How Do We Frame Peace Engineering Education? A Complex but Vital Question

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Dr. Nair chaired the national Global Learning Leadership Council of the American Association of Colleges & Universities (AAC&U) from 2010 to 2013 and is currently a member of the Global Advisory Committee. She is also on the advisory panel of the Center for Engineering, Ethics & Society (CEES) of the National Academy of Engineering, and the Chair for paper reviews for the World Engineering Education Forum 2018 conference on Peace Engineering education. She advises several universities and colleges on incorporating global and environmental literacy throughout the curriculum. She has served on numerous national committees including National Science Foundation's Committee on Equal Opportunities in Science and Engineering (CEOSE) and on the Division of Education and Human Resources Advisory Committee (EHR), the Educators Advisory Panel of the Government Accountability Office (GAO) and the Board of Student Pugwash USA. She has been involved in K-12 education and served as a member of the Board of the Pittsburgh Regional Center for Science Teachers, the School Reform Task Force of the Pittsburgh Public Schools, helping design the Science and Technology High School, the founding Boards of two charter schools –City High and the Environmental Charter School at Frick Park, and on the Winchester Thurston Advisory Board. She is co-author of a book, Journeys of Women in Science and Engineering: No Universal Constants, (Temple University Press, 1997).

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How do we frame Peace Engineering education?
A complex, but vital quest.

ABSTRACT
This *Evidence-based Practice* paper describes elements and questions of Peace Engineering (PEng) education as they emerged from the *VIII World Engineering Education Forum, X Global Engineering Deans Council, XIV Global Student Forum,* held in November 2018 in Albuquerque, NM USA. It also summarizes the overall results of the conference and the emerging plans for global collaboration for Peace Engineering and Peace Engineering education, which were the themes of the conference.
Rather than long presentations by established scholars, we convened pioneers who have spent the last decades educating engineers to work in an engaged, compassionate, competent way with local and global problems of necessity and wellbeing. The panel members from the various sectors discussed diverse aspects of Peace Engineering and, in general, conference participants agreed that the new global engineers, leaders and professionals need to be multi-disciplinary with a new mindset to solve global challenges. Among the aspects of Peace Engineering education the participants learned at the conference, they mentioned: a better idea of what Peace Engineering is, including teaching students about compassion; the skill changes needed and the strain it will put on an already loaded curriculum as we add dimension like ethics, security and understanding of information technology; and an understanding of "good" and "bad" examples of Peace Engineering.
We also identified the overarching components of Peace Engineering education as educating students to be global in thinking and acting; a detailed understanding of global problems and opportunities for engineering to mitigate these; ecosystem understanding of engineering work; and aspects of changing economic and information structures.

Historical origins of Peace Engineering education
The idea of Peace Engineering education continues to emerge as educators begin to be conscious of the general nature of engineering as a top-down endeavor, based primarily, if not solely, on satisfying technical requirements rather than as a collaborative, inclusive endeavor seeking to meet the needs of the specific communities that engineers serve. The current structure and culture have historical origins with the earliest engineers being employed by the military in general rather than being "civil" engineers. The first non-military engineering curriculum in a university was instituted in France at the *École des Ponts et Chaussees* as a "civil" engineering program in 1747 [1]. In 1847, the West Point Military Academy became the first systematic engineering school in the U.S. About 50 years after that, Rensselaer Polytechnic Institute followed Connecticut College as the first non-military school to implement an engineering degree curriculum. The Industrial Revolution maintained the hierarchical structure of engineering as most engineers worked for the industrial enterprise or the government.

The first concept bordering on Peace Engineering is probably that of "appropriate technology". In his seminal work, *Small is Beautiful: Economics as if People Mattered* [2], E.F. Schumacher, an economist who worked for the Chief Economic Advisor to the British National Coal Board. Seeing how labor was plentiful, while wealth was low in India, was what set him on the path of describing the need to design technologies to suit the local conditions and culture. Later on, Schumacher also advanced the ideas of practical action and Buddhist Economics, both of which

can be seen as precursors of Peace Engineering. The notion of appropriate technology faded as the idea of sustainability came into prominence with the 1987 U.N. report "Our Common Future", produced by the World Commission on Environment and Development, also known as the Brundtland Report [3. Most recently, "The 2030 Agenda for Sustainable Development" developed at the UN and accepted in 2015 by the member states [4] developed the idea of sustainability further. In January of 2019, the UN reported that climate change is being recognized as a "threat multiplier" and has a significant impact on Peace [5]. Engineering education has incorporated sustainability in general by increasing environmental engineering programs and courses, and teaching life cycle analysis and green design as part of design courses.

Beginnings of Peace Engineering Education

Student engagement in communities to help solve local problems with their expertise has been making its way slowly into engineering education mostly through extracurricular activities since the 1980's, especially in Europe with the different versions of "I*ngénieurs Sans Frontières"* (ISF)-France, founded in the 1980s and chapters in Spain and Italy in the 1990's. In 2001, the US organization of Engineers without Borders (EWB) founded by Bernard Amadei of the University of Colorado and EWB-Canada initiated a spate of student engineering work by U.S. students in needy communities all across the globe [6].

In the first Peace Engineering symposium at Bucknell University (2003), the late Aarne Vesilind brought engineering educators together for a day-long event to ask: "Is the accumulation of technical skills enough for engineers to be effective in practicing Peace Engineering, or do they need social, political, communication, ethical and legal skills as well?" In the Proceedings, Richard Bowen of Wales wrote, "The absence of conflict is a necessary but not sufficient condition for peace. Peace is additionally characterized by relationships between individuals, and social groupings of all sizes, based on honesty, fairness, openness and goodwill. That is, peace requires justice…." [7].

The Engineering Social Justice and Peace (ESJP) conference initiated by Catalano and Baillie has continued this thinking [8], [9], [10 It is the longest effort in the direction of Peace Engineering. Their commitment statement delineates this. Social justice is their goal, but "without a single or static definition of what it entails." The pieces of these are "peace and nonviolence", "reflexivity 0 resisting I justice", "praxis" or action, "equity and sharing", "maintaining independent and critical voices". (http://esjp.org/about-esjp/our-commitments)

These ideas were extended leveraging a framework based on differentiating positive and negative peace, where negative peace is the absence of conflict and positive peace, which is the promotion of actions that do not allow conflict to start.

It is only very slowly that engaging students in working for the good of communities locally and globally, along with teaching them the skills for such work in addition to technical competence, has just begun to permeate the academic curriculum in the US. Intentional courses of study in "Peace Engineering" are also just emerging. Drexel University is the first to offer a Peace Engineering program as a Master' degree.

The Global Conference on Peace Engineering Education– Objectives

Most recently, we have taken the Peace Engineering definition to a new level. Here, we define ***Peace Engineering*** as the intentional application of system-level thinking of science and engineering principles to directly promote and support conditions for peace. As a cross-disciplinary group of entrepreneurs, professors and professionals, we developed an outline of one possible framework for the implementation of Peace Engineering. This thought-provoking paper was a driver to invite people to "Shape Peace Engineering" [11]:

> ***Peace Engineering*** *works directly towards a world where prosperity, sustainability, social equity, entrepreneurship, transparency, community voice and engagement, ethics and a culture of quality thrive. Engineers have the power to play a vital role in the creative solutions that can radically transform and improve the wellbeing of people and other living systems, day to day.*
>
> *At the core of* ***Peace Engineering*** *is our planet's sustainable future, which is calling leaders to act in concert from a systems mindset. It is a call to develop solutions differently: that is, collaboratively; integrating transdisciplinary expertise and education programs; simultaneously applying technology solutions while supporting ethics, policy and living systems. And it is a call in the mingled vernacular of civil society, global institutions, and science and technology. Further, beyond addressing today's challenges, we must cultivate together the development of next generation leaders to continue to drive momentum.*

True Peace Engineering education integrated into the curriculum is still a concept that educators are trying to articulate. It has been fifteen years since Vesilind and Bowen initiated a concerted effort to articulate the elements of Peace Engineering by gathering together faculty who were doing various aspects that could be components of Peace Engineering.

The November 2018 conference was the first global conference on Peace Engineering. It was organized under the banner of the "World Engineering Education Forum", "WEEF-GEDC", as a collaboration among a number of organizations – the International Federation of Engineering Education Societies (IFEES), the Global Engineering Deans' Council (GEDC), and UNM student chapters of global engineering societies along with the Student Platform for Engineering Education Development (SPEED) who co-hosted of the Global Student Forum (GSF). This conference was organized for the first time in the USA. Hosting the conference in the state of New Mexico, the organizers wanted to commemorate the birth of Big Science in the National Laboratories [12], [13], which changed the world, and they wanted to look toward a future where engineering no longer just encompasses traditional concepts. A sustainable and peaceful future requires a new engineering education mindset that integrates social, humanistic, health, environmental, financial, entrepreneurial, arts and many other disciplines for the good of all living species. That is why the concept of Peace Engineering is a game changer.

In addition to the academic communities from over the world, there was a significant amount of participation, sponsorship and commitment from the industrial, non-profit, and governmental sectors. In all there were over 500 participants for this three-day intensive conference. People from 44 countries and 301 academic institutions gathered at this event. Details of the conference are available at the website: https://weef-gedc2018.org

The authors envisioned this gathering as one where questions of how to articulate and implement a system of "Peace Engineering education" while maintaining the technical capabilities that engineers are expected to possess were raised. So, the focus of the Conference was to gather emerging models of Peace Engineering education work and start a concerted and organized movement for Peace Engineering and Peace Engineering education. To this end, the authors presented to the global community thought-provoking questions in the form of panel discussions. After a set of pre-Conference Workshops, the program consisted of plenary panels and technical peer-reviewed paper sessions. The idea was that through these interactions and discussions, there would evolve a set of concepts and skills that could be developed as core elements of Peace Engineering education. Engineering codes all start with the dictum "An engineer shall keep paramount the safety and welfare of the public". The authors are also asking: "how do we educate an engineer to also be a proactively responsible professional for the welfare of the community, along with other members of society?"

Program Components

As expertise in the field is just beginning to coalesce, rather than having single-speaker presentations for the plenary sessions, plenary panels were organized to explore different dimensions of Peace Engineering from the perspectives of diverse organizations and practitioners. During parallel sessions, the GEDC followed the same threads addressed in the plenary sessions, focusing on implementing Peace Engineering education. Peer-reviewed papers, to be published shortly under the auspices of IEEE, were also presented during parallel sessions. The GSF organized their own student oriented parallel sessions and workshops and presented a few papers during the peer-reviewed paper sessions.

(a) Plenary Panels

The panels, guided by organizing questions, and moderated by one of the panel members worked well. Panel members addressed the questions succinctly and left ample time for discussions among themselves and with the audience. Most of the conference attendees remarked on the effectiveness of the format although some were dissatisfied with the brevity of the panel sessions.

As an example of how panels were organized, Table 1 shows the composition and organizing questions for four of the sixteen plenary panel sessions. Sample questions opened the door to areas to explore:

TABLE 1: Plenary Panels, Topics and Questions (four examples)

PANEL TITLE	MEMBERSHIP
PANEL 1 International Collaborations for Peace Engineering	**Ramiro Jordan**, University of New Mexico **Joseph Mertz**, Carnegie Mellon University **Bernard Amadei**, University of Colorado- Boulder
Organizing Questions	
Peace Engineering means educating a new generation of engineers to address problems of everyday living using their technical expertise with care and sensitivity to local conditions.	

Here are diverse ways of approaching this learning.

- *What should be the body of knowledge of engineers interested in working in a global and multi-cultural world and making the world a better place for all?*
- *How can we bring students to work in true partnerships to identify, solve, and implement solutions that the community can then maintain?*

PANEL 2 Examples of Peace Engineering	**Carlos Fuquene Retamoso**, Pontificia Universidad Javeriana, Colombia **Lois Warren,** Aqua Research LLC and Aqua Membranes LLC **Elizabeth Kistin Keller**, Sandia National Laboratories

Organizing Questions

Field workers and educators have long engineered peace in multiple ways and places in the international arena, providing expertise to solve local problems with the full engagement of the community. This panel presents examples of Peace Engineering by people who have engaged in the process in different ways to adapt to the situation – providing expertise to solve a technical problem with local community engagement, in areas of conflict and in areas of dispute.

- *What aspects of this type of work can be conveyed to the students as an integral part of their education? How?*
- *What are some of the framing principles for such work?*

PANEL 16 Academia, Industry, Govs, Multilateral, Funding Agencies	**Ekua Nuama Bentil**, World Bank **Rosalyn W. Berne**, National Academy of Engineering **Ron Hyman**, CAS Development, Liaison International **Don Millard**, National Science Foundation **Michael Milligan**, ABET **Rovani Sigamoney**, UNESCO

- *What are these organizations doing to further Peace Engineering and Peace Engineering education?*

PANEL 15 <u>Intergenerational Panel</u>: Representatives from: Students, industry, academia	**Delaney Heileman**, Computer Engineering student, University of New Mexico, President of SWE student chapter **Rebecca Kreitinger**, ECE student, University of New Mexico, President, IEEE student chapter **Laura Restrepo Alameda**, Environmental Engineering student, Universidad de Los Andes, Colombia, Founder and co-director of Uma Kiwe (Research Center for Peace) **Felipe Gallo**, Civil Engineering student, Universidad de Los Andes, Colombia, President of SPEED **Tom Lee**, Vice President for Education, Quanser **Don Weinkauf**, Dean of Engineering, University of St. Thomas

- *Why is it important to have multiple, diverse perspectives and ways of doing and teaching engineering, as a meaningful pathway to peace?*
- *How have people been excluded from engineering traditionally? How has that trend changed over time?*
- *What should we do to include different kinds of thinking in the doing of engineering?*
- *What are the barriers that make engineering inaccessible to some people as a pathway? How can we remove these?*

(b) Peer-Reviewed Papers

The Conference organizers had asked that papers be submitted under five general themes. Two hundred eight (208) papers were received, with the majority coming from the U.S., with India, Colombia, and Ecuador being second, third and fourth. The themes and the number of papers received under each are:

1. How do we teach/learn about Peace Engineering? - 43
2. Relationships among academia, industry, governments, multilateral organizations, NGOs - 31
3. Hands-on Education/Experiential Learning/Inquiry Learning/Problem-based Learning - 104
4. Entrepreneurship in the Circular Economy - 4th Industrial Revolution and Enabling Success -7
5. Other Peace Engineering Challenges – 23

One hundred eighty-four (184) papers were accepted. Several papers were withdrawn because the authors did not complete the paper after the abstracts were accepted, or due to visa and other problems with international travel. This resulted in only 102 papers being presented during the conference. The accepted papers will be published.

As the papers were reviewed, double blind, both by other submitting authors and professionals, topics emerged and were categorized into the following sessions based on the content of the papers:

- Partnerships between academia and other organizations – These papers generally described standing relationships between the universities and colleges and local or global organizations with students working on projects, many of them over the years.
- Faculty development – Workshops and other continuing programs for faculty to incorporate methods such as problem-based learning, communication, and other methods and skills in courses.
- Moving past conflict – Several papers, generally from South America and Africa, described how engineers, faculty and engineering students worked with communities during or after conflicts to support and rebuild various technological systems.
- Curricular and program design – Authors described how they re-designed curricula or programs to incorporate concepts such as ethics of working in communities, communication and engagement, and eliciting community input in projects.
- Vocational sustainability and Economic Development – Developing employment opportunities in affected communities or non-traditional populations along with economic development projects.
- Culture and education – Designing curricular experiences with an understanding of local cultures.
- Alternative technologies – Developing or adapting technological solutions to fit with local social and resource conditions.
- Humanitarian engineering – A perspective increasingly represented in universities on research and design specifically to improve the conditions in poor, underserved, or marginalized communities.
- Planning for Improved access to resources
- Environmental sustainability
- Innovation and Entrepreneurship

Evaluation of the Conference and Takeaways
The organizers asked for feedback through a cell phone-based survey during the last session of the conference and with a follow-up survey.

Overall, the participants rated the conference as very good or excellent in all aspects. When there was a "less than satisfactory" response, the respondent seemed to be looking for more complete coverage of the topic of Peace Engineering, and for more teaching material or strategies. However, the various programs and curricular pieces have yet to coalesce to a structure of a curriculum that would embody Peace Engineering learning and teaching.

A sample of questions asked on the conference:

- How would you rate the overall conference? [1 star = very poor, 5 stars = very good]. Result: weighted average = 4.06
- Using the same scale; Was the conference theme of Peace Engineering valuable in terms of understanding what Peace Engineering is and how it impacts various aspects of what you do (e.g. faculty development, curriculum, organizational challenges, global partnerships and opportunities)? Result: weighted average = 4.34

Following is a sample of takeaways and general comments from the event submitted by respondents:
Takeaways:

- A better understanding of what Peace Engineering is
- The incredible need for Peace Engineering
- Ethics and compassion
- A sense of the connection between everyday engineering practice and upstream or downstream impacts on peace/conflict
- Values [are] not key performance indicators
- Engineers need to get more in Social Sciences and Politics
- How to use engineering to improve the quality of life of humanity
- Need for change in university culture to support broad concepts like Peace Engineering
- Engineers have many roles in creating a positive peace and supporting a negative peace
- Peace is actionable, holistic, and must question the status quo
- Global innovation – working towards sharing technology and knowledge to create sustainability
- Work with the communities to meet their needs not just our ideas of their needs
- Disruption engineering approach
- Cross cultural collaboration is key (by discipline & by country)
- Academia is diminished by its lack of generosity of spirit and lack of collaboration
- Peace Engineering is the way we connect engineering with world needs and challenges
- Curricula and/or philosophy changes needed to support engineering for peace
- What others are doing such as the Stanford Peace Innovation Lab
- The strain this will put on educators to add this to already "loaded" schedules and student workloads.

General Comments:

- Every engineering student needs to be exposed to the inspiring content of this conference. Maybe an hour video with selected highlights could be produced to teach engineering students what their potential role is in making the world a better place.
- I believe the concept of Peace Engineering is the "why" for the entire field of engineering. Peace Engineering should be the frame to draw more students to the field.
- Great conference. I learned a lot and the quality of the sessions was great. The plenaries were way too vague.
- One of the best that I have attended.
- Knowing that engineers “make a difference” will be key to getting more kids interested in a career in engineering! The theme of Peace Engineering certainly resonates.
- Peace Engineering referring the planet, should indeed include more people from different countries and not only North Americans, the world is not North America!
- The topic could continue growing and we need to accommodate this growth.
- Un buen evento. Felicidades!
- A very interesting, challenging, at times depressing conference. I came looking for leadership and guidance on this subject, and was disappointed to find out that as a sector, we are far further behind that I thought. Not enough self-critical reflection is going on about how we as educators need to evolve.
- Conversion of discussions into action in technical education around the globe will be highly appreciated.
- A breakthrough, courageous act for the organizers to introduce and seat this concept; a surprise to see how much momentum and appetite exists for Peace Engineering. The challenge is to open up to co-create it without politics of sector (academe v business; engineering v business schools) or internal politics. Walk the talk of system wellbeing.

Conclusions – Lessons from the Conference

Essentially, Peace Engineering is a movement towards a new ethos for engineering. For education, it means developing students with a worldview based on inclusion, community engagement and an appreciation of, and skills to address, specific and local needs as expressed by a community rather than a uniform technological response to a problem abstracted from context. As it develops, Peace Engineering will bring different and diverse structures for the curriculum as well. Making connections with the Engineering, Social Justice, and Peace (ESJP) network is an important step that needs to be taken in this movement.

The papers highlighted various features that are being introduced in courses or more extensively. Three examples show the variety of ways in which Peace Engineering is being taught. The first is the multidisciplinary design course at University of Southern California “to teach students how to design products, services and technologies with a human-centered approach to help solve the needs of people caught in the midst of global crises” by working in refugee camps to meet needs [14]. Another example is the curriculum at the University of San Diego where students have experiences distributed throughout the four years. They endeavor to educate “Change making Engineers with a sense of social responsibility and social justice. Courses include: (1) a User Centered Design (UCD) course for first year students, (2) a Circuits course that includes Peace

Engineering concepts in design for second year students, (3) an Engineering and Social Justice course for third year students, and (4) an upper division elective on Engineering Peace. Students at USD learn methods for engineering innovation that meet the needs of users in the local community" [15]. At the Pontificia Universidad Javeriana in Bogota, Colombia, the Engineering Innovation for Global Challenges to address post-conflict issues has extensive reach [16]. Their paper describes the innovations of their educational programs. The programs have "two main components: the first one is the continuous dialogue with national and international partners, like World Bank, in order to establish the capacity building required to attend the social demands in Colombia and also the global job necessities. In the past 4 years we have created 44 new programs (undergraduate, master and PhD). The second component is the deep transformation in the learning, teaching and evaluation processes, trying to move methodologies of the past century to a modern dialogue with new cultures, linking knowledge and action, learning and service. Besides Interdisciplinary, Innovational and Intercultural skills, we emphasize other capacities that every person requires: a deep sense of humanity, social engagement and the permanent reference to the ethics question about the sense of life and happiness."

Summary of emerging questions on the multi-dimensional aspects of Peace Engineering Education

Based on the call for papers for the conference, we summarize the overarching questions in the next steps towards Peace Engineering in the following categories:

1. The Global Engineer
    - How do we develop next generation engineers (principled leadership, accountability, curriculum reform, Socratic methods in engineering, executive programs, joint and cross disciplinary programs)?
    - How do we bring Peace Engineering, ethics, employability, policy, mobility (displaced people), social responsibility into the classroom and our daily lives?
2. Societal Problems/Opportunities
    - How can engineering help reduce the gap between the haves and have-nots?
    - How can we contribute to specific global challenges (food, water, air quality, smart cities, security, food security, climate change, health)?
3. Effective Engagement
    - How do we address diversity (gender, political, geographical, religious, socio-economic, refugees, reintegration to society)?
    - How do we embrace personal accountability and hold each other accountable (local, national, global, public, private)? What is global ethics in this context?
4. Ecosystem Functions and Processes
    - How do we manage and measure the impact of global engineering innovations and ventures (social and business innovation and ventures)?
5. Emergent Models
    - What do emergent economic models imply as Engineering's role (Circular Economy, Industry 4.0/5.0)? How do we engage these models to move towards equity and justice?

Next Steps
The Conference succeeded in catalyzing conversations and idea exchanges for concrete plans for the next steps to advance a movement for Peace Engineering education. Some of these ideas are:

- A global Peace Engineering minor
    - Invite academic institutions to develop content that can be shared, and students can get credit at their home institutions
- Peace Engineering Certificate program (available online) at Drexel as a 4-course sequence: Introduction to Peace Engineering; Conflict Management for Engineers; Systems Engineering for Peacebuilding; Project Management
- Full MS in Peace Engineering at Drexel: includes core Peace Engineering curriculum (above) and additional coursework in data analysis, community-based design, risk assessment, social science, technical specialty tracks and experiential learning
- Peace Engineering case study database: https://peaceengineering.webflow.io/
- Workshop with NSF, NAE and other agencies and institutions
    - A group of interested parties and institutions to brainstorm about Peace Engineering curricula, research, and entrepreneurial activities
    - Building body of knowledge for Peace Engineering
    - Establishing research agenda for existing field of peacebuilding ($15 billion industry)
- Other forums: WEEF and GEDC 2019; CAEI-Colombia 2019
    - Promote discussion and planning for Peace Engineering programs and curricula in many forums. Possibilities include: the WEEF-IFEES meeting in November 2019 in Chennai, India and the Conference of the Americas on International Education (CAIE) in 2019 in Bogota, Colombia.
    - Data models, metrics, analytics and simulations: fine grain to large grain
      Stanford – Peace Data Model and Standard being built at the Peace Innovation Lab of Stanford "to establish a metrics-based approach to measure and price the value of peace". The Peace Innovation Institute at The Hague coordinates the Peace Innovation Lab at Stanford and our City Lab network around the world [https://peaceinnovation.stanford.edu/home/peace-data-standard/ https://www.peaceinnovation.com]
      University of New Mexico – fine grain metrics to be measured in the classroom and aligned with the new ABET 1-7 criteria.
    - Conflict-sensitive engineering design framework
    - ABET and ISTEC General Assembly
- Development of Peace Engineering as the new global engineering mindset
    - Have Peace Engineering be the new vision for engineering education
- Strategic document for Sandia National Laboratories
    - White paper on National Security and Peace Engineering being developed by Sandia National Laboratories and the University of New Mexico
- Four (4) case studies to be developed for the implementation of Peace Engineering concepts and the respective impact on society
    - New Mexico
        - Peace Engineering as part of a new economic development mindset
    - The Hague

        - World capital for Peace Engineering at the Peace Innovation Institute which coordinates Executive training for leaders
        - Peace Data Standard
    - Colombia
        - Workshop focused on activities in Colombia. In partnership with the Inter-American Organization for Higher Education (OUI) in their annual event CAEI-Colombia 2019 conference, October 2019.
    - Ethiopia
        - ISTEC tech transfer of digital libraries/content to all academic institutions in Ethiopia
        - Peace Engineering in the main agenda of two key events:
            - 10thAnnual Research Conference of Jimma University and the 9th Global Knowledge Exchange Network - April 15-25, 2019. This is a national Ethiopian event.
                - International event to be announced by Ethiopian government – August 2019. Led by Prime Minister Dr. Abiy Ahmed, which will include a Peace Engineering plenary talk and workshop
        - Ethiopia created a Peace Ministry
    - Peace Engineering and the United Nations (UN)
        - Support and promote projects that directly address the Sustainable Development Goals (SDGs) outlined by the UN

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