness and humility is highlighted. Next steps associated with this paper include the need to formally establish research-services with partner organizations, develop participatory methodologies, and further integrate undergraduate and graduate student projects into program activities.

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1. Humanitarian Engineering and International Development

1.1 Introduction

The Center for Humanitarian Engineering and International Development at Villanova University was established in 2020 for the purposes of integrating research and curriculum with existing outreach (Weinstein, 2020). Formally established in 2011, the engineering service-learning program provides opportunities for students and faculty to engage with humanitarian organizations around the world. With sixteen partners in twelve countries throughout Asia, Africa and the Americas, students and faculty have been providing engineering services in three key areas of international development: technical support for community development, capacity building, and the engineering design of humanitarian technologies. The transition of the service-learning program into a college center, creates new opportunities to provide research services to partners and coursework related to sustainable development. The integration of research and curriculum includes a graduate level concentration in International Development as a part of an MS in Sustainable Engineering program, and an undergraduate minor in Humanitarian Engineering.

1.2 Program Development

Whereas, the center was only recently established, the engineering program at Villanova University has a long history of outreach with non-profit humanitarian organizations internationally. The first engineering service-learning project started in 1991, when a small group of engineering students and faculty traveled to work with a Franciscan Priest, at the Chepo-Bayano Mission in Panama (O'Brien, 2010). This work included the design and construction of community water supply systems and is an excellent representation of employing a partnership-approach to service-learning. In 1997, this work was expanded to include the structural design of an orphanage in Honduras which employed a curricular approach via a Senior Design Capstone course (Dinehart, 2010). In 2004 this curricular-based service-learning model was further expanded to include a program partner in Nicaragua where the creativity of engineering students was captured through humanitarian design challenges related to water treatment technologies. The approach to integrating service learning and innovation was further expanded in 2010 through grant funding which was awarded by the National Collegiate Inventors and Innovators Alliance (Ermilio and Singh, 2010). In 2011 the Villanova Engineering Service-Learning program was formally established with the creation of a Director of Service-Learning position within the college (Jones and Gabriele, 2011) where curricular and non-curricular activities were further expanded to include partner organizations in Asia and Africa. At that time, the need for depth and breadth of opportunity was identified and curricular integration was explored through the creation of a 1-credit engineering service-learning seminar course (Weinstein, 2012).

Since 2011, engineering students and faculty have worked on 54 projects with 22 partners in 18 countries. These projects have included: STEM outreach to schools, training and capacity building workshops with local professionals, student design projects on humanitarian technology such as low-cost technologies for mine-action, community water supply infrastructure, the design and constructions of schools, renewable energy systems, transportation projects, and applications of information communication technologies to support sustainable development. In 2012, the engineering service-learning program began exploring research opportunities related to the sustainable development of water supply infrastructure in developing communities. In collaboration with program partners, research projects were defined and a fellowship for international development was created to recruit qualified graduate students with an interest in sustainable development (Ortega, 2014).

In 2016, a strategic collaboration between the engineering service-learning program and the graduate program in sustainable engineering included the creation of graduate student team leader positions and an International Development concentration within the MS in Sustainable Engineering program. A scholarship program was created to provide opportunities for qualified professionals with prior experience working on humanitarian project in developing communities to attend graduate school (Lorenz, 2016). With the influx of graduate students who had prior experience working on community development projects internationally, the engineering service-learning program expanded in both breadth and depth (Hunt and Ermilio, 2017). This has included the establishment of new partnerships and the expansion of research projects which are vertically and horizontally integrated between undergraduate and graduate programs, across several disciplines in engineering. Through the creation of the Center for Humanitarian Engineering and International Development, synthesis between curricular, research and outreach include an undergraduate minor in Humanitarian Engineering (Welker, 2020, Weinstein, 2020), formal research opportunities within the Master's in Sustainable Engineering program, and continued outreach through the engineering service-learning program.

2. Program Design: Depth and Breadth

Humanitarian Engineering projects at Villanova University are horizontally and vertically integrated within the College of Engineering. Students and faculty who get involved with the program include representation from across all departments within the college throughout undergraduate and graduate programs. One of the implicit objectives of the C4HE is to provide both breadth and depth of opportunity

for students and faculty, Figure 1. Opportunities to participate in projects include live-case projects that are embedded into existing courses, one-credit engineering service-learning seminar courses, senior design, and independent study options at the undergraduate level. Students who want to further engage with program partners can elect to pursue a minor in Humanitarian Engineering and can deepen their immersion experience through a summer service-learning internship program. Beyond graduation, students can volunteer with program partners via the year-of-service program which also provides them with the qualifications to apply for the graduate fellowship for international development program where they can pursue a master's degree in Sustainable Engineering.

Whereas students can participate at any level throughout their undergraduate and graduate experiences, the program is designed to be sequential in that students who are initially exposed to an embedded humanitarian engineering project, continue participating at other levels. The embedded projects are designed to replace other problem-based learning assignments within existing classes with the addition of a humanitarian component, a live partner, and a more open-ended problem that asks students to think holistically.

The engineering service-learning seminar includes a series of one-credit courses that prepare students for field immersion with a program partner. The seminar series is managed by a faculty member using a design-lab format where project teams meet for two hours weekly in a general assembly, and then break out into individual project teams. The general assembly session provides the structure for academic elements of the course with weekly assignments and lecture topics that include subjects related to working with humanitarian organizations in a developing community. Subjects within the general assembly include the role of external support, sustainable development, practical skills related to fieldwork, project planning, data management, reporting and project presentations. The general assembly session is also used to address administrative aspects of travel related to logistics and risk management, as well as professionalism as it relates to working in other countries such as social awareness, culture, history, gender dynamics, relationship building and communications. The breakout meetings are managed by graduate student team leaders who facilitate discussions and plan project activities with the team. Facilitated discussions include furthering the general lecture topic by adding context within the individual project areas. Finally, the breakout meeting provides students with a structured opportunity to plan project related activities, communicate with program partners, provide engineering design services, and complete project deliverables in a professional setting.

The minor in Humanitarian Engineering provides students with depth wherein learning outcomes include applied fundamentals in engineering within a humanitarian context, as well as non-engineering topics related to poverty alleviation, sustainable development, globalization, and culture. The minor requires a minimum of 18-credits with a required course in Applied Humanitarian Engineering and completion of the entire VESL Seminar series of courses. Two elective courses in engineering and two elective courses in non-engineering are also needed to complete the minor which provide options for students to explore various aspects of humanitarian issues globally.

Volunteer opportunities for full immersion in the field provide for a holistic and context specific understanding of global development challenges in low-income developing communities. The summer service internship is a 10-week program that entails a 1-week orientation, an 8-week field assignment, and a 1-week debriefing at the end of the internship. Full immersion into the projects includes a direct assignment, normally in pairs, with a program partner who has daily operational oversight of the interns. Faculty mentors provide guidance during the internship experience on a weekly or bi-weekly basis and in most cases, a site visit from a faculty mentor is planned during the 8-week field assignment.

The year of service program provides for even more depth where students who graduate can volunteer with a program partner for 12 months. The details of individual assignment are specific to each participant/partner however, common elements include an official volunteer position with the program partners, being a liaison for student projects, helping to coordinate field visits, and providing technical support on sustainable development projects. The year of service program strategically aligns with the graduate fellowship program which requires a minimum of one year of field experience prior to qualifying for the team leader position.

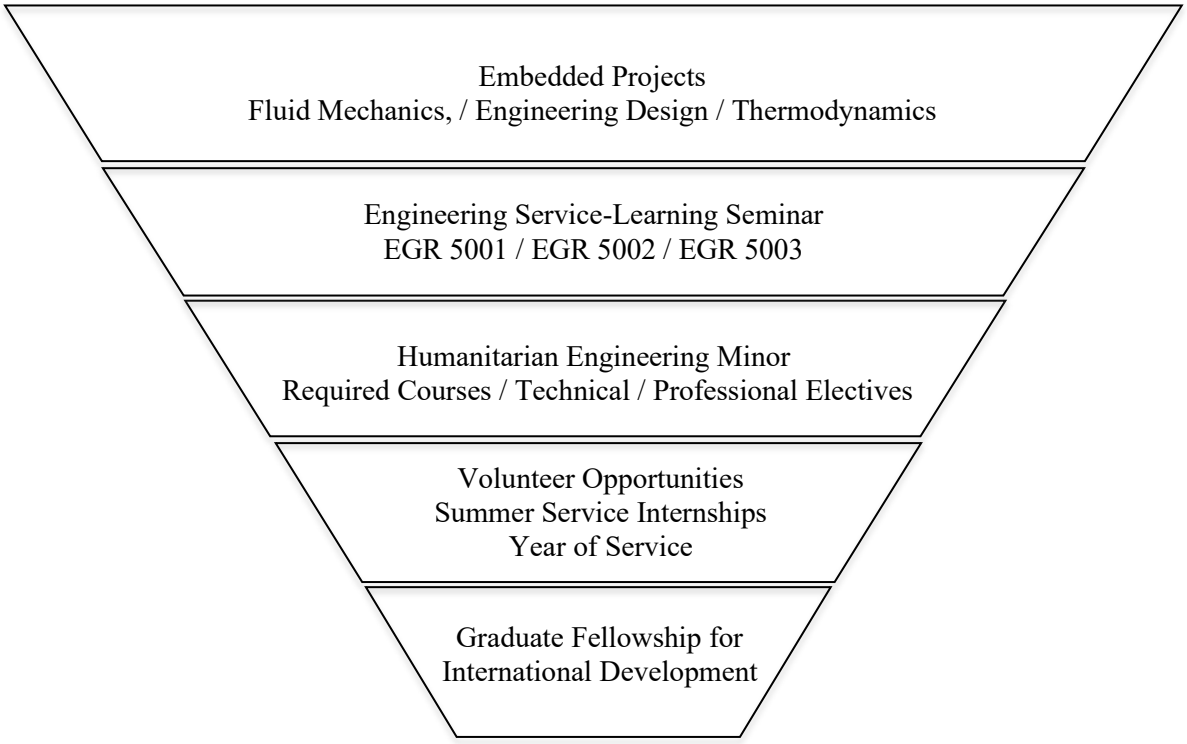

Figure 1: Breadth and Depth of Opportunity

3. Vertical Integration

3.1 Graduate Fellowships for International Development

The graduate fellowship for international development was initially piloted in 2012 after the associate dean for graduate studies traveled with a faculty delegation to Nicaragua for project planning purposes. The program was renewed annually with financial support from college leadership. At that time, the newly established graduate program in Sustainable Engineering was exploring research projects for its growing graduate student population. Based on the success of the initial pilot program, and after several months of planning, a concentration within the Sustainable Engineering program was created in International Development. The concentration was designed to provide a curricular foundation in development practice, for graduate students with an interest in research and leadership in sustainable development globally.

The international development concentration was formally launched in the Fall semester of 2016 with the inclusion of five graduate fellows and the creation of graduate courses to support learning objectives related to engineering and the sustainable delivery of services to achieve human development objectives globally (Table 1). The integration of these programs provides graduate students with practical skills in engineering and development practice through curriculum and field assignments, and leadership skills through experiential learning opportunities that entail managing country-level project and partnerships. Research opportunities are also provided where graduate students can coordinate with program partners to define a research problem, explore participatory methodologies, and implement research studies aimed at improving the efficacy of development initiatives with a focus on the sustainable management of technology and infrastructure in developing communities.

The incorporation of qualified graduate fellows as team leaders within the engineering service-learning program has increased the center's ability to manage growth and explore new opportunities (Hunt and

Ermilio, 2017). As the program has grown, program quality has improved in several areas, as measured by both student and partner feedback. Feedback from student participants suggests that incorporating experienced graduate student leaders has improved program quality in every area except for perceived project impact. Feedback from project partners also revealed improvements in key program areas, technical assistance, and project deliverables. However, despite apparent improvements, stakeholder feedback also identified room for further improvement in some key program areas including the quality and timeliness of project deliverables, travel logistics, and the orientation process. Hence, experienced graduate fellows appear to have a valuable role to play in facilitating service-learning experiences for undergraduate engineering students but, maintaining program quality in the context of growth seems to require more than increasing bandwidth through these leaders (Hunt and Ermilio, 2017). A key upcoming challenge with the leadership model described here will be continuity, as graduate students complete their degrees, necessitating continual recruitment and an annual transition of leadership.

3.2 Graduate Program in Sustainable Engineering

The Graduate program in Sustainable Engineering (MSSE) was established in 2011 in parallel with the Engineering Service-Learning program. The MSSE program offers several tracks to establish a fundamental understanding of sustainability challenges through the lens of engineering. Systems thinking is a core competency for students coming out of the MS program, and is embedded into the program's curriculum via the STEEP framework (Schmidt, et. al., 2015, Arup, 2006). The conceptual framework prompts the engineer to consider the social, technological, economic, environmental, and political dimensions of sustainability problems. STEEP is integrated throughout the program's core curriculum and provides an overarching framework for Sustainable Engineering research.

The 30-credit MSSE degree requires 3 core courses (9 credits) to build a *whole systems* foundation, 2-4 elective core courses (6-12 credits) to provide further breadth in Sustainable Engineering, and 3-5 courses (9-15 credits) selected from one of 5 tracks to provide depth in a discipline-specific area, and either a 3-credit capstone or 6-credit thesis research project. The International Development (ID) Concentration option entails 3 courses along with a research requirement. All 3 ID courses may count toward the elective core requirement, and specific ID courses also may count toward selected discipline-specific tracks (for example, a course in Sustainable WASH counts toward the water resources track). Under this framework, students can develop competencies in sustainability, international development, and a technical area of interest.

Table 1: MSSE and Sustainable International Development Track Curriculum

Core Courses (9 credits)	**Discipline-Specific Tracks (9-15 credits from 1 selected track)**	**Sustainable International Development Concentration Courses**
Sustainable Engineering Fundamentals Lifecycle Assessment & the Circular Economy Social and Economic Integrators	Alternate and Renewable Energy Sustainable Infrastructure & the Built Environment Sustainable Materials Sustainable Systems Water Resources Sustainability	Intro to Sustainable Engineering for International Development Sustainable WASH & Environmental Engineering for Development Information, Communications, and Energy Technologies for Development

3.3 Research as a Service to Partner Organizations

Starting in 2012 a pilot project began, to vertically integrate graduate students into the engineering service-learning program through the provision of research-services to international development organizations. The Sustainable WASH (Water, Sanitation and Hygiene) research initiative was the first

mechanism for faculty and graduate students in engineering to investigate sustainability factors related to water infrastructure in Nicaragua. This study continued with further studies to explore technical performance characteristics of water infrastructure and expanded to include program partners in Panama and Madagascar. It was then expanded to include studies related to remote monitoring of water system performance with the goal of providing local operators with tools to better manage the provision of water services. At the present time, this research initiative is aligned with development goals related to water with a focus on developing monitoring and evaluation tools for the sustainable management of water services.

Since that time, several research collaborations have been initiated with research opportunities in the field of humanitarian engineering and international development being both distinct and significant. Current research initiatives that involve international partners fall into three categories. The first research area includes establishing metrics for evaluating the sustainability of water and sanitation infrastructure in developing communities, a key program area for several program partners. The second entails the research and development of humanitarian technologies to support international development which often cuts across program areas and includes information communication technologies as well as technologies to address special case development challenges. The third research area is currently emerging within the college and involves developing renewable energy resources in the form of photovoltaics and biofuels.

Whereas several research projects have been piloted since 2012, the establishment of the Center for Humanitarian Engineering and International Development, ensures that research efforts are rooted in ethical engagement including the appropriate coordination with international agencies and university compliance. In addition, the Center provides new opportunities for multi-disciplinary collaborations where research findings can be communicated more effectively. Finally, the Center provides faculty with the needed support to successfully engage with international partners, funding agencies, and field teams using participatory research tools which are intended to foster collaborative learning.

3.4 Undergraduate Minor in Humanitarian Engineering

In 2020, the Provost's Office approved a new Undergraduate Minor in Humanitarian Engineering (Welker, 2020, Weistein, 2020). The approval of this proposal officially integrated existing engineering service-learning (VESL) initiatives into a program in humanitarian engineering which includes coursework and academic credit. The Minor in Humanitarian Engineering leverages existing partnerships and provides academic structure for multidisciplinary projects. This minor includes an 18-credit sequence that provides the structured learning environment needed for collaborative learning and the provision of technical support to humanitarian organizations globally. An introductory course (Applied Humanitarian Engineering) establishes the framework for the program with the objective of introducing students to the complex nature of sustainable development in low-income communities. In addition, this course provides students with the technical skills in engineering design, needed for successfully working with program partners internationally.

The minor fosters both academic fundamentals and applied experiential learning. Academic fundamentals are provided through a series of classes that include two required courses in engineering and two non-engineering courses offered as electives. Applied fundamentals are provided through experiential learning via a series of one-credit service-learning seminar courses (VESL Seminar) which includes engaging with program partners internationally. A final capstone project synthesizes applied fundamentals in the design and implementation of a project via existing capstone courses in engineering or another 1-credit VESL seminar. The capstone project provides further immersion into humanitarian engineering via an open-ended, problem-based learning experience.

3.5 Center for Humanitarian Engineering and International Development

Also, in 2020, the Provost's Office approved a new Center for Humanitarian Engineering and International Development (C4HE) for the purposes of furthering research and curricular initiatives related to humanitarian engineering and outreach (Welker, 2020, Weistein, 2020). The approval of this proposal officially transitioned the existing engineering service-learning program (VESL) into a Center and formally establishes the program with the university. The Center provides an integrated framework across multiple disciplines in engineering including graduate and undergraduate programs. The Center is the home for research projects related to sustainable development, and existing service-learning initiatives that include graduate team leaders, undergraduate students, and partner projects. The Center also allows partners to leverage their community development programs with funding agencies and provides opportunities for sponsorship within the university wherein alumni, private companies, and foundation provide resources to support the strategic framework (Figure 2).

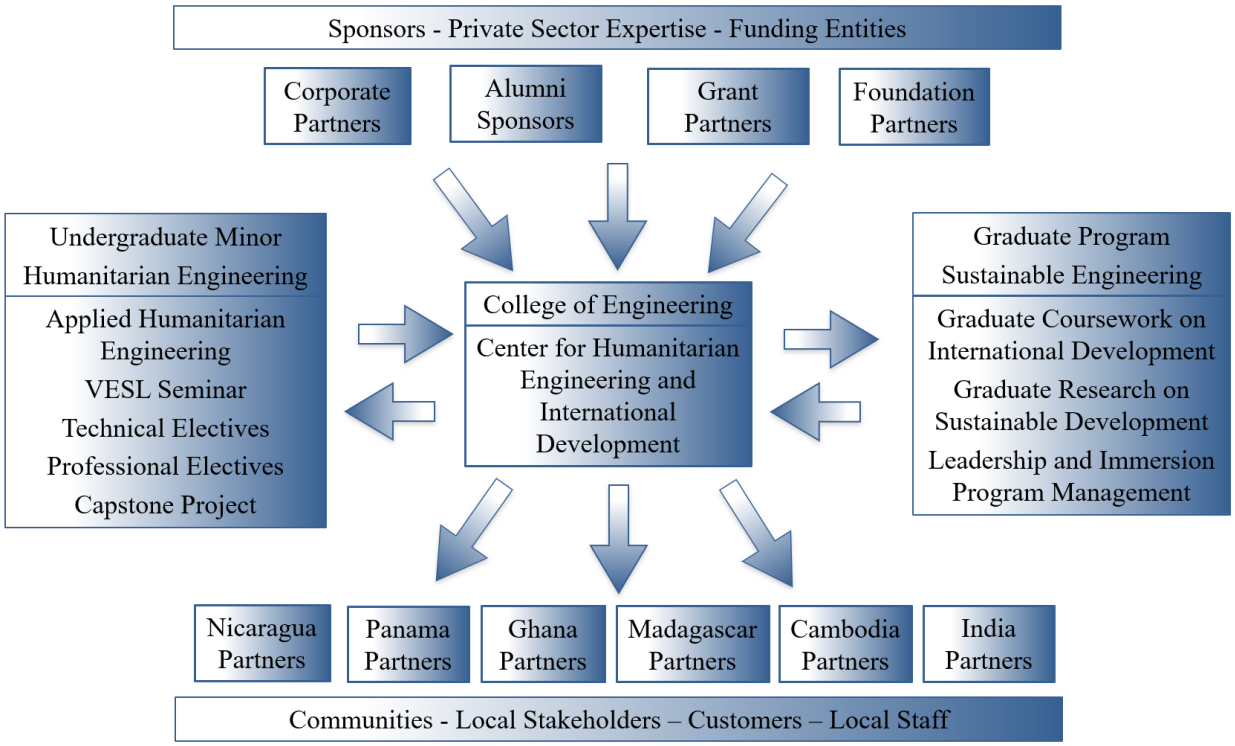

Figure 2: Integrated Strategic Framework

4. Ethical Engagement Framework

To ensure the sustainability of development initiatives as well as protect the health and safety of community stakeholders, this paper proposes that three core principles are needed for university engagement on global development challenges aimed at poverty alleviation. These principles are fundamental to success of university programs and are described here as the ethical engagement framework. Table 2 provides insights into best practices associated with these principles which include a partnership approach, empowering local stakeholders, and humility.

An essential aspect of providing engineering services in low-income developing communities is working with partner organizations that have the capacity to implement projects. In addition, recruiting graduate student team leaders with prior experience working in developing communities is critical when

considering the engineering ethical canons of "hold paramount the safety, health, and welfare of the public" as well as, "performing services only in areas of one's competence". Taking this partnership approach avoids potential complications related to the implementation of community development projects. Whereas, understanding local issues, participatory practices and project management are often learning objectives associated with service-learning programs, it is important to recognize the difference between learning objectives in an academic setting and project objectives within development program. As a result, the decoupling of learning objectives which exist within an academic timeframe, and development objectives which entail a project management timeframe, is an important element of ethical engagement. With project implementation being explicitly defined within the roles and responsibilities of program partners and communities, students and faculty focus their attention on the provision of technical support services. In this sense, partners and communities are transformed from beneficiaries to clients and customers, where engineering designs and technical support services are adapted to the local context prior to implementation. In some cases, where local partner organizations do not have the capacity to implement projects, the focus should change from providing technical support to increasing local capacity.

Local capacity building thus becomes another type of service that can be provided wherein students, faculty, partners, and community stakeholders come together in a community of learning. Thus, empowering local stakeholders and respect for local knowledge becomes another core principle of ethical engagement. Supplemental to this is the core principle of humility. In this regard, it is important to recognize that developing solutions to global challenges related to poverty alleviation, requires an in depth understanding of the problem. As a result, any external stakeholder, even local partners that operate outside of the project area, are foreign to problems being addressed within a particular community. Two corollaries become apparent once you embrace humility as an essential characteristic of working on humanitarian projects. The first brings up the question of the role of universities and students in addressing global challenges who ultimately have limited experience as community development practitioners. The second is the importance of establishing partnerships with organizations who emphasize empowerment via community-driven development.

Figure 3 further supports the ethical engagement framework by delineating roles and responsibilities from the point of view of a university program. Three primary stakeholders are identified along with areas of expertise which can be fostered to support various stakeholder interests. Whereas, partners are primarily interested in community development, they are also interested in leveraging expertise of university faculty and the creative ingenuity of young professionals (students) who can provide a new perspective on development challenges. The communities themselves are shown here as being centric to the partnership but are not identified as direct stakeholders within the university program. This is primarily as result of the importance of establishing partnerships with organizations who have the capacity to implement projects.

When all program stakeholders appreciate the various roles and expertise, the program partner is lead agency in terms of implementing community development projects and students and faculty provide a technical support creating a catalytic effect in support of sustainable development. As a result, the partnership model of the program partner would include community stakeholders. In this way, the ethical engagement framework should avoid positioning students and faculty in the role of acting as community development practitioners. Ultimately, the partnership approach creates opportunities for faculty to leverage their expertise in research and teaching, and for students to embrace experiential learning while providing insights on applications of innovation and creativity to address complex problems.

Table 2: Ethical Engagement Framework for Universities to Support Global Poverty Alleviation in Developing Communities.

Ethical Engagement Principle	Best Practices and Key Indicators
Partnerships Approach University initiatives should prioritize programs and partnerships over projects.	Best Practice: Partner with organizations that have the capacity to implement projects. Key Indicator: Projects will proceed with or without the involvement of university group. Partner has community development staff, administrative and logistical support, and resources to implement projects. Best Practice: Work with organizations that value the learning objectives associated with university engagement. Key Indicator: Partner has an interest in educating students and communities in development challenges related to poverty alleviation.
Community Empowerment University initiatives should establish a community of learning where all program stakeholders collaborate equally.	Best Practice: Support and advocate for community-driven development including participatory development methodologies. Key Indicator: Resources exist to support workshops for participatory planning with communities. Communities are in the critical path of decision-making process for project implementation. Best Practice: Integrate learning outcomes and capacity building into outreach initiatives. Key Indicator: Lectures, trainings and presentations are often included in fieldwork related to community development.
Humility University initiatives should respect the expertise of local partners and communities in all phases of a project.	Best Practice: Discuss roles and responsibilities continuously during program planning. Key Indicator: Partner meetings are planned during field work. Partners accept the responsibility to lead community development projects. Faculty embrace the opportunity to engage in research projects related to sustainable development. Students are provided opportunities to introduce creativity and innovation in the process. Best Practice: Educate students on the need to respect local knowledge and participatory methods related to community development. Key Indicator: Program participants (faculty, students, and others) understand the role of external support where the provision of engineering design services is intended to support partners in a community-driven development process.

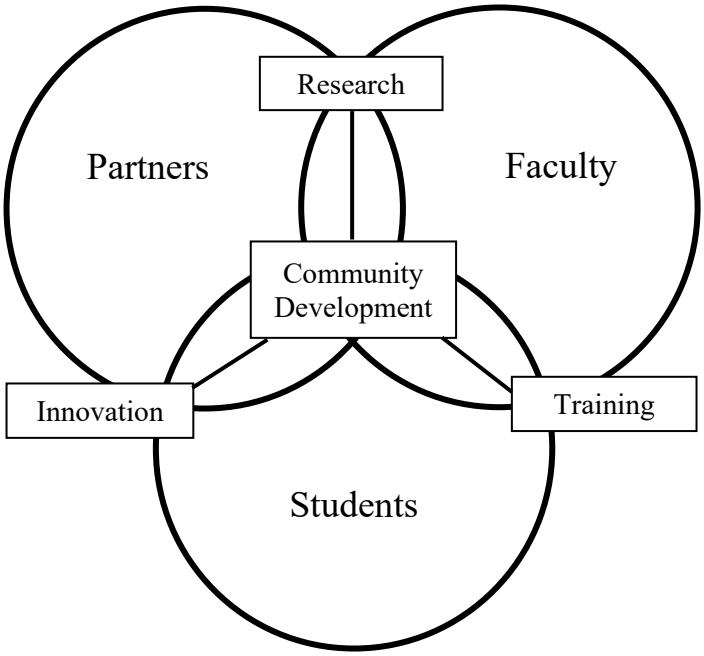

Figure 3: Program Partnership Approach

Local Solutions to Local Problems
Center for Humanitarian Engineering and International Development projects are rooted in ethical engagement with project partners and communities. Fundamental to this is the belief that empowering local communities is essential to creating sustainable solutions.

Ethical engagement with partners and communities is fundamental to the success of humanitarian engineering programs in academic institutions. Working with organizations that have the capacity to implement projects should be a guiding principle in any university outreach initiative and is the foundation of ethical engagement. Humanitarian Engineering programs must be rooted in an understanding that partners and communities are better positioned to solve local issues and that, they are experts in their own development. In addition, educational initiatives must emphasize the importance of humility as an essential characteristic in international development. This is not only critical because of the importance of relationship building, but also because of sustainability issues related to community ownership of development projects. University-based programs that include humanitarian engineering should task students and faculty with the provision of technical support to partner organizations with the partner organization taking the lead on community development and project implementation.

5. Program Partners

This approach has provided for opportunities to continually expand program partnerships wherein, the growth of many university humanitarian outreach initiatives is limited by faculty member's ability to volunteer their time. Through the integration of curriculum, research and outreach, students, faculty, and partners share in a community of learning that fosters a culture of service within stakeholder programs. Since 2010, new program partnerships have increase at a rate of one official partnership per year. With a steady demand of student participation, and with a cohort of qualified graduate student team leaders, this has resulted in project teams being smaller and adaptable with respect to field operations. One of the primary

limitations in terms of student participation has been the logical constraints related to in-country travel. In addition, wherein partner organizations have limited staff, time and resources, smaller field teams are more appropriate which also provides students with a more engaging immersion experience.

Table 3: Program Partners and Humanitarian Engineering Projects

Where, Who, When	Partner's Mission	HE Projects	Highlights and Status
Panama Chepo Bayano Mission, Since 1991	Development of local infrastructure: roads, bridges, water supply and schools.	- Water Resources Master Plan - Community Infrastructure - System Design	- This project is lead by Father Wally Kosuboski who is a Franciscan Priest from Wisconsin. Status: Remote Support
Nicaragua El Porvenir, formally Water for Waslala (WfW), Since 2004	Partner with rural communities to develop and implement lasting projects and educational programs that increase access to clean water.	- Technical support for water supply projects - Water technology - Sustainable WaSH	- WfW was founded by Villanova alumni. - This partnership has continued throughout several organizational transitions. Status: Remote Support
Cambodia Cambodia Rural Education Support Organization (formally Caramanico Foundation), Since 2010	Improve the quality of educational programs and develop a model for sustainable schools in rural communities.	- ICT Solutions for STEM Education	- Recent prototypes of ICT solutions have been tested and a pilot project to deploy devices to local schools is being planned. Status: Remote Support
Golden West Humanitarian Foundation (GWHF), Since 2010	Research and Development of low-cost un-exploded (UXO) ordnance technology	- Explosive Ordnance Disposal Robot - UXO Remediation	- The GWHF is known in the sector as being experts in the field. Status: Remote Support
Ghana Lifetime Wells (LTW), Since 2012	Sustainably improve quality of life, engaging and empowering local stakeholders, implement reliable water systems.	- Sustainable Handpumps.	- LTW is a local organization in the Villanova area. Status: Remote Support
India Profugo, Since 2013 Himalayan Hope, Since 2014	Improving quality of life and cultivating community expertise Improving education in rural communities in Northern India.	- Bio-gas digester - Water Quality Testing and Analysis - STEM Outreach - Program Development	- Profugo is a local organization in the Villanova Area. Status: Temporary Hold
Madagascar Catholic Relief Services Since 2014	Assist poor and vulnerable populations, fight poverty and nurture peace	- WaSH Training - System Monitoring - Sustainable WaSH	- Villanova is a partner school with CRS. Status: Remote Support
Tanzania Catholic Relief Services Since 2016	Assist poor and vulnerable populations,	WASH in Schools	- Villanova Partnership Status: Temp. Hold

	fight poverty and nurture peace		
Indonesia IPB University, Bogor Since 2017	University Partnership	Sustainable Agriculture	- Summer Program including courses. Status: Remote (2020)
Ecuador ESPOL University Since 2018	University Partnership	Residential Photovoltaic System	- University Partnership Status: Temp. Hold
Mexico Global Response Management, Since 2019	Emergency Response Medical Support	Asylum Camp Design STEM Outreach	Year of Service Volunteer Assignment EGR 2001 course Status: Remote Support
Peru WindAid, Since 2019	Increasing access to renewable energy	Wind Turbine Design	Status: Temp. Hold
Laos Catholic Relief Services Since 2021	Assist poor and vulnerable populations, fight poverty and nurture peace	WASH in Schools Pumping System Design	New Partnership
Previous Partnerships Haiti, CRS (2010) Philippines, SITMO (2006) Nicaragua, ADIS (2011) Thailand, EWB (2008) Panama, EWB (2010)	 Poverty Alleviation Cultural Heritage Community Health Development Development	 Capacity Building Innovation ICT4D Water System Design Solar Photovoltaic Design	 Post-Earthquake NCIIA Grant Telemedicine Grant Partner Limitations Partner Limitations

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