

Curiosity Connections – Women Like Me



Final Summary Report August 2019



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1. Executive Summary

Only 11% of engineers in the UK are women. For democratic, utilitarian and equity reasons this is not enough. Both recruitment and retention are important – more girls need to connect with engineering as a creative, socially conscious, collaborative discipline, and more women need to be supported to make a difference in the workplace.

The 'Curiosity Connections – Women Like Me' project aimed to change this through tiered mentoring and role modelling. Previous Ingenious research by Laura Fogg-Rogers indicates how important peer group and leadership support is for women, providing vicarious experience and changing social norms. This means that women need peer support to thrive in the workplace, and that girls need to see women succeeding in STEM careers in order to feel that engineering is for them.

This project therefore paired 21 mid-career (senior) women engineers with 21 junior women engineers (less than five years' experience) in order to provide career and public engagement mentoring. The engineers were 71% White British, 18% White International, and 12% BAME. The women were recruited from local engineering businesses in the West of England through collaboration with the WISE Bristol Hub and the West of England STEM Ambassador Hub. The engineering industries were widespread and included aerospace engineering, mechanical engineering, civil engineering and electronic engineering.

The women engineers received training in mentoring in October 2018 and April 2019. Each pair met at least twice throughout the project, with career progression and work/life balance being the most discussed topics, despite these not being the expected topics at the beginning of the project. Many of the mentors will continue to meet beyond the project lifetime, and it has been so successful we will start a new round of the Mentoring Project in Autumn 2019.

The results of the project are being compiled into a Manifesto for Mentoring. The junior engineers received training in education outreach in October 2019. Opportunities for public engagement were communicated through collaborations with local industries and science communication projects, including the Clifton Suspension Bridge, Show of Strength Theatre company, Aerospace Bristol, 'I'm an engineer, get me out of here', Primary Engineer and the Leaders Award, the Great Science Share, Technotopia, and several local schools and Academy chains.

The outreach activities resulted in over 10,240 children being engaged in public engagement with women engineers. Young girls were consequently exposed to confident female role models, with an impact both in the workplace today, and for the future of the profession. All activities have been communicated and made freely available through Curiosity Connections Bristol <https://curiositybristol.net/>.

Perhaps most significantly, the junior engineers reported that they feel significantly more equipped to take part in public engagement, with 54% of junior engineers feeling fairly well equipped before the project, but this

increased to 68% after the project, with 38% indicating they were very well equipped. Similarly, the mean score on the Engineering Outreach Self-Efficacy Scale significantly improved from 6.80 to 8.41 (out of 10). This indicates that the engineers are now much more confident to undertake education outreach, and are then more likely to continue public engagement following the project. We therefore conclude that mentoring is highly important to ensure a supportive workplace, which means that women are more likely to be retained in the engineering industry. Consequently, there are then more female role models to represent women in engineering, which will change perceptions of engineering as a career. Providing training for women engineers in engineering outreach, along with supported opportunities for public engagement, is also essential to improve engineers' self-efficacy for education outreach. This means that more girls will meet positive female role models in engineering, which we hope will improve gender diversity in future STEM careers.

Key project successes:

Coordinator for Public Engagement

Having someone who can be a point of contact for the engineers is essential in order to take the hard work out of public engagement organisation. This also meant many organisations contacted us to recruit diverse women engineers to take part in their events.

Peer mentoring

The junior engineers stated that they benefitted from meeting other engineers in the same position – as a woman in engineering and also learning about public engagement.

Vertical mentoring

The junior and senior engineers benefitted from encouraging others to continue in engineering. They want to see more women in engineering and recognise the need for industry support.

2. Project Objectives

- Train 20 mid-career women engineers to enhance their mentoring skills in order to support other women in the workforce.
- Train 20 junior women engineers in education outreach skills to enhance their ability to do public engagement and be role models for young girls.
- Provide a networking workshop for all 40 engineers at the beginning (October 2018) and end (April 2019) of the project in order to support peer mentoring.
- Pair up the 20 women engineers and 20 junior engineers and support the development of 20 mentoring relationships. At least two meetings will be required between each pair.
- Coordinate outreach activities to enable the junior engineers to perform education outreach in primary schools. The materials and guides for these activities will be freely available after the project on the Curiosity Connections website <https://curiositybristol.net/> and social media.
- Coordinate 60 outreach events at regional primary schools and local public events. Each junior engineer will be encouraged to do 3 outreach interactions.
- Target primary school children from the bottom 25% of deprived neighbourhoods in the West of England. The engineers will either visit the children in their schools, or will attend neighbourhood outreach events at local science centres and events (e.g. 'We the Curious' or Bristol Aerospace community open days).
- Disseminate the resources and outcomes from the project for other women engineers and STEM Ambassadors.

3. Project Activities

Website: <https://blogs.uwe.ac.uk/engineering/tag/women-like-me/>

Twitter: <https://twitter.com/EngOurFutureUWE?lang=en>

Target	Delivery	Outcome
Two training sessions for 40 engineers	Four training sessions for 84 engineers	Exceeded – our first training event reached 30 women engineers who had signed up to the programme. Our second event reached 7 of the junior engineers who wanted to improve their outreach skills. Our third event was a panel discussion about women in engineering, with 6 women engineers involved. Our final event attracted 48 regional engineers who attended to learn about women’s mentoring and to participate in a WES wikithon.
60 x outreach activities delivered by 20 junior engineers	77 outreach activities delivered by 26 junior engineers	Exceeded – in total we enrolled 26 junior engineers. Some did not complete any activities, but others showed great commitment and completed more than the three each that we aimed for. Our engineers recorded a reach of 10,243 children through school and public outreach activities. This can be regarded as a minimum, as in some cases engineers had only minimum estimates for numbers reached, e.g. through their own company events. Most audiences were mixed male/female populations.
40 mentoring sessions for junior engineers, delivered	42 mentoring sessions delivered by 26 senior engineers	Exceeded – in total we enrolled 26 senior engineers. These numbers can be assumed to

by 20 senior engineers		be minimums as we know that two mentors have gone on maternity leave during the reporting period – while they didn't record mentoring sessions, they have been actively engaged in the project.
Outreach activities	Four outreach boxes were utilized: Wind farms Thymio Robots Technology 4 Fun Lego Mindstorm robots	The initial target of outreach boxes was not met, as we found that the engineers wanted to develop outreach materials about themselves and their work, or alternatively to support existing events. Instead we supported them to develop their own ideas.

4. Evaluation

4.1. Methods

Full Ethics Approval was gained from the University of the West of England, Bristol Ethics Committee. The engineers were assessed using open and closed questions in a questionnaire at the beginning and end of the project. This examined their experience with public engagement, their views of women in engineering, and their views on the project. The Engineering Outreach Self-Efficacy scale was also used before and after the project to assess change with the junior engineers. The quantitative questions were analysed using descriptive and analytical statistics to look for change over the project. The qualitative questions were analysed using thematic analysis to look for common themes providing insights into the project topics.

A small group of 6 engineers was also recruited to take part in telephone semi-structured interviews after the project to qualitatively explore their experiences of outreach and mentoring using thematic analysis.

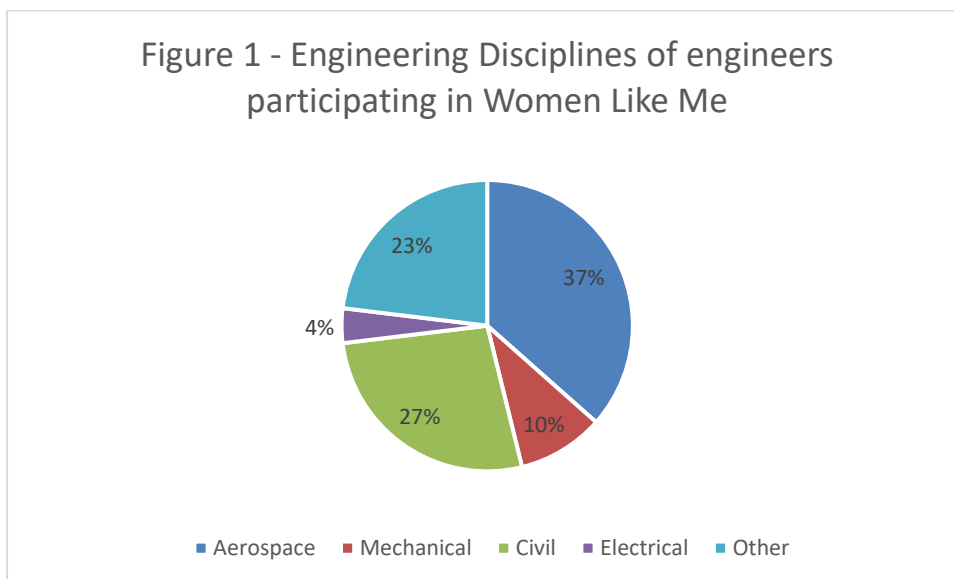
52 engineers completed questionnaires at the start of the project, 42 engineers recorded activities throughout the project, and 31 completed questionnaires at the end of the project. This drop-off was due to engineers failing to complete our final surveys, or through leaving the project due to maternity leave etc.

4.2. Participant characteristics

The project recruited 26 female junior engineers and 26 female senior engineers were matched with them. Due to attrition, only 42 engineers actually recorded their activities, but this still exceeds our initial target.

The engineers ranged in career level from 1 to 5 years' experience for the junior engineers, and 6 to 32 years for the senior engineers.

The engineers were fairly diverse, with 71% being white British, 18% being white other, 4% being British Indian, 8% being Chinese, and 4% Arabic.



4.3. Audiences

UWE Bristol, West of England STEM Ambassador Hub, and Curiosity Connections Bristol worked together to organize this project, with Laura Hobbs being our project coordinator in charge of communications to the engineers.

We worked with several organisations to provide collaborative activities for children and families; these include UWE Bristol BAME Girls into Engineering, Clifton Suspension Bridge, Show of Strength Theatre company, Aerospace Bristol, 'I am an engineer, get me out of here', Primary Engineer and the Leaders Award, the Great Science Share, Technotopia, and several local schools and Academy chains.

Many of the activities were written up and placed on our Engineering our Future blog <https://blogs.uwe.ac.uk/engineering/tag/women-like-me/>, or disseminated through the Curiosity Connections network (<https://curiositybristol.net/>). This will enable the project materials to be used by other STEM Ambassadors and teachers in primary schools.

As our coordinator was not present at many of the activities our engineers attended (reaching over 10,240 children) we were not able to ask the children to fill in questionnaires. However, we did ask for feedback from our partners, and the quotes are below and throughout this report:

"Women Like Me has supported us by sending female engineers to assist our bridge building workshop, this gives the students not only an opportunity to learn from an engineer, but also to engage with a role model and dispel common stereotypes and myths about who might be an engineer. We feel that representation is important and we hope to work with Women Like Me in the future to inspire new female engineers."
Regional Museum

"We just wanted to say thank you very much for organising this event. Our pupils found [junior engineer's] talk very interesting and they were inspired by her passion for her job and for her enthusiastic responses to all of the questions. Thank you from all of us at our Primary School." Teacher

"It was noticed that the first thing the girls related to you all was regarding identity. This became a platform of introduction/ an ice-breaker, where-by discussing which part of Africa you were from, in relation to their own backgrounds allowed for a rapport to have been built between your groups very quickly". Teacher

4.4. Engineers' Outreach

We trained the junior engineers in working with schools, and in education outreach skills for working with children. This occurred at the beginning of the project in October 2018, and we also provided a refresher technical workshop in February 2019 at the Curiosity Connections Bristol Conference.

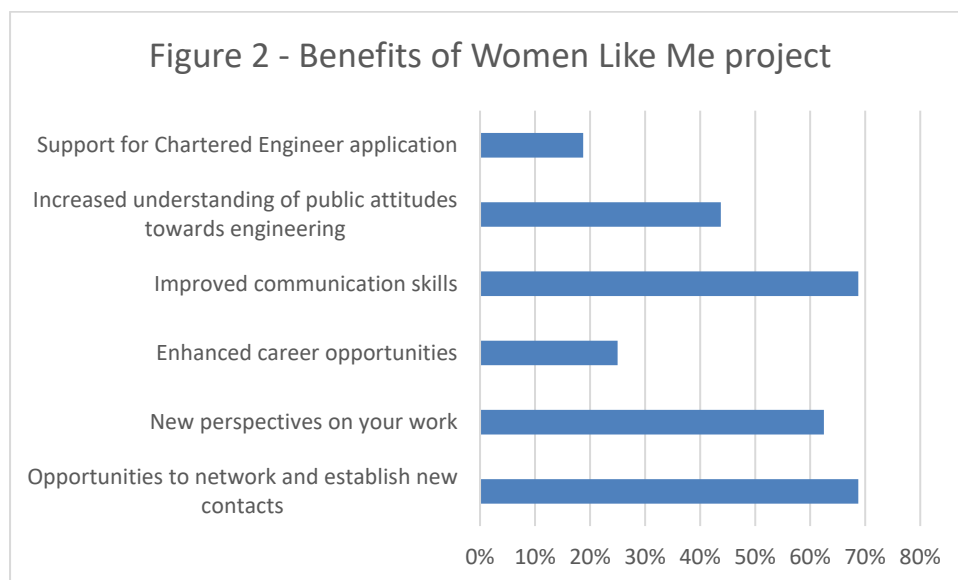
<https://blogs.uwe.ac.uk/engineering/female-engineers-come-together-for-outreach-surgery-at-curiosity-connections-2019/>

Of the 31 participants surveyed at the end of the project, the majority reported that they enjoyed taking part, and felt it was worthwhile for both engineers in the profession and the children they worked with. In fact, the main complaint was that the project needed to be longer with more networking sessions! Some engineers have voluntarily agreed to continue their mentoring outreach beyond the project.

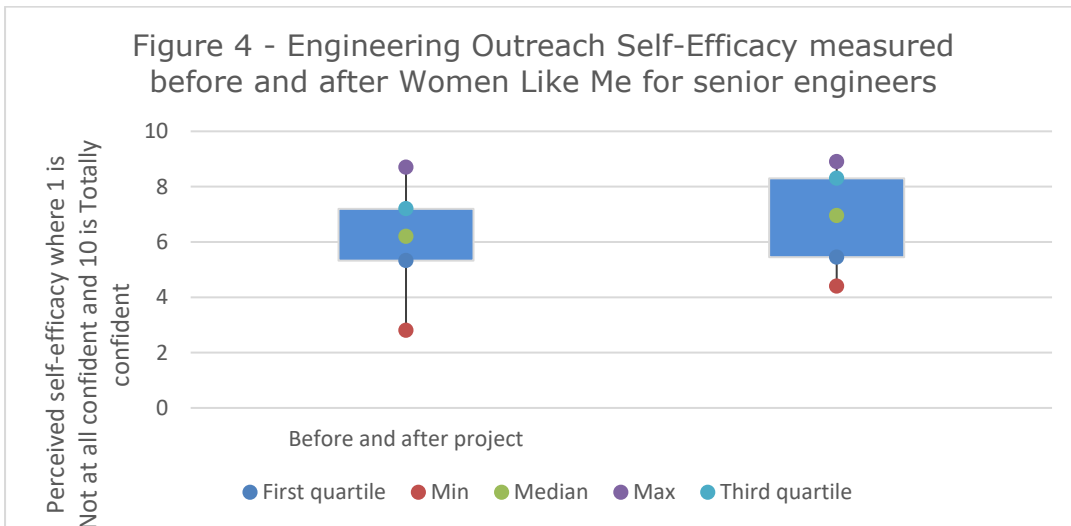
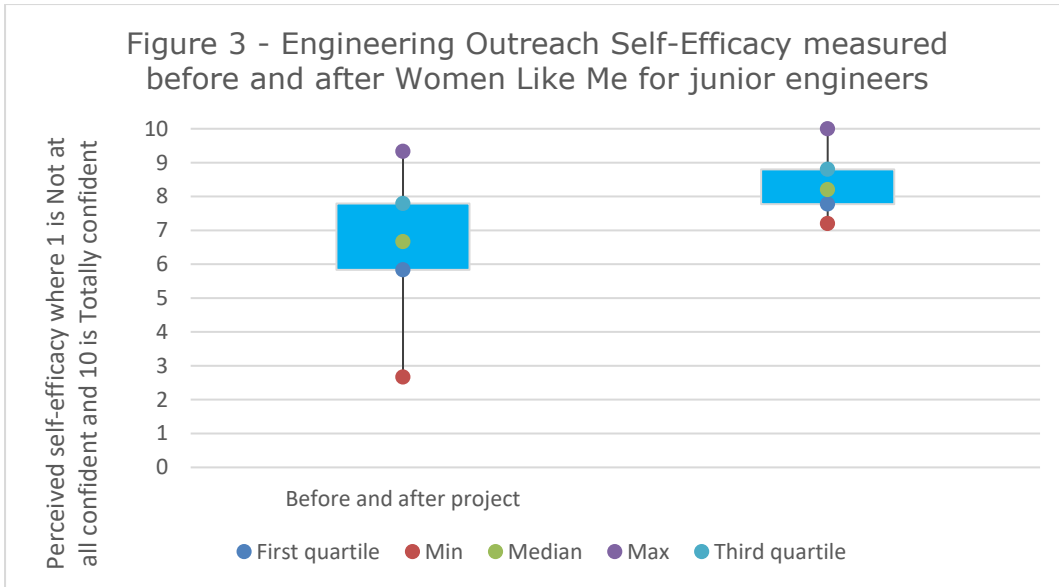
I've really enjoyed taking part in this scheme and have found it really beneficial - the training and speakers were really interesting, and [my mentor] has already had a positive impact on my work and personal development, and we've both agreed to continue the mentoring sessions after the end of the scheme. Junior engineer

I have very much enjoyed being part of this programme and the interaction with my mentee and would be happy to support in the future. Senior engineer

For the junior engineers surveyed at the end of the project (N=16), the main benefits were improved communication skills and the opportunity to network and establish new contacts with other women engineers (Figure 2).



The junior engineers received training in education outreach and public engagement skills, along with mentoring information. We assessed their perceived self-efficacy for education outreach using the Education Outreach Self-Efficacy Scale (Fogg-Rogers and Moss, 2019) at the beginning and end of the project. A Wilcoxon Signed Ranks test showed that the **mean score for the junior engineers significantly improved from 6.80 to 8.41** (score out of 10 – $Z=-3.05$, $p=0.002$), indicating that the engineers are now much more confident to undertake education outreach. Interestingly, the scores for the senior engineers (who did not receive education outreach training) did not show a significant increase (rising slightly from 6.53 to 6.99, but not significantly $Z=-1.07$, $p=.285$) (Figure 3 and 4). This indicates that providing training and supported activities can improve self-efficacy for engineers to undertake education outreach, who are then more likely to continue public engagement following the project.



Before the project, 54% of junior engineers felt fairly well equipped to undertake public engagement, but after the project, this increased to 68%, with 38% indicating they were very well equipped (Figure 5).

Figure 5 – Junior engineers’ perceived level of skill-sets for public engagement



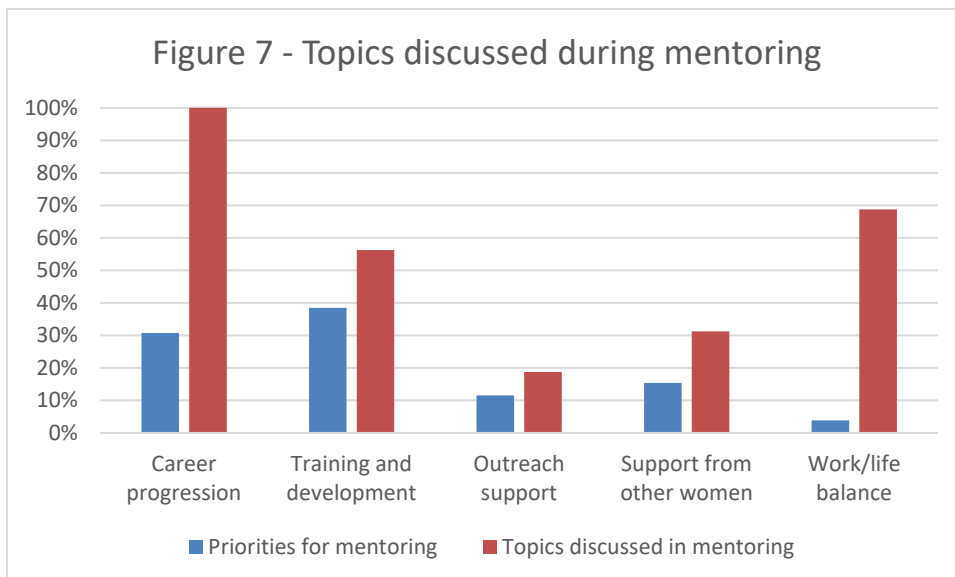
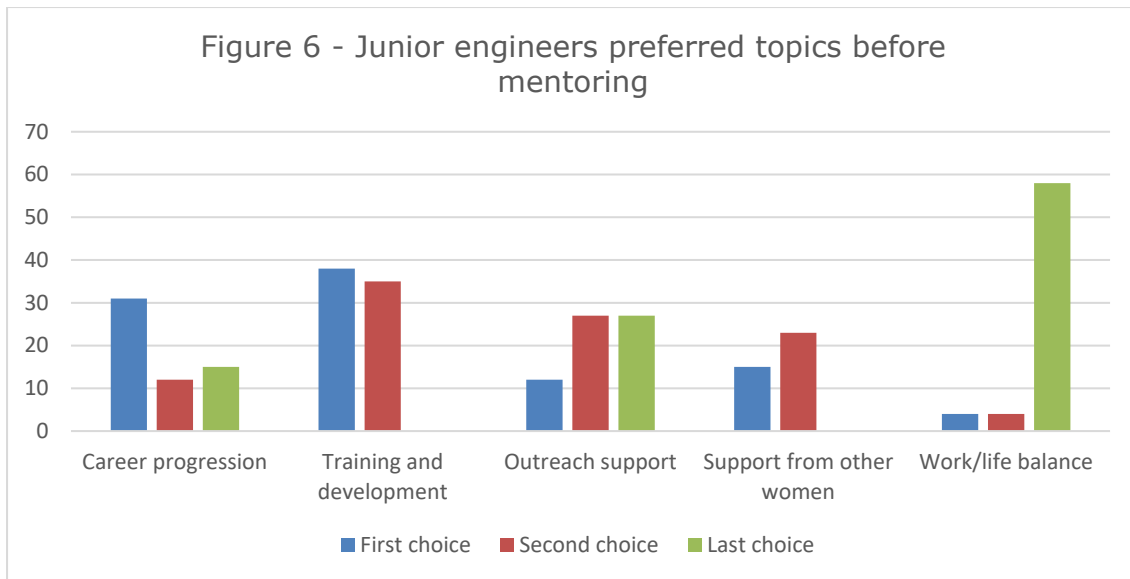
4.5. Engineers’ Mentoring

One of the aims for this project was also to encourage retention of women in engineering, so that we do not encourage girls into the profession only for them to leave in later years due to an unsupportive workplace culture.

As such, the mentoring sessions between the junior and senior engineers were a critical part of this project as well. We provided training in mentoring, paired the junior and senior engineers, and then requested that they complete at least two sessions. Figure 6 shows what the junior engineers expected to discuss, and Figure 7 shows what they actually discussed. It is important to note that career progression and work/life balance ended up being the key topics discussed, indicating how valuable it is to generate women’s support networks. Several engineers have since requested that we continue the project.

Having a mentor felt like having a safety net, having someone impartial and able to view things from the outside put things into perspective and allowed me to open up about issues and equally successes. Junior Engineer

Useful for the mentee to gain perspective and benefit from others experience. Useful for the mentor to "give back" but also reminds us how far we've come which we often don't unless we look back. Senior Engineer



The mentoring was very successful, and we will therefore continue this mentoring scheme beyond the Ingenious project and will relaunch in Autumn 2019. Improvements to the scheme will include a suggestion to meet more than twice throughout the year if possible, as some mentees wanted more support. Pairing also appears to be very important, with many mentees indicating that it is more helpful when the mentor is in the same discipline of engineering.

To have a really strong mentoring relationship it's good to be able to connect and have similarities and focuses between people. I personally think, from my experience of where mentoring has worked and not worked I think that that it can be substantiated but I also understand that it's quite personal as well. An alternative might be speed dating, you know, that sort of set up where you have mentor-mentee, go around and

you get to know somebody in that very short space of time and then perhaps you can choose your top five mentors. Senior Engineer

In the final workshop, engineers from throughout the region (all genders) were invited to take part in a session about developing women's support networks through mentoring. Networking was encouraged to enable women to meet senior industry figures so that they feel more confident to engage with engineers at all levels of their profession.

Following the session we are developing a 'Manifesto for Mentoring' to encourage other firms to provide such schemes, or to support a continuation of Women Like Me in the West of England. As such, we also hope to influence regional engineers (any gender) about the importance of supportive working environments for women and the need for diverse visible role models in engineering.

5. Conclusion

We therefore conclude that mentoring is highly important to ensure a supportive workplace, which means that women are more likely to be retained in the engineering industry. Consequently, there are then more female role models to represent women in engineering, which will change perceptions of engineering as a career. Providing training for women engineers in engineering outreach, along with supported opportunities for public engagement, is also essential to improve engineers' self-efficacy for education outreach. This means that more girls will meet positive female role models in engineering, which we hope will improve gender diversity in future STEM careers.