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# Women in Engineering: Addressing the Gender Gap, Exploring Trust and our Unconscious Bias

## Round Table

**Abstract**— There is still a large gender gap across the technology, engineering and physical sciences disciplines despite a number of efforts over the past three decades to address this. Creating a more diverse workforce including a better gender balance is important in order to meet the skills need of the future. There is also increasing evidence that organizations with a more diverse workforce are more creative and innovative and ultimately perform better and are more successful. In this Round Table, three women will present their lived experiences of being female in the engineering sector. This will be followed by an interactive session allowing the audience to explore their own unconscious bias and levels of trust. In conclusion, the session will open up to a wider discussion where the audience is invited to give their feedback and contributions to this important issue, and how we should be tackling it as a collective community across the sector.

**Keywords**— *gender gap, unconscious bias, women in engineering, trust, STEM and diversity*

### I. BACKGROUND

A large gender imbalance still remains in the technology, engineering and physical sciences across the globe. This is despite a focus on this issue for the last three decades. Table 1 presents the percentage of the workforce that is female for different professional sectors in the United States (US) and illustrates the significant imbalance in gender across the engineering and technology sectors compared to the health and life sciences [1].

| Professional Sector of the Workforce | Percentage of Females in the Workforce |
|--------------------------------------|--|
| Architects and Engineers             | 14%                                    |
| Computer Network Architects          | 10%                                    |
| Computer and Mathematics             | 26%                                    |
| Mechanical Engineers                 | 8%                                     |
| Biological Scientists                | 43%                                    |
| Physicians and Surgeons              | 38%                                    |
| Veterinarians                        | 63%                                    |

Table 1: Percentage of Females in the Professional Workforce [1]

The situation is repeated universities and the higher education sector. Table 2 shows the percentage of female undergraduate students studying in the US in 2013-2014 [2].

| Discipline                             | Total Number of Undergraduate Students | Number of Female Undergraduate Students (%) |
|--|--|---|
| Biological/ Biomedical Sciences        | 104633                                 | 61206 (58%)                                 |
| Computer and Information Sciences      | 55367                                  | 9974 (18%)                                  |
| Engineering and Engineering Technology | 108969                                 | 20031 (18%)                                 |

Table 2: Number and Percentage of Female Undergraduates in the US 2013-2014 [2]

The situation in many countries in Europe and elsewhere are equally stark. For example, in the UK only 18% of engineering, technology and computer science undergraduates in 2015-2016 were female [3] and less than 10% of professional engineers are female in the UK [4]

Why does this matter? Diversity in the workforce is important and is neatly summaries by Kenneth Gibbs [5]: “Diversity refers to difference. Science workforce diversity refers to cultivating talent, and promoting the full inclusion of excellence across the social spectrum. Diversity leads to better problem-solving, expands the talent pool and is important for long-term economic growth.” It is even more important given today’s economic climate and workforce needs. In the US, the estimated size of the Science, Technology, Engineering and Mathematics (STEM) workforce needed by 2018 is 8,650,000 [1] and STEM jobs are growing faster than any other sector. STEM jobs are set to increase by 17 percent between 2014 and 2024, while non-STEM employment will grow by just 12 percent. In the UK, it is estimated that an extra 69,000 people with engineering skills are needed every year until 2020 to meet the projected growth in that sector [6], further supporting the need for greater uptake of the physical sciences, technology and engineering by people from a range of diverse backgrounds including females.

## II. PROPOSED AGENDA

This round table is intended to be deployed for 90 minutes. It will be divided into three main blocks. The first block is intended to introduce the main issues and provide a lived perspective from the three female panelists. The second block introduces an interactive element and invites the audience to explore their own unconscious bias and trust through a short presentation and follow up exercise. The final block provides time for invited questions from the audience and a more in depth discussion on these issues and how to address them.

### A. *Lived Experiences from Women in Engineering (30 minutes)*

During this first session, each of the woman panelists will present their own experience of being a female in the engineering and technology sector. They will outline their lived experience and highlight some of the challenges and how these might be addressed collectively by the sector.

### B. *Our own Unconscious Bias and Levels of Trust (30 minutes)*

In this second session the audience are invited to explore their own unconscious bias and levels of trust. Unconscious bias occurs when our brains make quick judgements and assessments of people without us realizing it. These biases are influenced by our background, cultural environment and personal experience [7] and can lead to us stereotyping and having automatic preferences that influence our decision making and opinions, particularly when we are under pressure or having to make quick decisions. Recognizing our own internal biases and challenging them is an important step in breaking down stereotypes, and our own implicit assumptions, and through this, we can challenge the status quo and develop a more inclusive and open environment.

### C. *Open Discussion (30 minutes)*

In the final stage of the session, a discussion will be opened up between the panelists and the audience to explore the issues raised in the session, receive feedback from the attendees and discuss how we can move this agenda forward as a collective.

## III. WHY YOU SHOULD ATTEND

We encourage attendees from across the conference portfolio. This issue is an important one for all of us to address and you will get the opportunity in this session to explore your own unconscious bias and level of trust and discuss what we can do to support each other to develop a more diverse workforce including a better gender balance.

## IV. PRESENTERS INSTITUTION, POSITION AND BIO

### A. *Professor Rebecca Strachan, Northumbria University, UK.*

Rebecca Strachan is Professor of Digital Technology and Education and Associate Pro Vice Chancellor for Strategic Planning and Engagement in the Faculty of Engineering and Environment at Northumbria University. She is a leading expert in the exploitation of digital technologies to improve daily life and believes we should be using technology in transformational ways to support student learning. She has developed a keen

interest in gender, diversity and STEM, and is Deputy Chair of the University's Athena Swan Self-Assessment team and supports equality of opportunities for all. A strong advocate of partnership working, she is a fellow of the Higher Education Academy and member of the Council for Professors and Heads of Computing. Internationally she is a committee member of the IEEE Education Society and was part of the team that developed their MOOC on Open Education. She is the faculty executive lead for NUSTEM, a major widening participation program to engage more young people, particularly females in STEM [8] working in the UK and more recently in Nigeria. She is also the university lead for the BRIDGE project, aimed at encouraging greater diversity in the construction sector [9].

### B. *Dr Aruquia Peixoto, Assistant Professor, CEFECT/RJ, Rio de Janeiro, Brazil.*

Dr. Aruquia Peixoto is an Assistant Professor at CEFET/RJ in Rio de Janeiro, Brazil. She has a B.S. in Mathematics from UFRJ (Federal University of Rio de Janeiro), a M.S. in Engineering of Computing and Systems from COPPE/UFRJ and a PhD in Mechanical Engineering from PUC/RJ, all these institutions are in Rio de Janeiro, Brazil, and are some of the best universities in Brazil. She worked in the implementation of the State University of Roraima in the extreme north of Brazil, in 2006. She advised undergraduate students in scientific projects in UERJ (State University of Rio de Janeiro), where she won four prizes, co-advising the students with Paulo Rogerio Sabini, two prizes in UERJ, one as best work of Mathematics and the other as one of three best works in the technological field, and she has two national honorable mentions in student projects presentations in the Jornadas de Iniciação Científica organized by IMPA (National Institute of Pure and Applied Mathematics). She is member of the ACM SIGGRAPH International Resources Committee since 2013, member of the SIGGRAPH Asia Symposium on Education Committee since 2016 and 2017, and co-organized the meetings Women in CG during the SIGGRAPH and SIGGRAPH Asia Conferences, organized the meeting Girls in STEM in SIGGRAPH Asia 2016, and a round table Women in Engineering: Issues and Perspectives at the IEEE EDUCON 2017. During the year 2016 to 2017 she was visiting faculty at University of Kansas. Since 2017 she has been a member of the council ACM-W (ACM Council for Women), as SIG Liaison. For IEEE EDUCON 2018 she is Chair of the Special Session IDEE (Inclusion and Diversity in Education Engineering), and Chair of the Publication, Web and eMedia Committee.

### C. *Dr. Maria Teresa Restivo, Universidade do Porto, Portugal.*

Dr. Maria Teresa Restivo has a Physics degree in Solid State Physics and a Ph.D. in Engineering Sciences, both from the University of Porto. She was a senior researcher and academic at the University of Porto and joined its research Unit of System Integration and Process Automation (UISPA) integrating the Associated Laboratory of Energy, Transports and Aeronautics (LAETA) becoming the coordinator for it in December 2007. She is a member of the Scientific Council at FEUP. Her activity is related with the sensors development, wireless sensorization, online experimentation, development of sensorized devices of bioengineering for biological measurement and for distance

assisted rehabilitation and ageing and use of ICTs and haptic devices in higher education. She received the international qualification of ING-PAED IGIP – International Engineering Educator (PT003). She is both an individual and institutional (FEUP) Member of the VIT@LIS network and of ELTF – EUNIS and Institutional Member of the Global Online Consortium (GOLC). She was President of SPEE - Portuguese Society for Engineering Education (2010 – 2012) and Vice-President of IEEE Education Society, Portuguese Chapter (2011 - 2014). She is Executive Committee member of GIP - International Society for Engineering Education (2010 – 2016), then elected President and now Past President and she is Executive Committee member of the International Association of Online Engineering (IAOE).

*D. Itoro Emembolu, Northumbria University, UK.*

Itoro Emembolu is a PhD researcher in the Faculty of Engineering and Environment at Northumbria University. Her research is on evaluating the impact of academic research on young people's uptake of the STEM disciplines with a focus on the interface between outreach activities developed from the research of academic staff and practical applications that bring STEM subjects to life for young people. She is currently working on developing a multidisciplinary impact evaluation framework which can be applied in different interventions across the STEM disciplines. She also works for NUSTEM [8] on impact evaluation and data analysis of NUSTEM's outreach activities. NUSTEM works with young people and their circle of influence to cultivate more interest in STEM from under-represented socio-economic groups and to reduce the gender gap and increase diversity in those fields, originally in the UK, but more recently in Nigeria. Itoro has a Bachelor of Engineering in Mechanical Engineering, an MSc in International Business, Energy and Petroleum and an MPhil in Management. She is interested in raising aspirations and widening awareness of STEM careers and their pathways in young people.

## V. REFERENCES

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