

Professional development within study abroad programs for engineering educators to gain confidence in preparing students to contribute to the Sustainable Development Goals

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CONTEXT

Engineers of the future will play a vital role in working towards the universally recognised Sustainable Development Goals (SDG's) which have set the development agenda until 2030. Engineering graduates need to be equipped and empowered to tackle the global issues of poverty, sustainability and inequality yet a lack of knowledge amongst engineering educators of these issues has been suggested as a barrier for universities in preparing their students to be able to make an impact in this area. Limited opportunities currently exist for engineering educators to gain valuable real world experience in development practice. An Academic Fellow program exists that provides opportunities for engineering educators to be exposed to development contexts and human centred design approaches as part of a two-week immersive educational experience. This paper explores the impacts that this program has had on the professional development of participating engineering educators as well as their perception of their motivation, capability and confidence for preparing future engineers to address the Sustainable Development Goals.

PURPOSE

This research aims to shed light on whether academics who engage in Engineers Without Borders (EWB) Humanitarian Design Summit program, an immersive education program overseas, working alongside humanitarian engineering practitioners and trainers in a development context are more capable of and motivated to prepare student engineers for a career that contributes towards the SDG's.

APPROACH

In order to understand changes in behaviour and actions of engineering educators participating in the research a series of three interviews are conducted, one before the in-country development experience, one immediately after and one a full year after the experience. The research presented here includes an analysis of the post experience responses of eleven engineering academics and researchers to questions across areas of research, teaching and professional development.

RESULTS

All participants either agreed or strongly agreed that as a result of being an Academic Fellow they feel both 1) more capable of and 2) more motivated to prepare students to contribute towards the SDG's. The majority also added that their own impact on the SDG's was likely to come through the education of students rather than direct action. The vast majority have incorporated skills, techniques or anecdotes gained from the program into their teaching or research supervision, the caveat being that some of the techniques are hard to incorporate into the classroom due to large class sizes.

CONCLUSIONS

The Academic Fellow program has been shown to have immediate benefits to participating engineering educators, both in their teaching practice and professional development; a clear improvement in preparing engineers to contribute to the SDG's was only dampened by the fact that there was still not a high level of understanding amongst the participants on the details of the SDG's themselves. Overall the Academic Fellow program has had a positive impact on the professional development of participating engineering educators with these opportunities identified as being not readily available at their universities.

KEYWORDS

Professional Development; Humanitarian Engineering; Sustainable Development.

Introduction

The commencement of the Sustainable Development Goals (SDG's) in January 2016 was another reminder that the world faces a number of complex challenges that will require innovative thinking around poverty alleviation, sustainability and social justice. The goals, coordinated by the United Nations (2015) and adopted by governments around the world, set the global development agenda until 2030. With universal acceptance also comes the realisation that to achieve the 17 goals and 169 targets governments need to collaborate with not only development non-governmental organisations (NGO's) but also industry and importantly academia. The importance of engineering, across all three of these sectors in achieving the goals is apparent. Sinha (2015) believes that "engineers will play a vital role in meeting the challenges laid out by the newly adopted Sustainable Development Goals", with participation by engineers critical in meeting goals 6, 7, 9 and 11.

In the UNESCO (2010) publication *Engineering: Issues Challenges and Opportunities for Development* the authors stated that "Now and in the years to come, we need to ensure that motivated young women and men concerned about problems in the developing world continue to enter the field in sufficient numbers". It is therefore clear that universities in Australia need to be graduating engineers who are capable and motivated to make a positive contribution to the development agenda. Unfortunately, a lack of exposure and first-hand knowledge of global issues and development contexts amongst university staff may be limiting the impact that graduating engineers can have on the SDG's.

Limited opportunities currently exist for engineering academics to gain valuable real world experience in development practice which would allow them to disseminate gained knowledge or mindset to their student cohorts. In an academic landscape currently dominated by a 'publish or perish' mentality there is the potential for humanitarian and development experience to be seen as detrimental to professional development as it detracts from an academic's key performance indicators. Opportunities for humanitarian engineering development can sometimes be reserved for those with prior development experience or those located in dedicated research groups and centres such as the International Water Centre and the Engineering, Communities and Environment research group at the University of Western Australia, that have a strong development engineering focus.

The opportunity

Through an existing program, namely the Humanitarian Design Summit program, Engineers Without Borders Australia (EWB) provides the opportunity for academics to be exposed to development contexts and human centred design approaches in an immersive environment. The 'Academic Fellow' position allows participating academics to work alongside development practitioners and educators in a developing country whilst supporting the delivery of content to students. They are also supported with written resources, such as a comprehensive toolkit of workshops and activities, and a two-day training course prior to departure to further prepare academics for the experience. One of the aims of the Design Summit program is "to embed people-centred values and approaches in engineering, design and technology education" (EWB, 2016), however, the opportunity exists to investigate and gain valuable insights into the impact that these immersive experiences can have on an academics teaching, research, professional and personal development. Unlike most global mobility programs that are either targeted at students or academics, the Design Summit program provides a platform for academics to develop alongside students in a teaching and also learning role.

Overseas mobility programs

Student focused overseas mobility programs or learning abroad programs have increased in popularity at universities in Australia with their benefits to students summarised by Potts

(2016). There are also benefits of academics being involved in visiting, teaching and researching at universities abroad. Suarez-Ortega & Risquez (2014) highlighted that (with respect to female academics) “mobility impacted positively in their professional profile and was perceived as an enabler of career” and offering the potential for international collaboration. The mechanisms for this form of academic mobility are also established in Australia (e.g. Sydney South East Asia Centre, 2016). Such programs enable academics at universities in Australia to engage with universities in the Asia-Pacific region.

In a more limited way, the benefits of shorter-term academic mobility have been researched. In the 1980’s universities in the U.S. were trying to incorporate more international content into their courses. In programs, such as those run at Concordia College, academics had the opportunity to spend three weeks in a developing country that included language and immersion training. The benefits of these trips on academics and course development are described in Sandgren, Ellig, Hovde, Krejci, & Rice, (1999) with the experience having the intended benefit of leading to more globalised classes and an academics own professional and personal development which was described as increases in ‘self awareness’ and ‘social awareness’.

The Humanitarian Design Summit Program

The Engineer’s Without Borders Australia Humanitarian Design Summit program is a two-week overseas study tour designed to allow students to develop a deeper understanding of the role design and technology can play in creating positive change within developing communities. A key component of the learning experience is ensuring that students participate in a genuine, immersive and mutually beneficial experience with a rural community. To deliver the program, EWB partners closely with local organisations that have a working relationship with grass-roots communities. Over the course of the program the engineering, design and technology students co-create ideas with community partners for the partner’s projects. 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. Student teams are 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.

Since January 2015, over 450 students have participated in the Humanitarian Design Summit experience from 27 universities. A substantial number of these students have received Australian Government New Colombo Plan mobility grants to fund their experience. The Humanitarian Design Summit program has been embedded into formalised curriculum at many universities through work experience, research projects and for credit courses.

To date 14 engineering academics from a range of Australasian universities have attended a Design Summit in the role of Academic Fellow. The role has allowed these academics to gain crucial knowledge and exposure to humanitarian engineering. The immersive experience allows academics to inform their teaching, research and professional development and to impart gained knowledge to their student cohorts on return.

Academics are required to submit a written application and participate in an interview to be selected for the Academic Fellow role. Once selected, a two-day training retreat is held with the program facilitators alongside the academics. The training retreat covers the logistical arrangements for the program as well as community partner information and an introduction to community development. In the field, the academics work alongside the facilitators to guide students through the program workshops, community immersion and design process. In doing so, participating academics both lead the program and learn from the expertise of the facilitators, community partners and the immersion experience itself. Attending academics are also encouraged and supported by EWB to relate the program to their field of expertise and to connect with local organisations and institutions while in-country.

Objectives

The overarching objective of the research is to determine if engineering university staff participating in the Humanitarian Design Summit program have increased capability and motivation to work towards the SDG's either directly or through the education of students.

This paper introduces the first component of the research and investigates the initial impact that the Humanitarian Design Summit program has had on an Academic Fellow's perceptions of changes to their motivations and capability to have impact against the SDG's. The research also investigates the ways in which the Academic Fellows feel the program will have an impact on their university activities, including teaching and research as well as professional and personal development. Future research will focus on whether the perceptions translate into actual changes in motivations or capability of the students as well as looking at the long-term effect of the Humanitarian Design Summit program on teaching practices.

It is expected that this research can be used by organisations and universities to provide evidence based decisions on providing academics with these types of professional development opportunities. It is also hoped that this research will make a contribution to the understanding of the effectiveness of novel and complex passive teaching environments on academic development.

Methodology

In order to meet the objectives of the research, a longitudinal cohort study method has been employed to track the behavior and mindset of the participating Academic Fellows over an 18-month period. The primary data gathering mode is one-on-one interviews including structured questions with a mix of quantitative and qualitative responses recorded. The study will focus on identifying any influence that participation in the Humanitarian Design Summit program as an Academic Fellow might have on five areas. These five impact areas were identified through informal discussion with the Academic Fellows and the analysis of motivation statements submitted by six Academic Fellows. For reference, the term humanitarian engineering is discussed in Turner, Brown, & Smith (2015). The five impact areas are:

1. **Teaching environment** – To identify changes in the way the Academic Fellow presents their course material e.g. including more service based learning or smaller group activities.
2. **Research** – To identify changes in research focus e.g. applications for research grants, specifically related to humanitarian engineering and sustainable development.
3. **Humanitarian design and experience** – To identify changes in the content taught e.g. the use of humanitarian engineering examples.
4. **Sustainable Development Goals** – To identify changes in perceptions of understanding of the goals as well as understanding of personal impact.
5. **Professional Development** – To monitor changes in capability, skills and overall development.

For the same Academic Fellow, a series of three interviews are conducted with each containing questions relating to the five impact areas listed above. For each question a specific indication response e.g. yes/ no or agree/ disagree is recorded and then a longer explanation is recorded and the responses coded. Where possible a key quote is also captured for the response to each question.

The timing of the three interviews is as follows; 1) Post-application to the program but before the in-country development experience, 2) immediately post in-country development experience and 3) two semesters after the in-country development experience. The first

interview generates a baseline of data, establishing what the Academic Fellow is expecting and what they want to gain from the experience. The second interview records the immediate impact of the experience on the Academic Fellow and a check is made against the baseline to see if the development experience met the Academic Fellow's expectations and finally uncovering any expected change in future behaviour. The final interview, a full two semesters on, provides an insight into whether the anticipated, expected or stated changes by the Academic Fellow are actually realised and put into practice.

This research is a work in progress, this paper relates only to the analysis of the post experience interviews (interview two) of eleven Academic Fellows. It should be noted that in this study all fellows have teaching and/or research responsibilities in the engineering departments of universities in Australia and New Zealand and the majority of the respondents self-identified as being 'early career' academics, with two PhD students who have teaching and research supervision responsibilities. To preserve anonymity each Academic Fellow is given a respondent number. Additionally, it should be noted that not all of the Academic Fellows included in this paper went on the Design Summit program at the same time. As the program itself has expanded, from a single trip to Cambodia in January 2015 (with one Academic Fellow), two trips to Cambodia in June-July 2015 (with two Academic Fellows), five trips across India and Cambodia in December to February 2016/2016 (with eight Academic Fellows) and three trips across Cambodia and Malaysia (with three Academic Fellow).

Results and Discussion

In this paper the first set of results, taken from the post-Design Summit interviews, are discussed. In this section the responses to questions in the five impact areas outlined in the methodology are presented and discussed.

Impact area 1 - Teaching environment

Questions on teaching environment intend to identify changes in the way the Academic Fellow presents their course material. Academic Fellows were asked if as a result of attending the Design Summit as an Academic Fellow they intend on changing their teaching methods? Of those fellows who had teaching responsibilities an overwhelming majority gained from learning the facilitation techniques and 'tools' that are used on the HDS program, responses included:

"You come back with a big toolkit of ideas that you can use when you are teaching things like the EWB challenge" – respondent 8

"I now have a larger repertoire of tools ... that are proven as opposed to just reiterating the same old tools that tend to get stuck in academia" – respondent 7

"I was really impressed with the type of workshops you have put together, the role playing and scenarios ... and you use a lot of energizer activities and it is a really personable and interactive experience... I have definitely tried to build that into how I start off my course... I think those activities are really good at keeping the students motivated and at ease" – respondent 3

On changing their own teaching environments to be more like the one on the Humanitarian Design Summit program i.e. small facilitated discussions, there was a feeling that the style was effective but that it would be hard to scale to accommodate a large class size. Two respondents felt that the Humanitarian Design Summit program was unlikely to have an effect on their teaching, however this was because they were already using best or leading practice, one respondent commented:

“My teaching is reasonably informed by the current literature, so I do a lot of active learning in my classes” – respondent 10

Additionally, Academic Fellows who had been on the Design Summit with another academic noted that they picked up facilitation tools not just from EWB’s program delivery team but also from the other Academic Fellows.

Impact area 2 - Research

Research was the impact area where the Design Summit program had the least immediate influence, the benefit was seen as coming over a longer period of time with academics being able to take on humanitarian research over time. Academic Fellows were asked if, as a result of attending the Design Summit, they were more likely to apply for funding for a research project with a humanitarian engineering element. At the time of the interview one respondent had already used the Design Summit experience in an application for research funding. Research benefits mentioned by fellows included a) more able to understand research opportunities and collaborations in developing contexts b) more able to make research connections whilst in country c) increased understanding of the context to be able to put forward research applications. An example response:

“experience has provided me with more confidence to apply for research in this field” – respondent 8

Additionally, over half of the respondents mentioned, without being prompted, that they felt more confident and capable to supervise final year students who were undertaking research with a humanitarian engineering element as they could provide feedback and advice from their own experience. One respondent said:

“Having awareness of the human centered design process and challenges of engineering in developing contexts has helped me prepare my students for the challenges they are going to face in a research project” – respondent 6

However, there were also doubts about the practicalities of applying for research funding with a humanitarian engineering element. Namely they already had technical research in their ‘core’ area of interest and were unlikely to be able to take on new research at this time.

Impact area 3 - Humanitarian design and experience

In terms of positive impact on teaching the incorporation of humanitarian design principals and first-hand experience had by far the most positive response over the five impact areas. Academic Fellows were asked if, as a result of attending the Design Summit, did they intend on incorporating more humanitarian engineering elements into their teaching. In a similar manner to the types of responses for teaching environment the two respondents who mentioned they were unlikely to incorporate more humanitarian engineering content were because a) they already included a lot of humanitarian engineering content in their course or b) they felt their current teaching load was so technical and maths focused that there was no way of inserting humanitarian engineering concepts.

The other 9 respondents all mentioned an increase in the incorporation of humanitarian engineering content into their class. A few example responses include:

“My opening lecture, which introduces the role of an engineer in society, I now have a whole section on humanitarian engineering as I think it is important that people don’t think engineering is just about maths and physics, it’s about people.” – respondent 3

“After I went on the Summit, I rejigged my course...I moved to more of a spiral model, where we spend the first two or three topics empathising.” – respondent 1

With those Academic Fellows who already teach humanitarian engineering content in their class there is the concept that they had been teaching from a far field approach and now can bring real world experience back into the classroom with legitimacy, an example response supporting this was:

“I’m able to draw on personal experience when talking about community engagement, before this it was all based on reading” – respondent 7

Impact area 4 - Sustainable Development Goals

The Design Summit program looks to teach humanitarian engineering principals, human centred design and strengths based approaches and not explicitly the sustainable development goals.

On a positive note all of the respondents either strongly agreed or agreed that they felt more motivated to prepare students to contribute towards the SDG’s and the same was true when asked if they felt more capable of preparing students. However, of interest was that when asked how familiar the fellows were with the SDG’s on a scale of 1 -10 the most frequent response was 5, almost neutral. This response was accompanied by an explanation that they were familiar with the general concepts and themes but not with the individual goals. There appears to be a disparity between the self-identified capability of talking about the sustainable development goals and the self-identified understanding what the goals actually are. This leads to further research opportunities to investigate if the Academic Fellows perceptions of their increased motivation and capability translate into a revealed improved understanding for their students and also to investigate whether having a high understanding of the SDG’s themselves or simply presenting the ‘spirit’ of the goals is more important on student outcomes.

When asked how the fellows felt they were going to have an impact on the SDG’s the overwhelming response was that it was going to be through teaching of students.

“It is actually the students who [will] make the change” – respondent 9

Impact area 5 - Professional development

The impact area with the most questions and debate related to professional development. Reflecting on immediate benefit of the program on themselves nine strongly agreed that they felt more energized about their work having attended the Design Summit; the two fellows who were not more energized felt that as their day to day work was not related to the summit they were not necessarily more energised to return to it. All strongly agreed that the Humanitarian Design Summit program was the most fun professional development experience they had done in the last year with some saying most fun of all time. All agreed that it was a positive experience on their professional development, with comments including:

“At a university working group I was asked what the most interesting thing I had done in teaching and I mentioned the [Humanitarian Design Summit] program. It was an extraordinary experience of student learning without all the things we typically call a university class, but we witnessed the most learning outcomes” – respondent 1

“It is not just professional development it is personal development that effects professional activity” – respondent 2

Additionally, respondents commented that this sort of international training was rarely available to them. Professional development for the academics was revealed to be mostly workshops or external trainers.

Importantly the fellows were asked to identify the top three skills that they felt they gained or most improved on the Humanitarian Design Summit program. Interestingly there were a wide range of skills declared covering many themes. The list below shows the skills mentioned, with the frequency of mention included in brackets.

- Applying principals of human centered design (4)
- A strengths based approach / community engagement (4)
- Cross cultural communication (3)
- Student teaching / engagement / Interaction (3)
- Observation / Listening / appreciating others opinions (3)
- Student pastoral care (2)
- Facilitation (2)
- People management in novel environments (2)
- In community experience
- Problem Identification
- Leadership,
- Adapting to challenging situations,

As previously mentioned the training for the Humanitarian Design Summit program includes a two-day retreat. Noting the role of this retreat in the development of these skills, fellows felt they were able to learn things on the retreat and put into practice on the summit. Many respondents commented on how the Design Summit connected them to a network of other academics with similar interests.

Conclusions

The Academic Fellow program has been shown to have immediate benefits to participating engineering educators, both in their teaching practice and professional development. Academic Fellows have the perception that they are now more motivated, capable and confident in preparing engineers to contribute to the SDG's. Overall the Academic Fellow position has had a positive impact on the professional development of participating engineering educators with these opportunities identified as being not readily available at their universities.

One consideration of this research is that the engineering educators who have taken on a role as an academic fellow are likely to be those who are most interested in increasing their awareness and participation in humanitarian engineering. It is therefore important to continue this study and compare results with those Academic Fellows who join the program later and may not hold as high level of interest.

One unintended consequence of this research is that it has increased the sense of community within the Academic Fellow alumni. From potentially being the only person in their department or discipline with an interest in humanitarian engineering they have met others who share an interest.

The analysis to date has shown that there are significant changes that an Academic Fellow goes through and that they intend to translate that into the classroom. Further research is required to determine if this actually happens and is effective.

This initial research has also shown that the full impact of the Humanitarian Design Summit program on an Academic Fellow's professional development might not fully be realised in a year from the Design Summit experience. Therefore, an extended study period is being considered. In order to go beyond perceptions of change the investigation team are considering looking at student surveys to see if there are any actual changes to the way a course is taught. To be determined is the sole impact of the Design Summit program, in order to enact change other interventions may be required to support changes in professional direction that an academic may choose. As a work in progress there will be future publications on the long term impacts of the program along with an analysis of future Academic Fellows.

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