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Military Engineers: Unlikely Social Justice Warriors – Military Training That Supports Community Needs

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Abstract

The purpose of this paper is to highlight how military engineering activities in communities map to the frameworks of humanitarian and peace engineering that are increasingly being used in higher education. Building partner capacity is a primary consideration during military training in communities outside of the military installation. Every engagement is described as a capacity-building opportunity contributing to security and stability in the country, starting at the community level. The Department of Defense Security Cooperation Humanitarian Assistance program reviews country requests for a partnership to build needed infrastructure. Military construction units from all services then apply for the training opportunity to build roads, schools, clinics, emergency operations centers, or other facilities in partnership with their military engineers. These humanitarian assistance civic action projects are opportunities for Combatant Commanders to collaborate with Partner Nation government leaders to reduce human suffering, disease, hunger, and other issues related to poverty while training Department of Defense service members as well.

The unique opportunity for soldiers, sailors, and airmen to work in remote communities, side by side with foreign military engineers, learning new techniques hands-on, and using different materials is ideal for training in leadership, problem-solving, and honing construction trade skills. These exercises mirror real-world experiences in complex environments. These experiences make military engineers at all ranks valuable candidates for humanitarian, peace, or development focused engineering programs.

Introduction

Combat is not the only form of military engagement. In 2022, the Congressional Research Service reported 471 deployments since 1798 with 11 formal declarations of war [1]. These facts confirm that 98% of U.S military engagements are for operations other than war. The 460 other engagements involved engaging military partners and allies through military training, peacekeeping, humanitarian assistance, and disaster management or response. These experiences give military engineers insight to the challenges that global communities face and that are addressed through some type of construction project in a community. Some example projects include water wells, power generation, water systems, emergency operations centers, shelters, health clinics, schools, and bridges. These projects immerse military engineers in foreign local communities, working with local military service members, and community leaders to realize a much-needed project.

Authorization for Defense Security Cooperation Agency (DSCA) programs which include Exercise Related Construction (ERC) projects were formally authorized in the late 1980s and updated in the early 1990s [2]. These DoD security cooperation programs complement U.S. Department of State (DoS) and U.S. Agency for International Development (USAID)

objectives for building institutional capacity, improving health, access to education, economic security, and overall social stability.

Southern Command, the Department of Defense's Combatant Command responsible for relationships with military leaders across the Caribbean, Central and South America invests annually in various programs that require military engineers to design, plan, and build projects that were requested by partner nations and approved by the commanding general. These programs are critical to engineer officer and enlisted professional development. Engineer unit commanders request these missions due to the realistic experiential training value and the project's alignment with deployment readiness skills. These State Department and Combatant Commander approved training projects provide engineer leaders and service members an opportunity to hone their project planning, contracting, and project management skills while service members improve their construction trade skills. The military engineering training experienced in these global community partnerships offer experiential learning that is service focused and mutually beneficial while providing a vehicle for diplomacy. Any projects supporting infrastructure needs, disaster response, or institutional capacity building were considered for security cooperation engagements and vehicles for military engineer unit training. In general, the projects had to fall under the following criteria:

- Humanitarian Civic assistance: Projects that help build or repair a country's infrastructure (roads, clinics, schools) [2]
- Disaster assistance: DoD responds to foreign man-made or natural disasters when directed by the President or requested by the State Department through the local embassy. [2]

Security cooperation program engineering training in the military aligns in many ways with engineering programs in higher education labeled Humanitarian Engineering, Peace Engineering, and Development Engineering. Understanding how military engineers engage local and global communities to build requested infrastructure as a part of training and diplomacy may inform university engineering program leaders of the value veteran students bring to the classroom.

Objectives

This analysis evaluates military engineering community focused training exercises through the lens of higher education's Humanitarian Engineering programs.

1. Is military engineering training aligned with capacity building goals?
2. Is military engineering training aligned with higher education's Engineering for Global Development (EGD) or Humanitarian Engineering (HE) program principles?
3. What are the gaps?
4. Future study – Compare military engineering education at the advanced levels with graduate EGD or HE programs.
5. What are participants thoughts on attaining an EGD-type degree focused on Peace or Humanitarian engineering?

Author Positionality: The first author is a 30-year Army Engineer officer, with combined service in the Active and Reserve component. As an engineer leader, she designed, planned, and executed numerous security cooperation training programs in Latin America and the Middle East. In addition, the author had specific experience with combat construction, post conflict/peacekeeping reconstruction, and disaster response and reconstruction. The author also has graduate degrees in public policy, international relations, global management, and civil engineering.

Conceptual Framework/ Methodology

This article presents a preliminary analysis of two joint, interagency, intergovernmental, and multinational (JIIM) military engineering community centered project conducted in Costa Rica and El Salvador, Central America. A short explanation of the project approval process, project planning, and execution is provided. This is followed by a comparison of the military engineering training objectives with the established EGD/Global Engineering learning objectives found in Table 1 from [3], in order to identify alignment and gaps with military service members security cooperation training experiences with these Higher Education programs. [3] The Learning Objectives in Table 1 are from the 2021 workshop with academic leaders, students, and practitioners [3].

Table 1: 15 Learning Objectives for Global Engineering based on a 2021 Workshop [3]

#	Learning Objective (LO)	Learning Objective Description
1	Contextual Comprehension and Analysis	Analyze the historical and contemporary context of global inequalities and global development, and poverty alleviation policies, programs, institutions, laws and regulations, and social movements; identify alignments and gaps in (1) research and (2) practice within this context.
2	Cross-cultural Humility	Recognize and respect cultural differences and apply relevant skills to collaborate across cultures, with an emphasis on life-long learning.
3	Global Engineering Ethics	Examine ethical implications of global research and development, including consideration of power imbalances; recognize the limitations of engineering in guiding global development efforts.
4	Stakeholder Analysis and Engagement	Identify project stakeholders and apply appropriate stakeholder communication and consensus building tools.
5	Complex Systems Analysis	Analyze and be aware of various factors (e.g. technical, sociocultural, environmental, political) and actors (components), including interconnections, trade-offs and feedback within systems that influence the equity, efficacy, and sustainability of the engineering solution.
6	Data Collection and Analysis	Collect and analyze data using both quantitative and qualitative methods, as appropriate.
7	Data-driven Decision Making	Use methods, tools, instruments, and procedures employed in measuring and improving international development projects; discuss commonly used impact evaluation designs and the conditions under which each may be used.
8	Applied Engineering Knowledge	Apply rigorous engineering practices and principles within a global context and specific local contexts, considering unique constraints and requirements imposed by resource-constrained settings.

#	Learning Objective (LO)	Learning Objective Description
9	Project Design	Identify tools, methods, and approaches for project design; design and assess programmatic Theory of Change and evaluation frameworks for global development interventions.
10	Project Management	Apply project management skills and methods to manage a project from initiation/problem- definition through delivery.
11	Multidisciplinary Teamwork and Leadership	Function effectively on a diverse team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.
12	Communication	Apply and adapt written and oral communication strategies to reach and work with a diverse audience.
13	Climate Change, Sustainability, and Resilience	Identify and analyze the climate-change dimensions of global inequalities and describe pathways to improved sustainability and resilience, including attention to and approaches at local, regional, national and international levels.
14	Global Health	Understand principles of global health practice, apply lessons learned from public health interventions and evaluations, and understand how public health influences and evaluates development programs and projects
15	Development Economics	Examine historical and current development economics theories and their influence/impact on Global Engineering.

Military Community Engagement Training Analysis

Case Study #1: One Bailey Bridge and Four 2-Room Schools, Costa Rica, Central America
This project was received by the 46th Engineer Battalion (Combat)(Heavy) (46th EN BN), an Army Active Component construction unit, for execution one summer in the early 1990s. The Air Force Reserve took the lead on the school construction. It is important to note that the 46th EN BN was not a bridge unit. Combat engineering tasks such as bridge construction was a secondary mission skill set, to be tasked as needed. With one experienced Non-Commissioned Officer, he was tasked to train the soldiers on the Bailey Bridge construction prior to deployment.

The actual Bailey Bridge was donated from the British military and was shipped to Costa Rica for use in this Humanitarian Civic Action project. The Bailey Bridge is a military, erector set type bridge which can be built with a minimum number of tools and soldiers. It consists of 17 unique parts for the main bridge and 9 unique parts specifically for the bridge abutments [4]. Similar to the non-profit Bridges to Prosperity, a bridge was the solution to the seasonal isolation of village members during the rainy season.

The schools were a local design that mirrored other schools in the region. They were two rooms, made of concrete masonry unit (CMU) block with a tin roof. Initial testing of samples indicated that the CMU block was not consistently meeting ASTM standards for dimensions and compressive strength. After unsuccessfully communicating the company's failure to meet the ASTM standards in accordance with the contract the military had the option to cancel and find another manufacturer. Prior to making that decision, an experienced team of military staff members went to the manufacturing facility to assess the materials and manufacturing process. Adjustments were made resulting in block production meeting ASTM standards. This was an example of *capacity building* that was beyond the scope of traditional engagements.

U.S. military masons rarely have the chance to practice their skills. This project allowed them to train on a real world project that would be utilized immediately. It had significant meaning. Additionally, the team had the opportunity to meet the children and teachers that would be using the new building and classrooms. These connections with the local community made lasting impacts on daily production, team spirit, and individual sense of accomplishment.

Case Study #2: Two 4-Room Schools, El Salvador, Central America
This project was submitted by the El Salvadorian government through the U.S. Embassy, to U.S. Army South, and ultimately approved by the Southern Command Engineer. Projects were selected for their feasibility and training value. The projects needed to be completed in an eight week construction cycle.

First, the only person in the engineering chain who is educated on the history of El Salvador and the implications on its citizens is the Foreign Area Officer. This individual seeks advice from the Army engineer regarding projects, but the engineer is not formally educated on any aspect of regional history. Therefore, the advisory engineer could fail to take into consideration historical events or traditions when making recommendations. The engineer advisor or planner often has not earned a graduate degree.

For this project, the El Salvadorans provided the scope of work for the schools and the U.S military provided the design. Local schools were constructed with CMU block and tin roofs; however, these schools were designed with prefabricated walls systems from a Canadian company, and therefore were misaligned with local customary design materials. Materials for all of the schools needed to be shipped from Canada to El Salvador. Training events were planned with the National Guard and Reserve engineer units assigned to this project over a drill weekend prior to deploying to El Salvador. For this training, there was a video component, and a hands-on component using a small-scale model. Training for the El Salvadoran engineers would take place while in country.

The Battalion Commander identified Spanish speaking service members to improve communication between El Salvadorian military leaders and his team. However, on the job site, service members communicated via hand gestures and showing the El Salvadorians what was expected. “Learning by Doing” is a common training process which is a well-known theory of education popularized by philosopher John Dewy in the 1930’s [5].

Conclusions and Recommendations

It is important to understand that these projects are missions that for engineer leaders are vehicles for training in preparation for any possible deployment. Engineer leaders and craftsmen on the ground focus on skills critical to successful project planning and management. Learning Objectives 8 through 12 are consistently a focus during training events. Is the military missing an opportunity to better incorporate sustainable design (LO 13), data collection long term impact analysis (LO 6), and stakeholder history and cultural education to develop military engineers into global engineers with cross cultural competence? [6]

The comparison analysis of these two events against the Development Engineer learning objectives highlight alignments and gaps between military engineering community-based exercise training and Higher Education's efforts to develop graduate level engineers focused on global humanitarian, peace, and development.

My initial insight is that both military engineering experience and engineering higher education programs fall short of successfully and respectfully meeting the needs of communities. The shortfall from aspirations and potential remains significant regardless of the label of Humanitarian Engineering, Military Engineering, Peace Engineering, or a 'generic' engineering program. Both institutions engage in community projects, however, those engagements fail to maximize the training opportunity and the potential impact. Benefits could be realized if humanitarian engineering in higher education learns from military experience, and similarly for military engineering to learn from research on higher education community engagement efforts.

Irrespective of veteran engineer service members experiences, the academy of higher engineering education has limited its study of military engineering as solely a tool of war. This research presents a different side of military service which acknowledges that many individuals who enlist in the military do so, in part, for a sense of purpose and support of their community. Additionally, individuals are not disappointed if the training fails to have extensive work in their specific military skill. Service members enjoy learning a new skill and seeing an important project move toward completion regardless of the amount of time spent on their own construction trade. This military population should be considered for recruitment into Humanitarian Engineering and Engineering for Global Development programs as well as trade certification programs.

References

1. U.S. Library of Congress. Congressional Research Service, 2022. *Instances of Use of United States Armed Forces Abroad: 1798-2022*, by Barbara Salazar Torreon. CRS Report R42738. Washington, DC: Office of Congressional Information and Publishing, March 8, 2022.
2. Government Accounting Office, "Changes Needed to the Humanitarian Civic Assistance program", National Security and Military Affairs Division, Report B 248270, November 2, 1993. https://www.gao.gov/assets/nsiad-94-57.pdf
3. MacDonald, L., Thomas, E., Javernick-Will, A., Austin-Breneman, J., Aranda, I., Salvinelli, C., Klees, R., Walters, J., Parmentier, M.J., Schaad, D., Shahi, A., Bedell, E., Platais, G., Brown, J., Gershenson, J., Watkins, D., Obonyo, E., Oyanedel-Craver, V., Olson, M., Lau, R., Rao, G., Arzon, A., Krishnaswamy, K., Pickering, A.J., Mabey, C., Johnson, A., Gehr, R., Linden, K., Aligning learning objectives and approaches in global engineering graduate programs: Review and recommendations by an interdisciplinary working group, *Development Engineering*, vol. 7 (2022), https:// doi.org/10.1016/j.deveng.2022.100095.
4. Field Manual 5-277, Bailey Bridge, Headquarters, Department of the Army, Washington, D.C. 9 May 1986.

5. ToolsHero, “John Dewy: His biography, theories, and books”, Retrieved 28 February 2023, https://www.toolshero.com/toolsheroes/john-dewey/
6. Sebrell, Shawn, A., MAJ, “Cross-cultural competence: Leader Requirements for Intercultural Effectiveness in the Human Domain”, U.S. Army Command and General Staff College, 6 May 2014