

Humanitarian engineering Colombia: An initiative for engineering students from historically underserved communities

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The Humanitarian Engineering Colombia programme arose as an initiative by professors from the Colorado School of Mines, USA, the Colombian universities Universidad Minuto de Dios and the School of Mines at Universidad Nacional de Colombia. This programme is a response to the growing interest in humanitarian engineering and science, nationally and internationally, by students who want to chart careers with high social impact, and to apply their knowledge and skills to humanitarian circumstances such as poverty alleviation, environmental injustices, energy and housing inequities, to name some of the issues prioritised in the Sustainable Development Goals (United Nations 2015).

HE Colombia develops training activities at undergraduate and postgraduate levels, in conjunction with research projects with vulnerable communities. It is intended to give the engineering academic community access to interdisciplinary concepts, methods and practices not currently covered in a traditional academic offering. By adding social values to their science and engineering education in new and unique ways, graduates are sought who will bring innovative perspectives and approaches to work with communities that historically have been underserved by engineering, such as artisanal and small-scale miners, or small rural producers without school education or digital literacy. This programme is made possible because of international, inter-institutional and interdisciplinary collaborations between three academic entities that bring different yet complementary strengths to the engineering academic community. The universities that created this programme have been developing joint humanitarian engineering projects for four years.

The aim of the joint work between the engineering and humanitarian sciences areas is to develop technical professionals to promote the sustainable development of communities through a unique combination of faculty expertise in engineering, applied sciences and social sciences. Students will engage in critical reflection of their engineering education and practice, direct research with communities, development of socio-technical solutions and outreach with relevant stakeholders alongside the communities they intend to serve. Project experiences will prepare graduates for careers in development, corporate responsibility or further study.

HUMANITARIAN ENGINEERING COLOMBIA

The Humanitarian Engineering Colombia programme is a response to the growing interest in humanitarian engineering and science, nationally and internationally. It seeks to respond to students' growing interest in applying their knowledge and skills to humanitarian circumstances, based on themes such as interdisciplinarity.

It is intended to give the academic community linked to the programme access to an area that is important, but currently not adequately covered as an academic offering. By adding value to their science and engineering education in new and unique ways, it is intended that graduates will bring new and innovative perspectives and approaches, especially in working with communities and different stakeholders. In addition, it is an example of interdepartmental and interdisciplinary collaboration and exchange between faculty and students, which strengthens the academic community.

The engineering and human sciences area aims to train professionals with a socio-technical background, who promote the sustainable development of communities thanks to a unique combination of faculty expertise in engineering, applied sciences and social sciences. Students will engage in direct research and outreach within and alongside the communities they intend to serve. Project experiences prepare graduates for careers in development, corporate responsibility or further study.

The programme combines advanced technical or scientific content in an affiliated stream with attention to community engagement practices to ground the student experience. The disciplines of environmental engineering, geological engineering, and geophysics prepare students to apply Earth knowledge to promote more sustainable and just uses of water, energy, and other Earth resources, as well as to understand and mitigate potential risks.

Graduates of the proposed programme will be prepared to become impactful leaders who can leverage engineering and science to advance sustainable community development for people around the world.

Mission: HE-Colombia brings community-based research and design through engineering students and the faculty to the most vulnerable communities in Colombia.

Why Colombia: "Colombia is a testing case of capitalist, modernising globalisation. Colombia (along with Mexico) has the dubious privilege of having maintained one of the most enduring and callous forms of elite control in Latin America, unabashed pro-US policies, and ruthless capitalistic development. Today, these two countries continue to be the strongholds of the neo-liberal model, going against the tide of progressive regimes in the continent. It is no coincidence that these two countries exhibit the highest degrees of conflict, violence, inequality, and human rights abuses on the continent. It is also not a coincidence that Colombia – endowed with immensely rich natural resources and a large, highly trained professional class – continues to witness amazingly vibrant social movements. Periodic peace processes (including the ongoing peace talks between FARC guerrillas and the government, initially sponsored by the Norwegian government and currently taking place in Havana) are only part of the sustained attempt at social transformation by many actors (peasants, Afro-descendants and indigenous movements, and student, labour, women, environmentalists, and urban groups). Colombia is thus a testing case of the reaches and limits of an imperial kind of globality, and of attempts by many groups to resist it and bring about a more livable and ecological societal model." (Crawley et. Al.)

Organisational structure

- **Executive Committee:** The Director, Bogota Lead, and Medellin Lead will make joint decisions on new areas of practice, projects and programme development and implementation, funding opportunities, and strategic partnerships.

- **Director;** Director of Humanitarian Engineering Undergraduate Programs at Mines, will report the activities of HE Colombia to the Executive Committee of HE Program at Mines
- **Bogota Lead;** Director of Uniminuto's Parque Científico de Innovación Social (PCIS), will oversee all HE-related activities related to PCIS.
- **Medellin Lead;** Director of IGNEA Research Group, will oversee all HE-related activities related to IGNEA at Faculty of Mines, Universidad Nacional-Medellin.
- **Advisory Committee:** This group will advise HE Colombia on future opportunities, educational and methodological innovations, programme and project performance, and strategic partnerships. (names here are suggestions):
 - Engineering societies: Iana Aranda, President of Engineering for Change, Director of Global Development for ASME
 - One alumni of HE
 - One development scholar
 - One engineer/scientist with experience in community work
 - One engineering educator with substantial international education experience
- **Affiliated Faculty:** This group will be selected according to their commitment to work on initiatives of HE Colombia and their demonstrated expertise in community-based research, design and teaching
 - MIT D-Lab: work on CCB workshops with ASGM communities
 - PCIS
 - Two from HE Mines
 - Two from UNal
 - Two from Uniminuto

Main partners and their areas of strength:

- Parque Científico de Innovación Social (PCIS), Universidad Minuto de Dios
 - Social innovation and entrepreneurship; Ingenieros Sin Fronteras-Colombia; Ingeniero a Su Barrio
- IGNEA research group, Universidad Nacional de Colombia-Medellin
 - Research and project capacity in civil, mining and materials engineering
- HE Programme of Colorado School of Mines
 - Community-based research, design, and engineering education

Strategic partners: These partners will be invited to collaborate on specific projects and initiatives according to their interests and strengths:

- MIT D-Lab (creating capacity building)
- RETOS (on-going mediation between communities and students)
- PACT (labour, human rights issues in mining, flower and food production)
- Ingenieros Sin Fronteras (Uniminuto-Uniandes)
- Universidad Sergio Arboleda (graduation option in humanitarian engineering)
- Naples-Prime

Areas of practice:

- Artisanal and small scale gold mining (ASGM)
- Recycling materials
- Agriculture and food production
- Sustainable transportation
- Renewable energy

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I am the author of numerous scientific and academic articles in the area of extractive metallurgy, sustainability in mining and ceramic materials published in high impact international journals, and I have been director of research projects developed with national and international funding.

I have directed doctoral, masters and undergraduate thesis carried out at the School of Mines. In the administrative area I have been Editor in chief of Dyna- Colombia Journal. I am part of scientific societies such as SME / TMS / SOMP / ACM / AIST / Riprexs / SAI.

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