The impact of the EWB Design Summit on the professional social responsibility attitudes of participants

Abstract

The Engineers without Borders (EWB) Design Summit is an international educational study tour primarily for Australian undergraduate engineering students. Since its inception in 2015, almost 1000 participants have experienced the two-week program, learning about human-centred design, working cross-culturally, and more generally about how engineering and technology can contribute towards creating positive change within communities. Design Summits have predominantly been held in Cambodia and India, as well as Nepal, Malaysia, Timor-Leste, and Samoa, with community-based organisations that EWB Australia already has an existing relationship with.

The Design Summit program has a number of aims, including 'nurturing future development leaders' and 'embedding people-centred values and approaches in engineering education'. To evaluate how well these aims are being met, a questionnaire was adapted from existing instruments that purport to measure multi-cultural competence [1] and the perceived social responsibility of engineers [2, 3]. The results from this latter part of the questionnaire are the focus of this paper.

This questionnaire was used in a pre-/post-/retention protocol with Design Summit participants. The results will be discussed in detail in the full paper. Although the analysis was confounded by a low completion rate (less than 8% of those who completed the pre-Summit questionnaire went on to also complete the 'retention' questionnaire, ~6 months after the Summit), one finding is clear.

There is a strong self-selection bias for students who participate in these programs, to have a strong sense of social responsibility. On the quantitative attitudinal questions they scored highly on these measures in the pre-Summit questionnaire, and since they topped out on these questions on the post-Summit and retention questionnaires it seems the instrument is not sensitive enough to reliably measure any attitudinal shifts that may have taken place.

Pre-Summit attitudes to professional responsibility were compared over the first six rounds of the Design Summit program, to see whether there had been any measurable changes in the successive cohorts attracted to the program as it has expanded in scale. No systematic changes were observed.

The Humanitarian Design Summit Program

Why

Student focused overseas mobility programs or learning abroad programs have increased in popularity at universities in Australia over the past decade; mobility programs have numerous benefits to students summarised by Potts [4]. The Humanitarian Design Summit Program was developed in 2014 by Engineers Without Borders Australia (EWB) to provide students the opportunity to develop a deeper understanding of the role Human-Centred Design and

technology play in creating positive change and explore first-hand the application of engineering and technical skills in developing contexts. The program offers an experiential service learning mechanism allowing students to reflect upon people-centred values and approaches in engineering, design and technology whilst at the same time supporting community organisations by generating ideas and engaging in two-way knowledge sharing.

Whilst there is a focus on learning the Program also aims to nurture the students to become future development leaders as well as to promote the professional development of staff working at the community-based organisations the program collaborates with.

The Design Summit is one part of a spectrum of educational and professional development opportunities offered by EWB for students and graduates to learn about humanitarian engineering [5]. The first step is the EWB Challenge, a competition for first-year engineering undergraduates to design sustainable engineering solutions with EWB's community partners in developing countries. While students participate in the Challenge from their home institutions, it offers a vehicle to develop personal and professional skills in human-centred design, sustainability, teamwork, and more, through the resources and interaction facilitated by EWB's relationship with the community partner [6]. Each year approximately 10,000 students participate in the Challenge, a small fraction of which go on to participate in a Design Summit. In their final year, students can choose to do their honours research project in humanitarian engineering, for example investigating low-cost building materials in Cambodia, or designing inexpensive prosthetic hands. Graduates and engineering professionals may also apply to be a EWB Field Professional, as a long-term volunteer working overseas in fields such as appropriate technology development, housing construction, or water and sanitation.

How

Six countries in South Asia and the Asia-Pacific provide the setting for each immersive learning experience or Summit (Figure 1). Each Summit runs over two-weeks in which students ultimately progress ideas through a human-centred design cycle. To deliver each Summit, EWB partners closely with local grass-roots community-based organisations that have a strong working relationship with communities. These partnerships ensure that students participate in a genuine, immersive community experience with a real opportunity for idea generation and two-way knowledge sharing. Measured learning outcomes for students include development of personal and professional skills, application of knowledge in a development context, recognition of development practices and use of human-centred principles.

The program has expanded since its launch in 2015 to now delivering 12 Summits a year with over 800 previous participants from 27 universities. Since the recording of program gender data began in mid-2016, 45% of program participants have identified as female. In order to maximise student participation and minimise disruption to university schedules each Summit is scheduled to run between semesters (Dec-Feb and Jun-Jul). Approximately half of students have their participation funded by Australian Government New Colombo Plan mobility grants. This grant requires the Summit form a formal part of a student's university course, whilst most students use the experience as part of required work experience the Humanitarian

Design Summit Program has been integrated into formal curriculum such as research thesis projects and as part of the 'Engineering in a Humanitarian Context' course at the Australian National University [7].

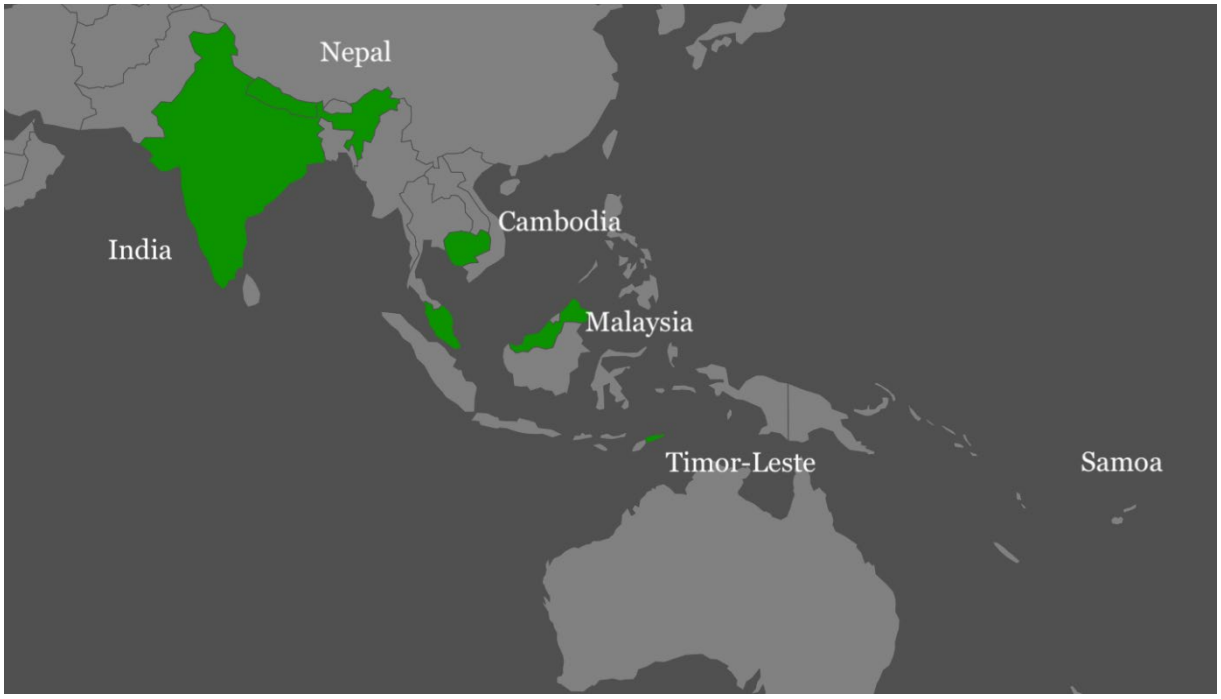

Figure 1: Location of Humanitarian Design Summits (created using AMCharts)

What

During each Summit, and irrespective of the country context, students are directed and supported by trained facilitators with expertise in engineering and community development, to provide a scaffolded way for the students to experience development and people-centred design in the field. Typically, 40-50 undergraduate students take part on each Summit. Fewer students than this is not cost effective to run because set-up costs and staff salaries do not scale, and more than this the logistical complexity and imposition on the community become too great.

The students are generally supported by three facilitators, three mentors and up to three academic fellows. Academic Fellow positions allow university staff to gain first-hand experience in humanitarian contexts, and then incorporate what they have learned into their own teaching [7].

Each Summit includes a mix of workshop sessions, cultural immersion activities and student-led investigations following the same structure. Generally, each Summit commences with four or five days of acclimatisation, hands on workshops and cultural immersions, typically in a major urban centre. Topics covered include community development principles, people-centred design, and cross-cultural communication. These activities prepare students for a four to five-day community visit, typically in a rural area. Summit participants are separated into groups, each with a facilitator and one or two mentors, and visit a different community.

Within these visits, smaller teams are formed to explore opportunities and challenges faced in the community (Figure *2*). Congregating again the Summit culminates with presentations of ideas to community members and organisations, which may include the presentation of prototypes and documents. The Design Summit is primarily a learning experience for both the community organisation and the students around how human-centred design can be used to develop low-cost and practical ideas.

Figure 2: Students in Kampot Province Cambodia assess community opportunities (picture Nick Brown / EWB)

Study Design

To evaluate in part how well the aims of the Design Summit are being met, a questionnaire was developed from existing instruments that purport to measure multi-cultural competence [1] and the perceived social responsibility of engineers [2, 3] – the Engineering Professional Responsibility Assessment. This latter section of the questionnaire is the focus of this paper.

A pre-/post-/retention protocol was used in which students on the Design Summits were required to initially complete the questionnaire as part of their pre-departure preparations. They were also asked to complete the questionnaire at the end of the Design Summit. Where possible, this took place in a timetabled session on the last day of the Summit, or otherwise students were given a link to complete the questionnaire online and asked to complete it as soon as practicable. Finally, approximately 6 months after the conclusion of the Summit,

participants were emailed a request to complete the questionnaire a third time, to collect the 'retention' data.

The Engineering Professional Responsibility Assessment

The Engineering Professional Responsibility Assessment (EPRA) instrument was developed to measure students' social responsibility attitudes and operationalize the professional social responsibility development model [3]. This model characterises the development of social responsibility using three realms [8] (see Figure 3 and *Table 1*).

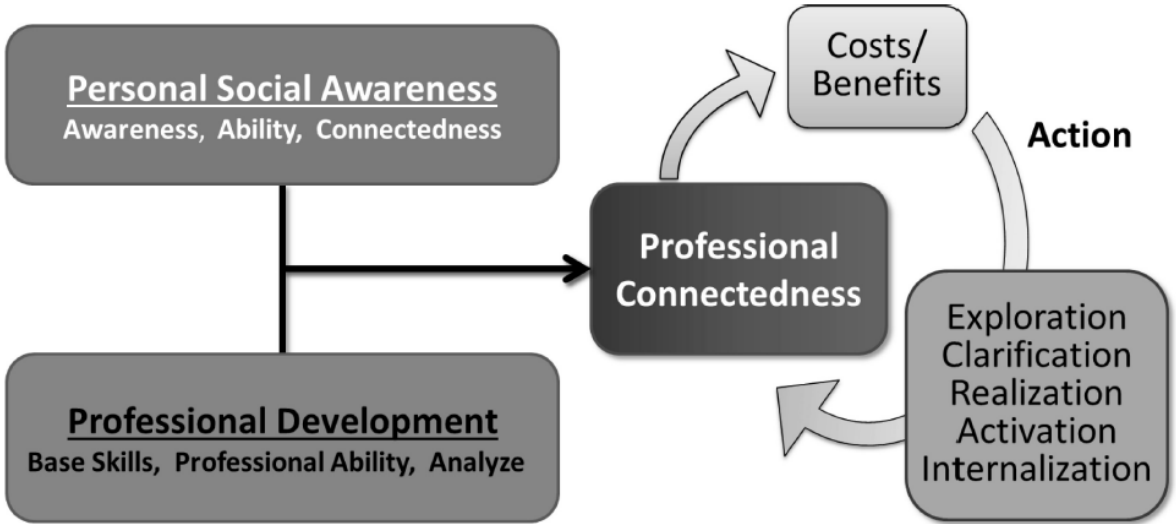

Figure 3: Professional social responsibility development model, from Canney and Bielefeldt [8]

Table 1: Realms and constituent dimensions of the professional social responsibility development model, from Canney and Bielefeldt [8]

Realm	Description	Dimensions
Personal Social Awareness	Development of a feeling of moral or social obligation to help others	**Aw**areness
		Ability
		Connectedness
Professional development	The inclusion of social considerations and understanding social context in the engineering design process	**Ba**se skills
		Professional **a**bility
		Analyze
Professional connectedness	Cyclical merging of the other two realms whereby taking action leads to more developed personal and professional social responsibility	**P**rofessional **c**onnectedness
		Costs-**b**enefits

The EPRA instruments consists of 50 Likert-scale items as well as questions on desirable job attributes, volunteer history, and demographics. The Likert items are the main component of the instrument with the other sections offering some convergent evidence of validity [3]. Each of the 50 Likert-scale items are mapped to one of the eight dimensions, and have a 7-point response scale from 'strongly disagree' to 'strongly agree', or from 'very unimportant'

to ‘very important’, depending on the particular wording of the question. Sample items are listed below in Table 2. Underlined items are scored in reverse as they are negatively worded.

Table 2: Representative questionnaire items from the different dimensions

Dimensions	Sample item
Awareness	Community groups need our help
Ability	I can make a difference in my community
Connectedness	I feel an obligation to contribute to society
Base skills	How important is ethics for a professional engineer
Professional ability	Engineering skills are *not* useful in making the community a better place
Analyze	I would *not* change my design if it conflicted with community feedback
Professional connectedness	It is important to use my engineering abilities to provide a useful service to the community
Costs-benefits	I believe that extra time spent on community service is worthwhile

Results

Data was collected on the first six Summits in Cambodia, and the first two Summits in India, in total spanning a period from January 2015 to February 2016. Pre-departure questionnaire data was also collected from several students intending to participate on the planned July 2015 Summit in Nepal, but this Summit was cancelled after the earthquake of April 2015.

Response and completion rates

Over the entire study, 559 questionnaire responses were submitted. Of these, some were omitted from the analysis for various reasons. Twenty-one questionnaires had no responses to the 50 Likert-scale questions analysed in this paper, and a further 15 were removed because less than 65% of the questions were answered (all other submissions had more than 90% of questions answered). Six of the questionnaires failed an internal validity check, by not responding to the statement *“Please mark “3” if you are reading this question”* with a 3. A further four sets of responses were removed because in each case the individual had submitted two sets of responses for the same stage of testing. The response rates and completion rates for the final set of submissions are indicated below in Table 3.

Table 3: Response and completion rates

Testing Stage	Submissions	Response Rate (%)	Completion Rate (%)
Pre-	296	95.2	99.7
Post-	205	66.8	99.6
Retention	24	7.8	99.8

Ceiling effect

Questionnaire responses to all items, across all three stages of testing, showed a strong ceiling effect in that responses were clustered at the high end of the scale. The percentage of negative responses was calculated for the whole set of responses. More than 26,000 responses to items were submitted, and of these only 3.8% were scored negatively.

The percentage of negative responses was also calculated separately for each of the 50 items. The median percentage was 2.2%. That is, half of the items had fewer than 2.2% negative responses (i.e. responses of Strongly Disagree, Disagree, or Slightly Disagree). Only six items had a proportion of negative responses greater than 10% (Table 4).

Table 4: Highest rates of negative responses

Item	Negatively-scored responses (%)
pc9: I feel called by the needs of society to pursue a career in engineering	19.5
pc8: The needs of society have no effect on my choice to pursue engineering as a career	15.0
pc4: Community service should *not* be an expected part of the engineering profession	13.5
pc7: I feel called to serve others through engineering	10.7
pc15: I believe that I will be involved in social justice issues for the rest of my life	10.7
pc6: I view engineering and community service work as unconnected	10.7

Across all eight dimensions of the EPRA, results were clustered around the high-end of the scale – corresponding typically to an 'Agree' response. There was no consistent pattern of change between either the pre- and post- stages, nor between the post- and retention stages (see Figure 4). In any case, drawing any conclusions from the comparison of the post- and retention data is dubious because of the low response rate at the retention stage. The comparison between the pre- and post- data, with only small variations amongst the results clustered at the high end of each dimension, suggests both that there is a strong self-selection bias in the students that participate in the Design Summits, and that if there are any meaningful attitudinal shifts before and after the Design Summit, this instrument is not sensitive enough to detect them convincingly.

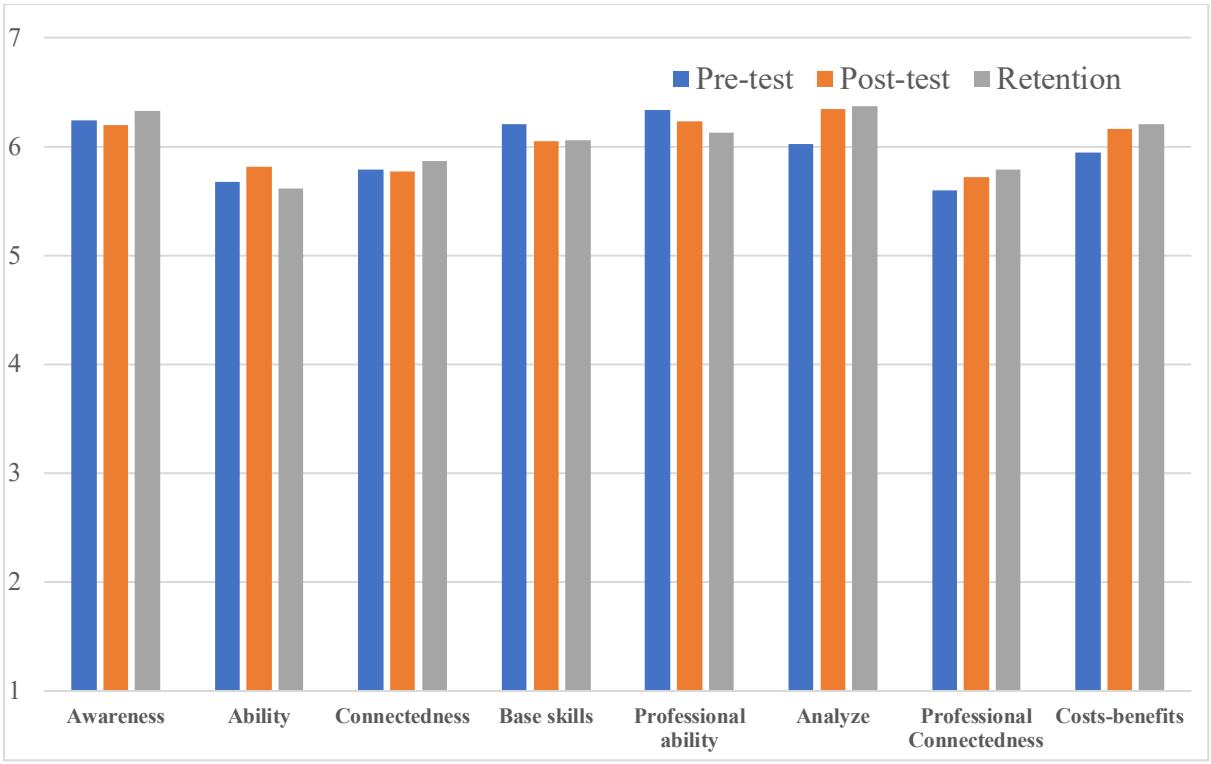

Figure 4: Averaged responses to the different Professional Responsibility dimensions

Comparing successive cohorts

The EWB Design Summit program has quickly expanded from its first offering in January 2015, with five Summits that year, to now running 12 Summits each year. A question that has been raised by EWB staff is what effect has expanding the annual program intake had on the calibre of students who participate – as the popularity and renown of the program has grown, is it attracting more mainstream students who have not previously been as committed to EWB's values as perhaps the first intake, or by increasing the pool of applications is the program attracting a greater number of high achievers?

Questionnaire data was collected from the first six rounds of Design Summits from January 2015 to February 2016. Pre-Summit data has been collated against the three realms of professional responsibility identified in the EPRA (Figure 5). Insofar as these measures reflect the calibre of student participants, the scores have been consistent and, if anything, show a subtle upward trend. The growth of the Design Summit programs has not lead to any measurable reduction in the calibre of participants.

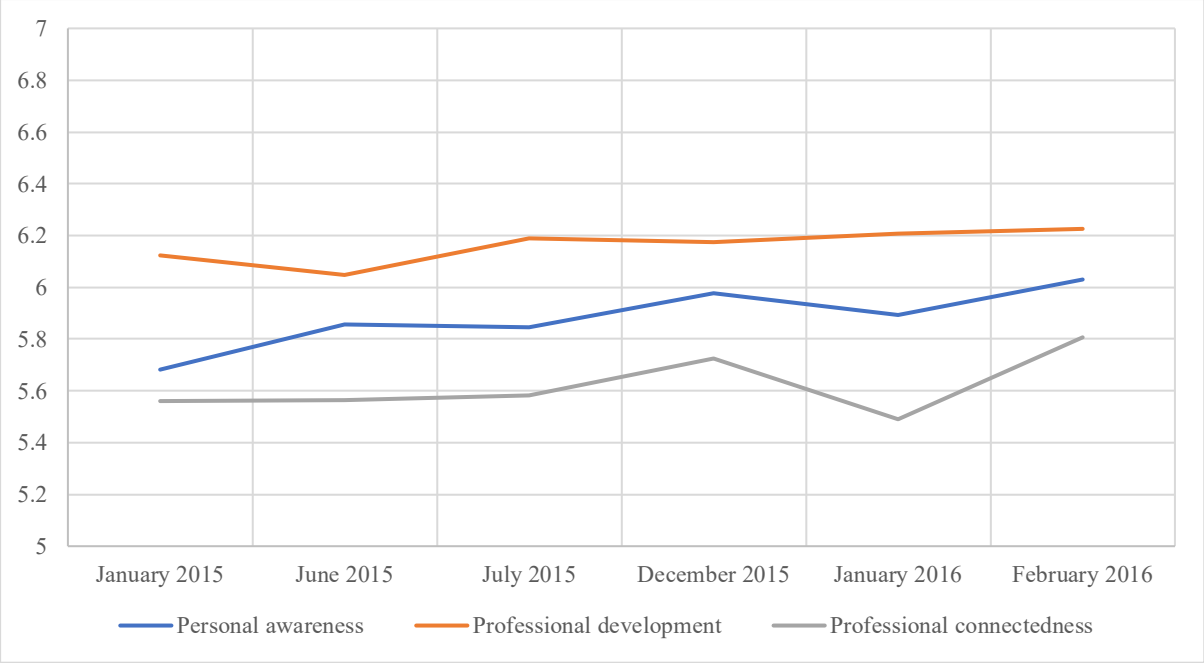

Figure 5: Professional responsibility realms aggregated over Design Summit rounds

Conclusions and Future Work

The EWB Design Summit continues to attract students with a well-developed sense of professional responsibility. However, any further developments in the different dimensions of professional responsibility are difficult to measure because incoming students are consistently scoring near the top of the scale. A more nuanced instrument is required to investigate this area. An alternative, but indirect, measure of the program's success is tracking how many Design Summit participants go on to complete final year research projects in humanitarian engineering, or volunteer as EWB Field Professionals. This data is being collected and will be systematically analysed in the future.

Other areas of future work include establishing the reliability of this survey instrument in an Australia context by comparing pre- and post- data for specific individuals, and exploring the internal validity of the instrument by comparing responses to the Likert-type questions discussed above with other question sections from the Engineering Professional Responsibility Assessment.

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