



engineers  
without borders  
australia

# Engineering Redefined

Exploring the links between humanitarian  
engineering and gender diversity





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“Engineering is not just ‘problem solving’ or ‘designing things’, and it isn’t just about being good at maths or science - engineering is for people who want to apply themselves in their community and make a difference.”

– Rachel Welling, EWB volunteer, Monash University Chapter



## Engineers Without Borders Australia

Engineers Without Borders Australia (EWB) is a member-based, community organisation established in 2003, that creates social value through engineering. EWB’s vision is that everyone has access to the engineering knowledge and resources required to lead a life of opportunity, free from poverty.

## Origin Foundation

Origin Foundation is a philanthropic foundation established by Origin in 2010. Origin Foundation believes in the power of education to help create better lives for young Australians.

Origin Foundation has supported EWB to explore the linkages between gender diversity and Humanitarian Engineering Education, and provide preliminary insights into how this correlation could support a more broadly diverse engineering profession.

### A note on the term ‘Humanitarian Engineering’

The term ‘humanitarian engineering’ is used throughout this report. As there are differing interpretations of humanitarian engineering around the world, the definition used in this report is the one put forward by Neil Greet in 2014 [4]. The definition states that humanitarian engineering...

*“brings enhanced well-being, welfare, and comfort to any individual or community in disadvantaged circumstances and is inclusive of research, design, manufacturing and construction. The issues to be addressed in engineering terms might include chronic ongoing conditions for an individual or group, or be associated with high-impact disasters and emergencies which imperil large numbers of people”.*

The focus of this report is on Humanitarian Engineering in the Australian university sector and considers Humanitarian Engineering as the application of engineering competencies and principals in a humanitarian context, rather than seeing Humanitarian Engineering as a stand alone engineering discipline.



# Summary

The framing of the many complex challenges facing our world into a set of globally agreed United Nations Sustainable Development Goals has created a platform for collaboration across countries and industries. The Australian engineering sector can, and should, be a strong contributor to this global effort to 'end poverty, protect the planet, and ensure prosperity for all' [1] through engagement in creative, innovative technical solutions.

We know that diversity in various forms within project teams can be a powerful catalyst for innovation, and thus the Australian engineering sector should be comprised of a diverse cross-section of society in order to be best placed to address the challenges of the future. However, a snapshot of gender diversity in the Australian engineering sector is not heartening: women made up only 17.6% of those completing engineering and related technologies courses at Australian Universities [2] and only 12.4% of the total Australian engineering labour force in 2016 [3].

One of the many factors contributing to women opting out of engineering, and STEM fields more broadly, is a perception issue. A Google image search of the word 'engineer' yields a simplified sea of yellow hard hats, unfurled A0 site plans, and mostly male faces. In contrast, for over ten years Engineers Without Borders have coordinated education programs that empower students to explore the different ways in which engineers work and engage with communities, exercise key professional skills such as two-way communication, and embed sustainable approaches into every stage of a project. We believe that engineering should be seen as an industry which creates positive outcomes for communities, and a career pathway through which one might make a positive difference in the world.

**We will redefine engineering as a community centered profession that provides leadership in the creation of a more sustainable and inclusive world.**

The purpose of this research has been to explore links within the engineering discipline between the perception of engineering as a profession that creates positive outcomes for communities, and gender diversity. EWB education initiatives which have already seen strong gender diversity are a basis from which insights might be drawn, which could support efforts to improve the diversity of the engineering sector more broadly.



You have the opportunity to change your community and be inspired.

— Alec Jones, EWB Chapter President, Edith Cowan University

What you need to know about engineering



# So What Did We Find?

This report outlines key insights around the following themes:

**Values-alignment between an initiative/organisation and participant** - The most prevalent motivators, regardless of gender, for getting involved in EWB education initiatives were based in shared values and building understanding.

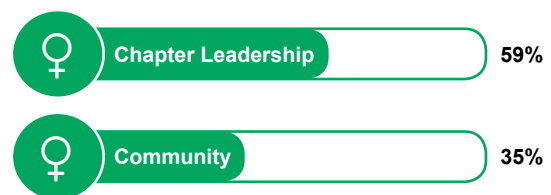
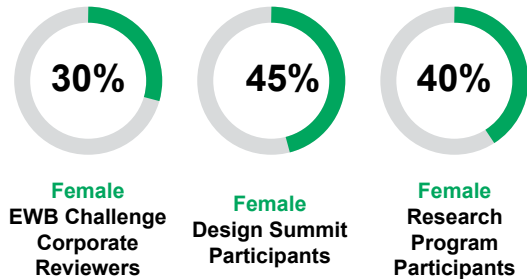
**The influence and substance of social connections** - Motivation statements referring to 'social-connectedness' resonated much more strongly with women than men. However, rather than social connections based on gender, the motivation statements referred to building networks with 'like-minded people' or further alignment with the EWB community. As many existing networks and societies in the STEM fields already focus on women supporting women, there is an opportunity to complement these with platforms for individuals to connect based on another identifier - a strong values base.

**Exploring a 'personal pathway' through engineering** - Post-program reflections highlight the value an initiative might provide in creating an opportunity to move beyond classroom theory and explore answers to questions such as 'what kind of engineer do I want to be?' and 'what can my role look like as a professional engineer?'

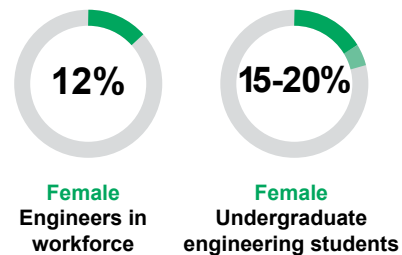
**From having role models, to being a role model** - Articulating the relevance and potential impact of engineering to younger students is motivating for university students when returning to their own classroom. Many initiatives which aim to attract and retain diversity in STEM fields already focus on the influence role models can have on others through, for example, providing a real example of what an engineering career path might look like. However, there are also clear benefits for the role model themselves, such as increased motivation stemming from building their own deeper understanding of their chosen career path.

We conclude the report with recommendations drawn from these insights, which might support educators, industry, and others in our network to open up the engineering profession to a more diverse range of future professionals.

## Women in EWB



## Compared to Australia



## Acknowledgements:

We extend our sincere thanks to Origin Foundation for their support and commitment to this research, and to furthering the collective understanding of gender diversity in engineering through their active partnership with EWB.

Much of this research is based on feedback from the EWB community, without which there would be nothing to investigate and no story to tell. Thank you to everyone who has shared their experiences, provided thoughtful reflections, shaped our insights, and become involved in this conversation. We look forward to continuing our work toward a more sustainable, inclusive world with you.

# The Role of Diversity in Addressing Global Challenges

Engineers have a reputation for solving complex problems and the world is facing a number of them. The 2030 global development agenda, agreed upon by over 150 nations and laid out by the United Nations in the Sustainable Development Goals (SDGs) [1] certainly contains complex problems. Achieving the SDGs will require innovative thinking and new ideas around poverty alleviation, sustainability and social justice, as well as greater collaboration between non-governmental organisations, industry and academia. Engineers will play a vital role in meeting the 17 Sustainable Development Goals and 169 targets in Australia as well as supporting the global effort. Engineering participation is critical in areas such as 'clean water and sanitation', 'affordable and clean energy', 'sustainable cities and communities' and 'industry, innovation and infrastructure'[5] .

An important requisite for impactful innovation is a team that is diverse in terms of thinking, approach and background [6]. Indicators of a diverse team include people with varied cultures, languages, ages, geography, personal hardships and gender [7]. In order to contribute to the sustainable development agenda, Australia needs to be producing innovative, capable and motivated engineering graduates from diverse backgrounds who go on to form diverse and effective teams. A low interest in engineering by young people, especially women, will negatively affect the capacity of engineering to meet the sustainable development agenda [8].

The Australian engineering sector itself is relatively diverse in some instances; the 2011 census showed that 55% of the Australian engineering population was not born in Australia [9] and this is mirrored in the fact that in 2015, 43% of students commencing engineering degrees in Australia were overseas students [3]. Engineers Australia, the peak body representing the engineering profession in Australia, report that whilst many of these students return to their home country after graduation an increasing number are entering the Australian workforce [3]. Outside of nationality, the engineering profession in Australia, as with much of the world, is still a male dominated field; in 2016 only 12.4% of the engineering labour force were women [3]. Whilst men and women can be taught to think in alternative ways, there are differences that will persistently influence a person's fundamental thinking and approach [6].

It is therefore clear that for Australia to effectively contribute to the global development agenda, the gender balance in the profession needs to be addressed.

"Gender equality is more than a question of justice or equity. Countries, businesses and institutions which create an enabling environment for women increase their innovative capacity and competitiveness. Gender equality will encourage new solutions and expand the scope of research. This should be considered a priority by all, if the global community is serious about reaching the next set of development goals."

– UNESCO





## PROFILE

# Priyani Madan

## EWB Volunteer

Priyani works as a Civil Engineer with Arup and originally joined EWB's Melbourne University Chapter, spent a year interning at EWB's national office, and attended two Humanitarian Design Summits that she found 'life changing'.

"I experienced a lot of racism and bullying at school as I was one of the only people of colour. It led to depression that I struggled with for a really long time up until a couple of years ago. One of the stepping stones for getting better was volunteering as an intern one day a week for EWB when I was studying at University. Being around such inspiring females was a really pivotal experience in my life and I met mentors who are still in my life now. It was the first time I had met adults I aspired to be like, and reinforced my decision to study engineering."

"I also started tutoring and mentoring students with SAIL, a non-profit organisation which provides free English support and community services to the Sudanese Australian community. I think my biggest achievement so far was organising a work experience program for ten Sudanese secondary students from SAIL to spend three days at Arup learning about engineering and career pathways."

"All the students said it was a life changing experience and they know more about engineering and career opportunities now. It made a difference, not only to the kids but to Arup. Everyone who was involved was touched by it in some way. I find volunteering makes my personal and working lives better. It creates an awareness that you can use your skills to change lives and communities, and has made me more inspired to do my job."



"Being around such inspiring females was a really pivotal experience in my life and I met mentors who are still in my life now. It was the first time I had met adults I wanted to aspire to be like, and reinforced my decision to study engineering."

# The State of Play

**Engineering is failing to attract women into the profession, and the women that do choose engineering are unlikely to join organisations with gender parity.**

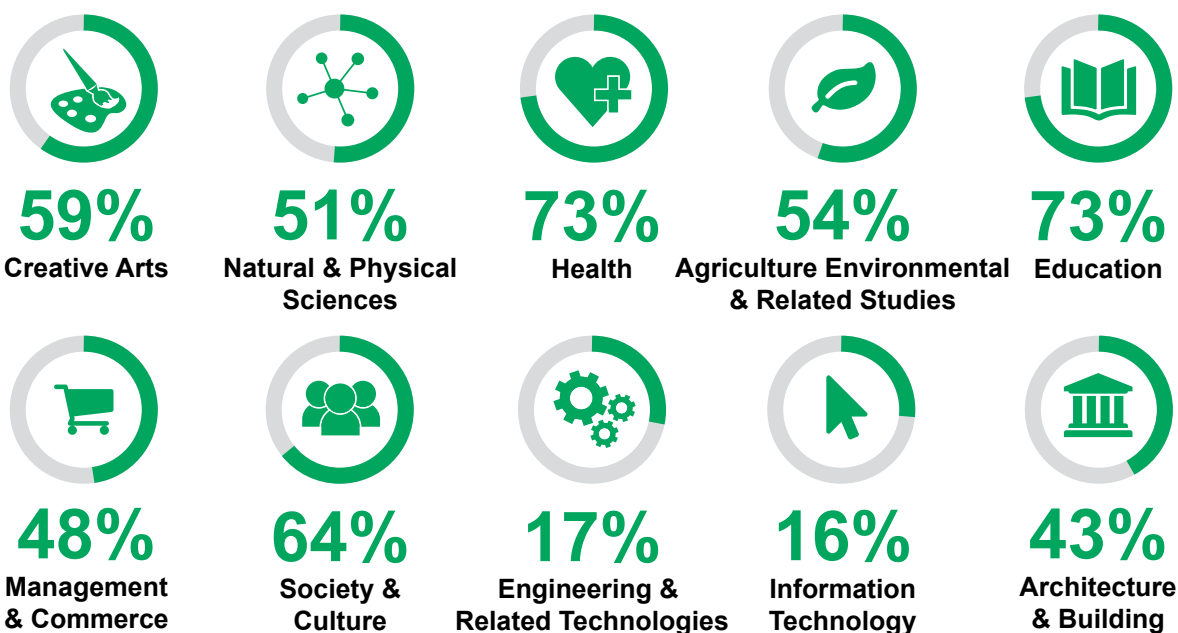
In 2016, just 17.6% of those completing engineering and related technologies degrees at Australian universities were women [2]. In the same year women represented 12.4% of the Australian engineering labour force [3].

The underrepresentation of women in engineering fields has been a historic issue. The Australian Social Trends report published by the Australian Bureau of Statistics in 1994 singled out engineering and surveying for poor but improving female participation rates. The report acknowledged that data had shown “courses which have been traditionally dominated by men are gradually moving toward equal participation... the engineering/surveying field, which had 8% female participation in 1988, had increased to 11% (standardised) by 1992” [10]. This was at a time when 53.0% of students in higher education were female [10]. A 2008 report [11] into the supply and quality of engineering graduates in Australia noted that although changes had been made in the mid 1990’s “... the anticipated increase in participation by women reached only a relatively low plateau around 2001”.

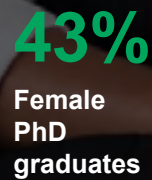
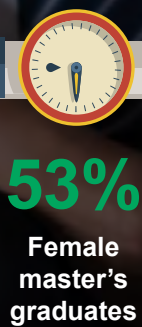
A lack of gender diversity in engineering is by no means unique to Australia. Some of the lowest profession female participation rates are seen in Japan and South Korea (5% and 10% respectively), with other OECD countries like Canada, USA, Germany and Finland not faring much better (22% for Finland and 19% for the others). Cyprus, Malaysia and Oman have a much higher female participation rate, with around 50% female engineering graduates. Just behind them are countries like Denmark, Russia, Tunisia, Brunei and Mozambique having female participation rate between 34% and 42% [12]. Overall, in OECD countries, only 24% of engineering students are female, lagging way behind other disciplines [13].

Globally, the lack of women in engineering is not just limited to engineering practice. UNESCO [12] reports on the ‘leaky pipeline’ of women entering research in general; whilst globally women compose roughly 53% of graduates from bachelor and master’s levels programs, they drop off to 43% of PhD graduates and just 28% of researchers.

## Gender parity across disciplines in Australia: Female participation rate of students commencing full time bachelor degrees in Australia over ten discipline areas in 2016







Globally women compose roughly 53% of graduates from bachelor and master's levels programs they drop off to 43% of PhD graduates and just 28% of researchers



Whilst historically female participation has been below parity across many fields, significant changes and resulting improvements have been seen. Medicine, which like engineering requires a fundamental understanding of the sciences, has seen a significant increase in the number of women graduating. In the United States in the 1970's, both engineering and medicine had a low number and percentage of female graduates. Over time, female participation increased in medicine and eventually met parity in 2008; engineering saw the same initial change but reached a plateau at around 20% in 2000. The initial increase in engineering participation probably reflects the fact that in this period the female participation rate in university education was also increasing across the board.

Whilst other disciplines have made significant progress, engineering has not seen a change in the proportion of degrees being completed by women.

For domestic students, the percentage of female representation has actually decreased slightly, from 10.2% of total completions in 2006 to 8.6% of total completions in 2016 .

Whilst in 2016 54% of students who commenced a bachelor degrees in Australia were women, only 2% of those women chose a degree in the 'engineering and related technologies' field. Conversely, in the same year 13% of men chose the same field [2].

Australia has had, and continues to have, a gender diversity problem. Low interest in engineering from young people, especially women, will negatively affect the capacity of engineering to meet the sustainable development agenda<sup>[8]</sup>.

Medicine has steadily increased female participation, at a rate not matched by Engineering.

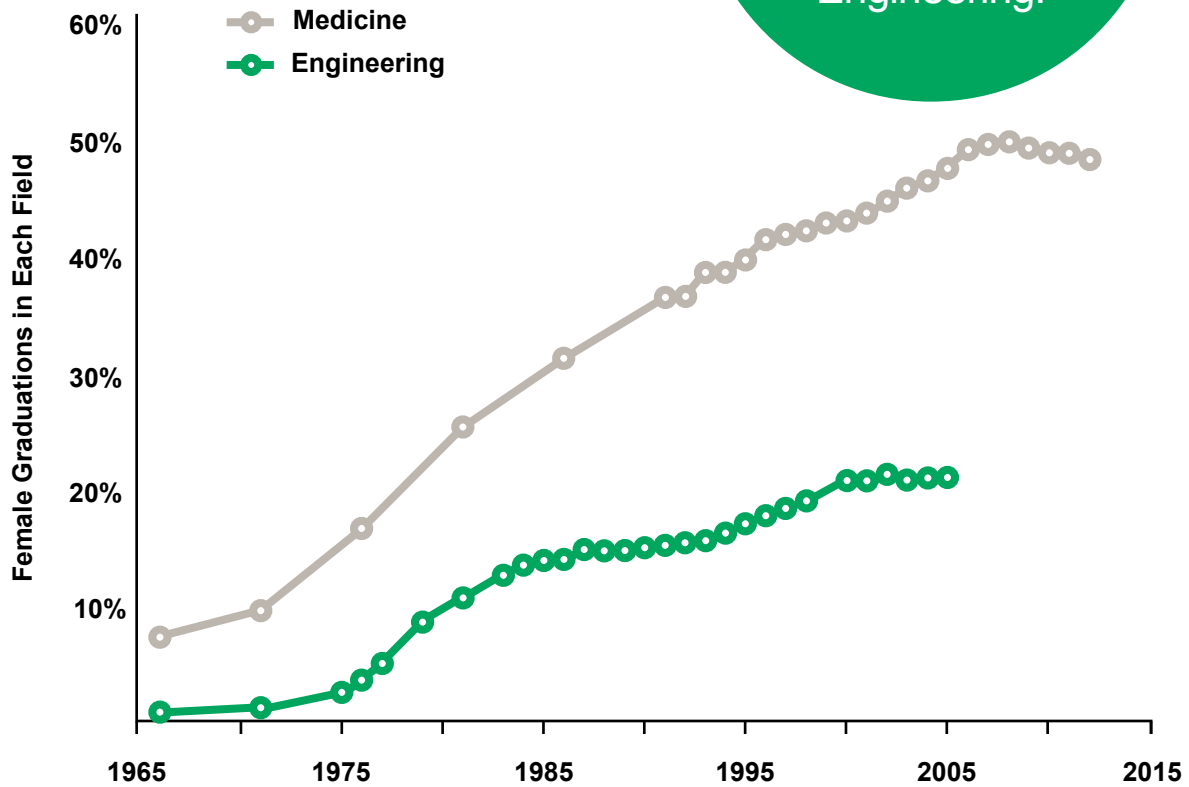


Figure A1 Comparing graduation rates from medicine and engineering university courses in the USA [14]



## PROFILE

# Sam Johnson

## EWB Research Program Graduate

"The passion to do something that benefits other people was definitely there in high school. I chose to do civil engineering and then looked for ways through my degree to achieve that outcome. That's how I got interested in Humanitarian Engineering." explains Sam Johnson, who graduated in 2016 from University of New South Wales (UNSW) in Civil Engineering, and currently works for The World Bank supporting Pacific Island Governments in the delivery of maritime, aviation, and road infrastructure projects. An active EWB member and volunteer at university, he undertook a final year thesis through the EWB Research Program because "it is the only humanitarian engineering research program of its kind in Australia, maybe in the whole Asia Pacific. Many students look at that and think 'Wow! I can have real impact with my thesis'. Graduates today expect that their work is going to be closely tied to social benefit, and EWB has played a big role in putting that on their agenda."

Community development organisations partner closely with the EWB Research Program, so students only work on technologies and applications relevant to the needs of communities often long underserved by the traditional engineering sector. "The culture that EWB brings to its research program makes it a hub for innovative ideas, and thinking about things differently both inside and outside of Australia," says Sam. "And its popularity is growing really rapidly." Choosing to research business models for social enterprises serving Base of Pyramid (BoP) markets, Sam was invited to spend two months in Cambodia doing further work with social enterprise ATEC\* Biogesters.

This overseas experience complemented his engineering training and impressed The World Bank. "EWB was what made me eligible to apply for this kind of job with The World Bank so young. It gave me that grounding in Humanitarian Engineering and community led design, and exposed me to what it is like working in developing countries."



"The passion to do something that benefits other people was definitely there in high school. I chose to do civil engineering and then looked for ways through my degree to achieve that outcome. That's how I got interested in Humanitarian Engineering."

# The Engineering Sector has a Diversity Issue

## What is being done about it?

It is clear that the Australian engineering sector lacks diversity in many forms and that despite decades of attention, particularly around female participation, there have been no significant improvements. However, momentum is building around this issue and a wide variety of organisations now exist to affect change in this space. Some of these organisations are advocates, raising awareness and influencing conversations, others are implementers, creating the systems and delivering the programs through which gender parity might be achieved. Many are both.

We acknowledge the numerous other organisations positively contributing to diversity in the engineering sector, and the multitude of initiatives occurring around us. While EWB has always valued inclusivity and diversity in all forms, addressing the gender diversity challenge in the Australian engineering sector has not historically been an explicit piece of the organisation's mission; our diverse community has thrived organically, which is an important reason why the research described in this report is so interesting. With this in mind, it is necessary for us to understand the surrounding environment so we can find where EWB is best placed to contribute and collaborate both now and into the future.

The variety of approaches to addressing the lack of diversity in the engineering sector, and STEM fields more broadly, can be organised into the general categories. The different approaches are strongly linked to one another, and often incorporate engineering as one piece of the puzzle when addressing female participation in STEM as a whole.

What you need to know about engineering

"If you like to be challenged, if you want to know how it works, if you want to make it better - Then be an engineer."

- Corinne Wallis, EWB Board Member





## Communicating the issue and setting the agenda

Demonstrative, and in many cases quite shocking, diversity statistics are being shared across a wide variety of forums and catalysing calls to action. Position papers from places such as the Office of the Chief Scientist [15], Engineers Australia [16], and the Australian Council of Engineering Deans [17] have contributed to bringing the issue of diversity in STEM to the forefront of policy and planning, and influenced conversations around how the challenge might be addressed. Supporting the voices of these organisations are the wide-reaching and frequent news reports, interviews, and thought pieces which bring this topic into the public discussion. A range of current examples can be cited from outlets such as the New York Times [18], Forbes [19], and The Age [20]. These organisations, and the individual champions within them, are moving the conversation forward and inspiring coordinated action.

## Researching the trends and paths to effective action

The issue of lack of gender diversity in STEM is not limited to the Australian context. Fortunately, neither is the research and evidence-basis from which a deeper understanding and effective interventions might be developed. Numerous universities and representative organisations, particularly in the United States [21], are engaged in research exploring the underlying reasons why this issue exists, and evaluating the impact of different mechanisms which might be used to address it. In an Australian example, a 2016 study funded by the Office for Women in partnership with Chief Executive Women Ltd canvassed successful initiatives from across the globe and formed the data into an understanding of 'international best practice for promoting the participation of young people, particularly girls' in STEM [22]. The evidence basis this research creates is vital to informing what initiatives are pursued, and to understand if, and when, they have been successful.

## Working towards an inclusive culture

The historically male-dominated and masculine nature of many engineering workplaces and university classrooms is well documented [23], and an issue that is not limited to the engineering or broader STEM fields. To address this, organisations such as Melbourne-based DCC Jobs [24] are working across sectors to support women with visibility of, and access to, companies with strong gender equity policies through making these company policies explicit and transparent. Notably, there are many examples of when this recognition and celebration of companies who demonstrate

inclusive culture sets a very clear and positive standard and creates social pressure for others to improve or risk losing out on a wide range of high performing job candidates [25]. In an example outside the corporate sector, the Science in Australia Gender Equity (SAGE) Pilot of the Athena SWAN Charter has engaged 30 universities, six medical research institutes and four government science organisations across Australia in coordinated, measurable actions to address gender equity in the fields of science, technology, engineering, mathematics and medicine [26].

## Changing the perception of Engineering and what Engineers look like

Initiatives such as outreach workshops, profiles of current professional engineers and university students, and industry and community networks all contribute to a deeper understanding of what a career path in engineering might look like for a diverse audience. Some initiatives, such as 'People Like Me' from the WISE Campaign in the UK [27], focus on providing role models and resource packs for young people and their teachers and family members, to generally support a broader picture of engineering beyond the stereotype of 'men who are good at math'. Other initiatives aim more specifically to evolve current perceptions of engineering through emphasising the inherent social relevance of the discipline, and focusing on the variety of skills engineers might utilise to make a positive difference in their communities [28]. For example, the 'Changing the Conversation' campaign coordinated by the National Academy of Engineering in the United States, developed evidence-based messaging around 'engineering as inherently creative and concerned with human welfare, as well as an emotionally satisfying calling' [29].

EWB is contributing to changing the perception of Engineering and what Engineers look like through 'redefining engineering as a community centred profession that provides leadership in the creation of a more sustainable and inclusive world' [30]. Underpinning all education programs, community projects, and volunteer initiatives are core values and development principles which inform the approaches used and the way engagement occurs. As an organisation with partners in multiple sectors including academia, industry, and community groups, EWB is uniquely placed to provide pathways and role models for future engineers who want to use their skills to have a positive impact in the world.



# Exploring trends in Humanitarian Engineering education

A growing body of research in the engineering education space is demonstrating that curriculum which emphasises the social relevance of engineering is linked to more gender diverse student cohorts. While these university courses or initiatives sometimes opt for terms other than 'humanitarian engineering', the core principles of engineering with a human-focus and social purpose are present, and therefore contribute to the understanding of a larger trend.

Research grounded in individual university courses [31],[32] is supported by larger studies across different disciplines of engineering within a university [33], and is beginning to be discussed as a trend across the university engineering space as a whole [18]. Similar studies are also extending into the engagement and outreach space, through exploring feedback from pre-tertiary students [34].

**'At the core of each of the programs is a focus on engineering that is cutting edge, with an explicit social context and mission.'**

A 2015 New York Times opinion piece by Lina Nilsson, then Innovation Director of the Blum Center for Developing Economies at the University of California Berkeley, gained significant attention by collating statistics from universities across the United States to bring public attention to the trend of increased gender diversity in humanitarian STEM courses. In it she notes that "none of the programs, clubs and classes were designed with the main goal of appealing to female engineers" rather that the common thread was "at the core of each of the programs is a focus on engineering that is cutting edge, with an explicit social context and mission" [18]. The EWB initiatives discussed in this paper are similar. As research into this area continues and is shared more widely, it is important to be conscious of how humanitarian engineering initiatives are presented. For example, targeting humanitarian engineering initiatives specifically at women and only to increase gender diversity risks fostering stereotypes in the profession that the technical components of engineering are for men and social components are for women [35].

**What you need to know about engineering**

"There is a perception that you need to be super person to study engineering. You need a certain level of comfort with math but beyond that it's up to you."

– Jayt Buchanan,  
EWB Volunteer, RMIT chapter





## PROFILE

# Rameen Hayat Malik

## EWB Design Summit participant

"For me, there was always a motivation to do something meaningful. I just didn't quite understand what that looked like or how it was to be done.

Another thing I also knew was that I enjoy the wonder and freedom that comes with creating and innovating. Along came the decision to do engineering and to combine it with law to fulfill my passion for social justice. However, there was still a disconnect between wanting to create socially conscious design solutions and the opportunity to do it.

So when the opportunity came up to undertake the EWB Design Summit, it seemed like the perfect opportunity to draw the link between technology and my principles of social justice and equality.

It was truly an amazing experience. I applied and expanded my engineering knowledge and skills from beyond the classroom and into situations affected by factors beyond the technical.

Despite headaches, mosquito bites and sunburn there was always someone two steps ahead wanting to help. Hearing each other's stories, paired with our mutual passion to create social impact was a source of surprise and comfort every day.

Personal development eventually melded into professional development. The human centred design process and strength based approach made its way off the paper and became apparent in front of us through just talking, doing and observing. We presented our design ideas to the community leaders and members. Seeing the pride in their faces that the kids they'd hosted for five days had learned from their community and were giving back to the best of their ability, helped us realise once again that the design process could never be removed from the human element."

"So when the opportunity came up to undertake the EWB Design Summit, it seemed like the perfect opportunity to draw the link between technology and my principles of social justice and equality."



# The Opportunity at EWB

**As an organisation with high gender diversity in its initiatives and an explicit focus on social impact, EWB is well placed to further investigate the linkages between gender diversity and engineering education initiatives with social purpose.**

The first large-scale Humanitarian Engineering Education offerings at tertiary level in Australasia were developed by EWB, and since then have expanded and are now running in partnership with universities across Australia [36]. The research described in this report focuses on three elective programs coordinated by EWB which engage university students, namely: The Humanitarian Engineering Research Program, Humanitarian Design Summit Program, and School Outreach Program. Whilst these initiatives are not part of a student's mandatory university curriculum, in many cases they may be incorporated into a formal course for credit.

## School Outreach Program

The EWB School Outreach program exposes primary and high school students to the role of engineers in solving global challenges such as lack of access to water and sanitation, resilient construction and climate change through creative, hands-on workshops in their classrooms. The workshops are facilitated and delivered by trained EWB volunteers who may be university students, engineering graduates or professional engineers. The objective of the program is to highlight inspiring career options available to engineers and technical professionals and the power of humanitarian engineering to create positive change. In 2016/2017 these workshops reached over 3,800 students in 120 regional schools.

"It can spark an idea, a change in outlook, or reshape the direction of someone's life."

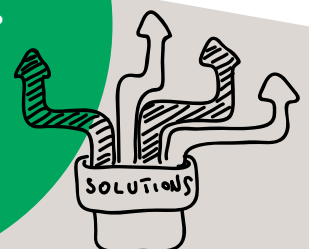
– Jenny Mackay, School Outreach volunteer, and Origin engineer.



**What you need to know about engineering**

"Engineering ≠ Math. It's about solving problems for people."

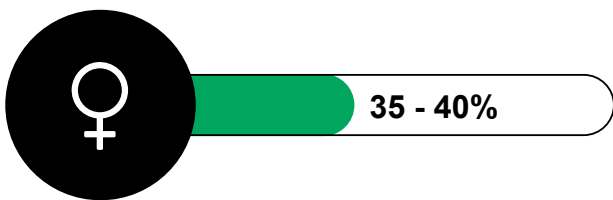
– Matt Imhoff, EWB NSW Chapter President



# Humanitarian Engineering Research Program

The Humanitarian Engineering Research program creates authentic and real world learning opportunities through research. It engages final year students through real world research projects in collaboration with community-based organisations. The program is based on two-way sharing of knowledge and ideas between universities and community-based organisations. Research topics are nominated by community-based partners working with marginalised or disadvantaged groups in the Asia-Pacific region and fall within 'water and sanitation', 'clean energy', 'appropriate housing', 'assistive technology' and 'education and training'.

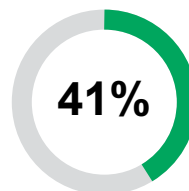
EWB's Humanitarian Engineering Research program was established in 2006 [38] and over the past 10 years has seen a female participation rate between 35-40%.



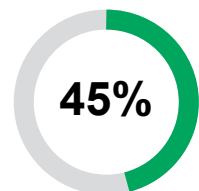
# Humanitarian Design Summit Program

Since January 2015, over 1140 students have participated in the EWB-led Humanitarian Design Summits. This program aims to nurture future development leaders, and embed human-centred values and approaches in engineering, design, and technology education through overseas immersive learning experiences. Each Humanitarian Design Summit runs for approximately two weeks in one of six countries in the Asia-Pacific region. The format includes workshop sessions, cultural immersion activities and student-led investigations to help participants develop a deep understanding of the role Human-Centred Design (HCD) and technology play in creating positive change within communities. EWB partners closely on the delivery of the program with both universities and local grass-roots organisations that have a strong working relationship with communities. Students often use the Humanitarian Design Summit experience to count towards work experience requirements, and at some universities the experience has also been integrated into formal humanitarian engineering curriculum [37].

Since the recording of gender data began in mid-2016, 41% of program applicants and 45% of program participants have identified as female.



Female Program Applicants



Female Program Participants



## PROFILE

# Emma Dade

## Environmental Scientist, and EWB Corporate Galvaniser

“EWB provides me with opportunities to mentor others to become problem solvers and change-makers in the community development and engineering sector. I also love that it links me with other like-minded people who are passionate and inspiring, and who hold the same values as I do.

As a Corporate Galvaniser I provide EWB’s corporate members with opportunities to act as leaders in the humanitarian engineering movement, and empower them to be change agents and problem solvers.

My first trip to Cambodia 7 years ago as part of the EWB Dialogues on Development initiative was a profound experience that kick-started my involvement with EWB. Since then I feel inspired every time I facilitate a workshop for our members, whether it be on presentation skills, human centred design, or community development.

I believe that all engineers are humanitarian engineers, and that putting people at the centre of the design process leads to better and more sustainable solutions for communities, clients, government, and society. Moreover humanitarian engineers have the ability to connect on a human level with an engineering project, to think outside the box and to consider the bigger picture. It is this ability that puts people back at the heart of engineering designs and solutions, whether it is for large infrastructure projects or local community services.”

And it is joining EWB that made me realise that there is a powerful and beneficial role for community in all engineering and design projects.”



# The Research Process

The research described in this report is a step forward in understanding how changing the perception of engineering as a profession which creates positive outcomes for communities might influence diversity within the sector. The broad question of,

## ‘What effect do humanitarian principles have on gender diversity in engineering and associated disciplines?’

is then narrowed to focus on how embedding humanitarian principles into university engineering education has supported this perception of engineering as a human-focused discipline, and the links to gender diversity within particular student cohorts. The research seeks to understand the motivations behind university students opting in to EWB-coordinated initiatives which have an embedded focus on creating social impact, and the perceived benefits or competencies gained from the experience. The similarities and differences between respondents of different genders is explored.

The university experience is just one part of the ‘pipeline’ which attracts individuals into the engineering sector and retains them throughout their career. This research is focused on the university stage of an engineering career as this is where EWB programs have seen strong evidence of gender diverse cohorts already, and thus might be able to contribute to the conversation by investigating and showcasing this trend more rigorously. This work sits alongside the initiatives at other stages of a career led by numerous other organisations.

Additionally, gender is just one lens through which to view and evaluate diversity within this engineering pipeline. As previously discussed, diversity within a team might be considered through the lens of gender, or through culture, language, age, geography, personal hardships, and others [7]. These personal identifiers are not mutually exclusive, so whilst addressing gender diversity in engineering is the focus of this particular study, as research in this space moves forward it is important that the intersectional nature of diversity in engineering is considered so that for example, all women who might be interested in engineering benefit from initiatives, not just one class or ethnicity.

# Approach to understanding participant motivations

The Humanitarian Engineering Research Program and the Humanitarian Design Summit Program engage university students from across Australia and provide a large pool of young future engineering professionals from which to draw insights. This component of the research explored variations in the declared motivations of students electing to participate in these two programs.

A survey tool was developed to capture the primary motivations of program participants. Through the coding of previous open-ended responses to the question ‘why did you enrol in this program?’, a list of 24 motivation statements were created. These statements, organised into 6 categories, are shown in Table 1. Survey respondents were asked to identify their gender, and select 5 out of the 24 motivation statements that most resonated with them when they were applying to participate in the relevant program.

Using responses from the two programs (which both focus on the learning and application of humanitarian engineering) enabled stated motivations to reflect ‘humanitarian engineering initiatives’ rather than, for example, reflecting the motivation to participate on ‘a overseas study tour’. More detail on the research approach and the data gathered can be found in Stoakley, Brown, Matthee [39]. A number of steps were taken to reduce the introduction of bias into responses for the motivations of students participating in these two initiatives. All program participants were surveyed after being informed they had been accepted onto the relevant initiatives, Humanitarian Design Summit respondents were invited to remain anonymous, and Humanitarian Engineering Research Program respondents (who completed the survey on an existing administrative survey) were advised that their responses would not affect their place on the program. In all cases, participants were notified that responding to the survey was not mandatory in order to participate in the program. The recorded motivations are those that have been self declared by the participants.

Motivation Category	Motivation Statement
<b>Values</b>	<ul style="list-style-type: none"> <li>Wanting to give back to the community</li> <li>The possibility of making positive social changes</li> <li>Work directly with and help people who might be disadvantaged</li> <li>Inspired from personal experience to make a difference</li> </ul>
<b>Career</b>	<ul style="list-style-type: none"> <li>Gain relevant work experience</li> <li>Build up your CV</li> <li>Kickstart a career in humanitarian work</li> <li>It is a way to earn course credits towards your degree</li> <li>Expand engineering knowledge</li> <li>Make new connections that might help your career</li> </ul>
<b>Social-Connectedness</b>	<ul style="list-style-type: none"> <li>Know EWB and just want to continue to be involved with EWB</li> <li>Looking for an opportunity to connect with like-minded people</li> <li>Looking for a way to feel connected with different people</li> </ul>
<b>Social Pressure / Encouragement</b>	<ul style="list-style-type: none"> <li>My parents have encouraged me to participate in this kind of program</li> <li>My friends have encouraged me to participate in this kind of program</li> <li>Other with whom I am close place a high value in this kind of program</li> </ul>
<b>Understanding</b>	<ul style="list-style-type: none"> <li>It is an opportunity to learn about, from and experience different cultures</li> <li>Learning about and applying humanitarian engineering</li> <li>Experience developing-world issues first hand</li> <li>Understanding how engineering works in the real world</li> </ul>
<b>Enhancement</b>	<ul style="list-style-type: none"> <li>Looking for an opportunity to put what you know into practice</li> <li>Being able to develop personal skills</li> <li>Gain leadership skills</li> <li>Looking for a truly challenging task</li> </ul>

Table 1: Categorisation of the 24 motivational statements

# What Did We Find Out About Motivations?

What you need to know about engineering

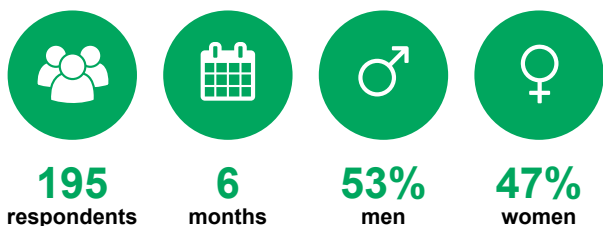
"It is a great field where your contributions can positively affect your community, and communities around you for the long-term. It is immensely rewarding."

– Jen Zen Ho, EWB Volunteer,  
University of Melbourne Chapter

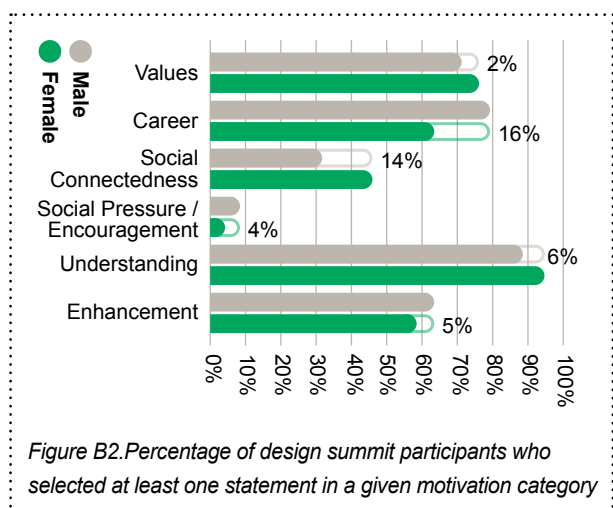
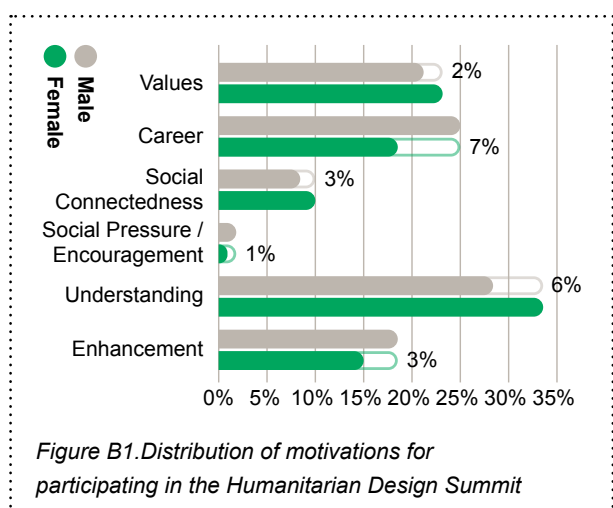




# Humanitarian Design Summit Motivation Survey



The distribution of stated motivations of survey respondents participating in the Humanitarian Design Summit program across the six motivation categories are shown in Figure B1. Additionally, Figure B2 shows the percentage of respondents selecting at least one motivation in each of the categories.



As shown in Figures B1 and B2, the ‘understanding’ category contained the greatest proportion of selections, with 88% of men and 94% of women selecting at least one of the motivations in this category. The top three most frequently selected motivation statements are shown in Table B1. All of the most frequently selected statements are from the ‘values’ or ‘understanding’ categories, with two of the responses the same for men and women. This aligns with the core advertised purpose of a Humanitarian Design Summit program as a learning and professional development overseas experience and shows that generally men and women primarily have the same motivation for participating.

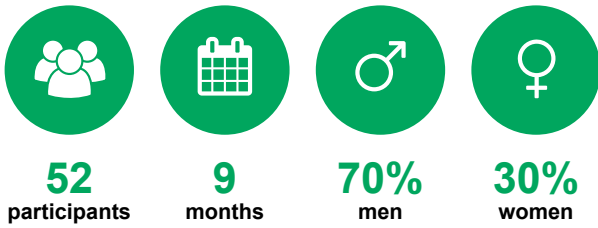
A variation in responses from men and women can be seen in the ‘social-connectedness’ and ‘career’ categories. A greater proportion of women selected a ‘social connectedness’ motivation than men with the reverse true for a ‘career’ motivation. Neither men or women appear to be motivated by ‘social pressure’ with fewer than 10% of men and women selecting a motivation statement in this category.

Overall both male and female participants on the Humanitarian Design Summit program are primarily motivated by ‘understanding’; across all of the motivation statement categories relatively large gender differences are seen in two categories, male respondents are more aligned to ‘career’ and female respondents to ‘social connectedness’

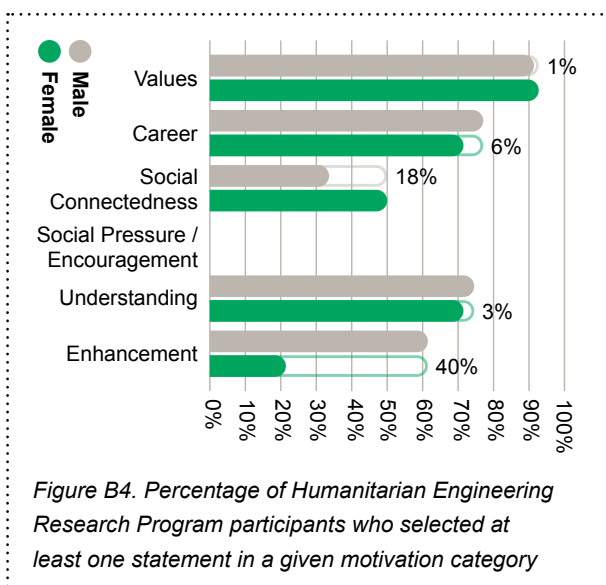
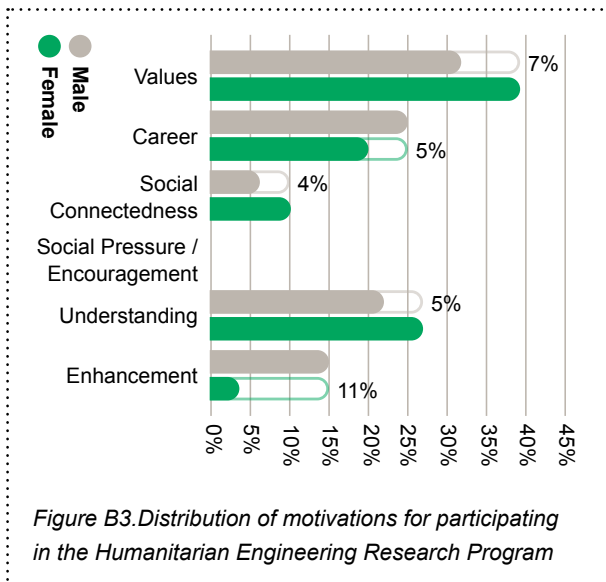
Women	
Motivation Statement	% of total responses
Learning about and applying humanitarian engineering (Understanding)	12
It is an opportunity to learn about, from and experience different cultures (Understanding)	11
The possibility of making positive social changes (Values)	10
Men	
Motivation Statement	% of total responses
Learning about and applying humanitarian engineering (Understanding)	8
The possibility of making positive social changes (Values)	8
Experience developing-world issues first hand (Understanding)	7

*Table B1. Humanitarian Design Summit: most frequently selected motivations for participating*

# Humanitarian Engineering Research Motivation Survey



The distribution of stated motivations of survey respondents participating in the Humanitarian Engineering Research Program across the six motivation categories are shown in Figure B3. Additionally, Figure B4 shows the percentage of respondents selecting at least one motivation in each of the categories.



Over 90% of both men and women in the Humanitarian Engineering Research Program identified with motivation statements from the 'values' category. In contrast to the strong alignment to the 'values' statements, no participants reported feeling motivated to engage with the program due to statements in the 'social pressure / encouragement' category.

The three most frequently selected motivation statements from the Humanitarian Engineering Research Program survey are shown in Table B2. Similar to trends seen in responses from the Humanitarian Design Summit Program, most of the top motivation statements for both men and women were from the 'values' and 'understanding' categories. The motivation statements selected within each category were also similar, suggesting there is no significant difference in the primary motivation for participation in this program by men or women. Interestingly, the most popular response from men, 'the possibility of making positive social changes', was almost double that of the second most popular response, 'learning about and applying humanitarian engineering'. A career statement 'expanding engineering knowledge' made the men's top three, with the Humanitarian Engineering Research Program being completed in final year it follows that participants may be considering the impact on their next step into the engineering workforce.

The responses show that both men and women most frequently selected motivation statements in the 'values' category. Whilst anecdotally the research program has participants who are often referred to the program by friends or academics, their pressure or encouragement either is relatively small or doesn't translate into an important motivator as no responses from either gender were in the social pressure / encouragement category.

When delving into the difference in responses between men and women, men selected a greater proportion of motivation statements in the 'career' and 'enhancement' categories, while women responded more frequently to statements in the 'values', 'understanding', and 'social-connectedness' categories. The most striking category is 'enhancement'. Over 60% of men selected at least one motivation in this category whereas only 20% of women selected motivations in this category. This is the biggest difference across the data, showing how differently this motivation category is considered.



Women	
Motivation	% of total responses
Wanting to give back to the community (Values)	13
The possibility of making positive social changes (Values)	11
Learning about and applying humanitarian engineering (Understanding)	10
Men	
Motivation	% of total responses
The possibility of making positive social changes (Values)	16
Learning about and applying humanitarian engineering (Understanding)	8
Expand engineering knowledge (Career)	7

Table B2. University Research Program: most frequently selected motivations for participation

## Looking across the data from both programs

Looking across the data from both programs, the most popular category of motivation statement was the same for men and women, and aligns with the aim of the respective program the participants had chosen to engage with. The most frequently selected category for both men and women participating in the Humanitarian Design Summit, a program tailored towards experiencing humanitarian engineering in an immersive hands-on experience, is 'understanding'. In the Humanitarian Engineering Research Program, an initiative more aligned to taking acquired knowledge and applying it in a humanitarian project, the highest response rates were seen in the 'values' category. The second most popular motivational category for each initiative was the same as the most popular category for the other initiative suggesting that participant motivations across EWB initiatives is relatively similar.

Of all the individual motivation statements, 'learning about and applying humanitarian engineering', and 'the possibility of making positive social changes' appear in the most popular three motivations for all genders across both initiatives, which suggests many students have similar motivations for engaging with EWB irrespective of the particular engineering education initiative they choose.

## PROFILE

# Becky Watts

## EWB Design Summit participant and Field Professional

"In my first semester in engineering at Australian National University, I did the EWB Challenge and my lecturer Jeremy Smith gave us a bit of insight into composting toilets," says Becky Watts of her first encounter with Humanitarian Engineering.

"It was a really interesting insight into engineering 'how can you use that technical knowledge, physics and maths, and turn that into a real life solution?' That really got my attention."

Becky joined EWB Australia's first Design Summit Study Tour in Cambodia. It was her first chance to develop ideas based on real, first-hand experiences in a developing country.

"I saw something on the roof of a school and I was like, 'what is that? In this community where there was no running water – where all the households don't have any electricity, there was this solar panel."

The solar panel Becky saw had failed due to a lack of trained personnel to maintain it. She was struck by the opportunity to help countries like Cambodia develop sustainably with renewable technology. "Developing countries – they don't have existing infrastructure so there's a real opportunity to satisfy increasing electricity demand with renewable energy." With support from EWB Australia and local NGO BabyTree Projects, Becky returned to the village to help install two new solar panels and provide training to locals on how to look after the equipment.

Her experience inspired her to take a 20 month EWB field professional placement for Appropriate Technology in Cambodia.

Becky now works with Deloitte in Economic and Commercial Advisory for Energy and Resources.



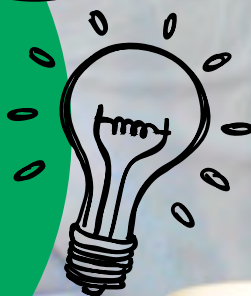
# What Competencies Do Participants Feel They Gain?



What you need to know about engineering

"Engineering is so much more than maths and science, it is also creative thinking, design, problem solving. Technical skills are only part of the equation. Don't rule out engineering as a career just because you're bad at maths/science."

– Rebecca Lin, EWB volunteer, Monash University Chapter





As a membership-based organisation, EWB consists of more than a dozen Chapters which provide the framework for EWB members to connect with like-minded individuals either at their university or, for non-students, in their region. The EWB School Outreach Program engages hundreds of university students each year through their University EWB Chapters. These students volunteer their time and, unlike the Humanitarian Design Summits or Humanitarian Engineering Research Program, most commonly participate in this initiative outside of their university curriculum requirements.

This component of the research explored the change in skill and personal growth self-reported by university students participating in EWB's School Outreach Program. Understanding the perceived benefits of EWB's School Outreach Program volunteer experience provides insights into why students initially engage with this program and why they stay involved. This could have implications for understanding how this retention may apply to other stages of an engineering career path.

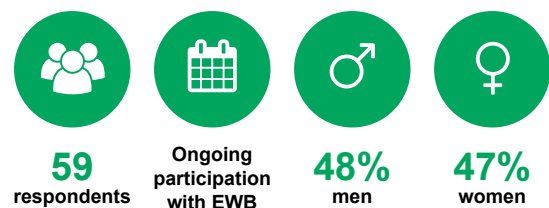
EWB School Outreach volunteers were invited to provide a short written response to the question:

**'Has being involved with EWB School Outreach made you a better student? How?'**

This question was included in an existing EWB School Outreach Program volunteer feedback survey, to reduce the burden on volunteers and increase response rates. Respondents were given the option to remain anonymous, and to opt-out of their responses being used for research purposes.

## What did we find out about experiences?

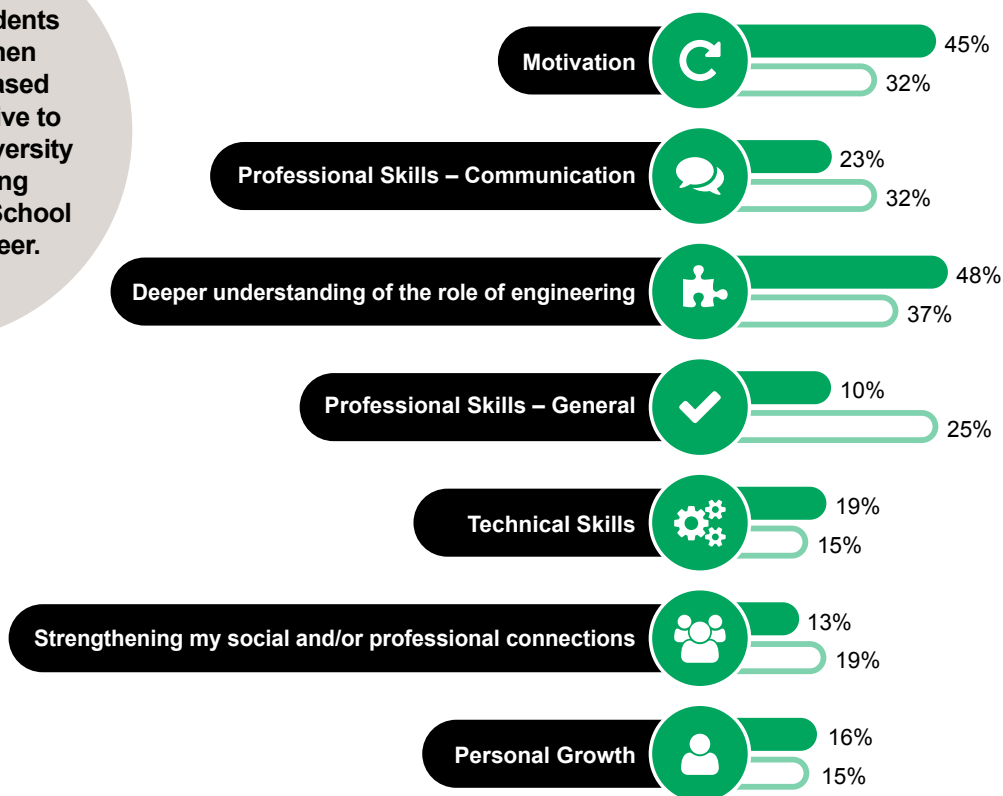
### Survey Respondents - School Outreach Program



The open-ended survey responses were coded into seven categories: motivation (drive to do well in studies); deeper understanding of the role of engineering; professional communication skills (general communication, public speaking); general professional skills (teamwork, interpersonal skills, leadership); technical skills (practical application which supplements my course); strengthening my social and/or professional connections; and personal development (reflection, time management, organisation).

Previous EWB School Outreach Program monitoring and evaluation surveys focused on measuring the benefits of engaging with the program through the lens of building specific professional competencies; for example, improved public speaking skills or ability to work in a team. However, by providing program volunteers the opportunity to frame their own short answer response to a question around personal growth and program benefits, a previously unexplored area of interest was revealed.

37% of all respondents and 45% of women referenced increased motivation and drive to do well in their university studies, following participation as a School Outreach volunteer.



Graphic C1

● % of women who referred to this area ○ % of total respondents who referred to this area

In addition to comments around professional and personal skills, numerous survey respondents spoke to feeling inspired and motivated after volunteering with the School Outreach Program, and acknowledged the positive impact these feelings had had on their desire to do well at university. As shown in Table C1, 37% of all respondents and 45% of women referenced increased motivation and drive to do well in their university studies in their short answer responses. Additionally, 38% of all respondents and almost 50% of women commented on gaining a deeper understanding of the role that engineering might play in the world.

**Almost one third of short answer responses directly attributed an increase in motivation at university to a deeper understanding of the role of engineering the participant had gained through the EWB School Outreach Program. Almost 70% of these responses came from women.**

The EWB School Outreach Program provides university students the opportunity to speak about engineering through the lens of EWB projects and principles. It seems that workshops which present a human-focused vision of engineering to young school students, may also support developing or reinforcing this perception of engineering in the workshop presenters themselves and that this perception is highly motivating. University students in the School Outreach Program are able to see the relevance of what they are studying, and understand the ways in which engineering is a profession which creates positive outcomes for communities through the opportunity to articulate these ideas to others.

**Sample response which comments on ‘motivation’**

“EWB has motivated me to studying harder as an engineer. Each time I take part in the program I become excited as it makes me proud to be an engineer.”

**Sample response which comments on ‘a deeper understanding of the role of engineering’**

“Volunteering for EWB School Outreach has exposed me to the knowledge of how engineers can contribute towards a better, sustainable, and more knowledgeable society”

**Sample response which link understanding and motivation**

“It has given me greater motivation to study as I know the potential of my degree to change the world”

“It’s helped to reinforce the significance in my studies, making me more committed to engineering.”

“Being involved with EWB School Outreach has taught me more about humanitarian engineering, and the knowledge that I can contribute to positive social change has given me more motivation to focus and complete my studies”

Table C2. Sample responses from School Outreach Program volunteers in each theme



"Remember that engineering is not just building bridges, it has real impacts on real people. How can you change the world?"

– Sam Cunningham-Nelson,  
EWB Volunteer, QLD Chapter.

What you need  
to know about  
engineering





# Key Insights

## Values-alignment between an initiative/organisation and participant matters

The most prevalent motivators, regardless of gender, for getting involved in the EWB education initiatives included in this study were based on shared values and building understanding.

Across both the Humanitarian Design Summit Program and the Humanitarian Research Program, 'learning about and applying Humanitarian Engineering' and 'the possibility of contributing to social change' are in the top three most frequently selected motivation statements for both men and women. This suggests most university students have some similar motivations for engaging with EWB education initiatives, and that these motivations are grounded in values and understanding rather than, for example, completing a program to expand their CV or because family members had suggested it.

## The opportunity to better understand and contribute to social impact can drive engagement.

It is also interesting to note that the overall most popular motivation category was 'understanding' for the Humanitarian Design Summit Program and 'values' for the Humanitarian Research Program. This may be reflective of the role a participant is expected to play in each program - while both programs encourage students to positively contribute through their experience, the Humanitarian Design Summit Program has a strong focus on learning and building skills while immersed in a context, while the Humanitarian Research Program encourages students to apply their knowledge to a specific research project with the aim of directly benefiting a partner organisation's work. This suggests the way a Humanitarian Engineering initiative is framed and clarity around the role of the participant is also important.

"EWB's values align with my values. I feel welcome and appreciated - like my contribution is valued. I also fit in socially in a way I haven't so much within my university course."

– EWB Member

## The influence and substance of social connections

Motivation statements referring to 'social-connectedness' resonated more strongly with women than men participating in the Humanitarian Design Summit Program and Humanitarian Research Program.

Many existing networks and societies in the STEM fields already focus on women supporting women and the positive outcomes which can arise from mentor relationships, peer-to-peer connections, and diverse role models.

There are opportunities to compliment 'women in engineering' initiatives with social connections and support mechanisms, where the community is linked by shared values alignment and a sense of social purpose, rather than just gender identity.

Survey respondents were provided the following motivation statements within the 'social-connectedness' category: 'Know EWB and just want to continue to be involved with EWB', 'Looking for an opportunity to connect with like-minded people', 'Looking for a way to feel connected with different people'. Importantly, while the motivation statements referred to building networks with 'like-minded people' or further alignment with the EWB community, this does not specify only feeling connected to other participants of the same gender identity, solely engage with networks of other women, or looking for support from only female engineers.

It is quite possible women in engineering are seeking connections with a community defined by something common to Humanitarian Engineering Education initiatives, in addition to connections with other women in the sector.

The benefit of being part of a community of values-aligned individuals has been echoed in reflections from the EWB Chapter leadership. When EWB members who hold executive positions in their local Chapter were asked to reflect on why they chose to be involved with EWB, many mentioned the influence of the community around them.

"I am proud of the community we have created, to see so many people who are passionate and committed to working towards achieving our aims."

– EWB Member

## Exploring a ‘personal pathway’ through engineering

Post-program reflections have highlighted the value an initiative might provide in creating an opportunity to move beyond classroom theory, and explore answers to questions such as ‘what kind of engineer do I want to be?’ and ‘what can my role look like as a professional engineer?’

University students who have run workshops through the EWB School Outreach Program reflected that this experience has helped build a picture of what engineering might look like for them. Reflections from participants in the Humanitarian Design Summit Program, some of which have been included as profiles and quotes throughout this report, support the theory that practical experience of engineering as a discipline with a social-focus, supports university students to create an engineering identity that motivates them to continue in the field.

Practical experience of engineering as a discipline with a social-focus, supports university students to create an engineering identity that motivates them.

## From having role models, to being a role model

Articulating the relevance and potential impact of engineering to younger students is motivating for students when returning to their own classroom.

Many initiatives which aim to attract and retain diversity in STEM fields already focus on the influence role models can have on others through, for instance, providing a real example of what an engineering career path might look like. Female role models in particular can be a powerful positive influence on young students, and challenge the existing gender stereotypes which young women are so frequently exposed to.

There are clear benefits for the individual acting as an Engineering role model.



This research highlights there are also clear benefits for the individual who is acting as an Engineering role model in these initiatives. University students who volunteer with the EWB School Outreach Program have the opportunity to speak to younger students about what an engineering career path might look like, and how engineers can make a positive influence in the communities where they work. These students have reflected that they are seeing the relevance of their university studies through this opportunity to articulate a vision of engineering to others. Leading EWB School Outreach workshops is a way to understand, and then be reminded of, the powerful role engineers can play in building a better world.

Leading EWB School Outreach workshops is a way to understand, and then be reminded of, the powerful role engineers can play in building a better world.

When considering how to attract and retain a diverse engineering sector, the influence of ‘role models’ should continue to be considered from the perspective of their potential influence on their audience. However, there is also an exciting opportunity to build on the core motivation and inspiration that comes from acting as a role model for others.

# Recommendations for Moving Forward

The research described in this report has explored the university student experience during EWB-coordinated Humanitarian Engineering initiatives, with the aim of further understanding links between the perception of engineering as a profession with a social purpose and gender diversity. The insights gathered provide the basis for a set of recommendations to be considered by academia, professional bodies, and industry interested in attracting and retaining a more diverse student cohort and, by extension, a more diverse engineering sector.

## **Increase the community focus of all engineering disciplines**

A growing body of research from across the university and school space is indicating that engineering courses with a clear social purpose and emphasis on positive outcomes for communities attract a more gender diverse student cohort. The gender diversity within EWB Humanitarian Engineering Education initiatives such as the Humanitarian Design Summit and Humanitarian Research Program provide further support for this trend. Additionally, across both programs, both men and women strongly identified both 'learning about and applying Humanitarian Engineering' and 'the possibility of making social change' as significant motivators for choosing to become involved.

Currently, EWB is uniquely placed to provide engineering students opportunities to learn about and apply Humanitarian Engineering principles; there are very few other opportunities, however these are growing. There is significant opportunity for other organisations across all engineering disciplines to explicitly embed a social focus into engineering teaching and practice. EWB programs have demonstrated that women in particular are motivated to engage with engineering experiences which have a social purpose at their core.

## **Provide opportunities to build an engineering identity**

EWB Humanitarian Engineering Education initiatives create pathways for university students to deepen their understanding of the engineering sector, share a vision of the role engineering might play in the world, and build out an identity as a 'Humanitarian Engineer'. Experiences

such as the Humanitarian Design Summit Program provide opportunities for university students to move beyond the theory discussed in a classroom, and be guided in a facilitated environment through a real experience of what engineering with positive community outcomes at the core might look like for them. Current university initiatives such as Formula SAE teams provide similar opportunities for students to participate in a real-world experience and build an understanding of what engineering might look like in practice.

Initiatives which support student understanding of Humanitarian Engineering practice through real experience should be strongly supported. These courses and programs provide opportunities for a diverse cohort of university students to see the relevance of their studies and create a vision of the type of engineer they want to be in the future.

## **Articulate this engineering identity to others**

This research has opened up the idea that university students who are starting their engineering journey are incredibly motivated by the opportunity to articulate their experience and future direction to others through the lens of Humanitarian Engineering. Engineers who have experience bringing a social focus into their work, or exploring how this might be done, should be given the opportunity to articulate their work to others.

## **Create platforms for values-aligned communities**

The Humanitarian Engineering Education initiatives coordinated by EWB engage students across disciplines, year-levels, and universities. They create a platform for students from a wide variety of backgrounds who share similar values to connect, network, and build relationships outside of the classroom. Bringing an awareness of these communities to young people across Australia could influence the amount of school students who see engineering as a career for them and a network they want to be a part of. Universities and businesses should also consider what opportunities exist within the organisation for students or employees to connect through a shared values-alignment; for example, through participation on pro-bono projects.



# What's Next

The initial research presented in this report provides a base for further investigation into the relationship between engineering education initiatives with a humanitarian focus and a diverse university engineering cohort. The three EWB initiatives discussed provide a rich context to begin to understand the implications of Humanitarian Engineering offerings on diversity in the university classroom, at a time when both humanitarian engineering and gender diversity are becoming increasingly prioritised at Australian universities.

There are many opportunities for further research to support confidence in these findings and address questions which rose along the way. For example, EWB is interested in a deeper understanding of how program participants have interpreted each of the options provided in the motivation survey, to clarify the trends seen so far and further the analysis. Additionally, extending the survey tool to compare responses from students engaged in Humanitarian Engineering initiatives versus those who have chosen other paths could generate interesting insights into differences which might exist between these groups.

The research process inevitably generates new questions along the journey, and there are many which EWB hopes to address in the future. As an example, while previous research has demonstrated the influence of family members and/or teachers on a student's eventual interest in STEM at university, the motivation surveys in this study had few or zero responses in this area. Very few students reported feeling motivated to sign up for Humanitarian Engineering initiatives due to encouragement from family members or friends. As this was not a prominent motivator, deeper analysis was outside of the scope of this study, it is an example of an interesting discovery which would benefit from further questioning.



The creative, innovative engineering teams which will be successful in addressing our global sustainable development challenges require diversity of so many types – the underrepresentation of women in the sector is just one hurdle.

While the research to date has focused on diversity through the lens of gender, EWB recognises a significant opportunity to build on this work through exploring diversity in other forms. The creative, innovative engineering teams which will be successful in addressing our global sustainable development challenges require diversity of so many types – the underrepresentation of women in the sector is just one hurdle. This research is a step into a deeper understanding of the EWB network, and should be considered a catalyst for further conversations on the influence of bringing a social-focus into the core of the engineering sector.

These findings provide a basis for further investigation into the relationship between engineering education initiatives with a humanitarian focus and a diverse university engineering student cohort.

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