

SEFI Position Paper on Diversity, Equality and Inclusiveness in Engineering Education

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INTRODUCTION

Engineering is constantly empowering society in amazing ways. It is at the core of innovation and can address Grand Challenges facing Europe and the world. Innovation is driven by personal experience and worldview, and therefore diversity, equality and inclusion are core assets supporting innovation. SEFI believes that diversity, equality and inclusiveness are essential to enriching engineering education experiences and generating innovations that can drive the development of creative solutions to address the world's challenges. We learn from diverse experiences, beliefs, and perspectives. Diversity in all dimensions (individual, organizational and societal) fuels innovation and the development of imaginative, holistic and enduring solutions to global problems.

*"Achieve gender equality and empower all women and girls."
(UN Sustainable Development Goal 5)*

SEFI strongly believes that **everybody must be provided with equality of opportunity**, to pursue and advance their engineering careers, and that no individual should experience discrimination, marginalization or have their contributions or talents excluded because of conscious or unconscious biases. Recognizing and supporting diverse individuals is more than a moral or ethical obligation. It is also **the logical choice** to improve the practice of engineering and its impact on society. However, in order to create the types of environments in which diversity can thrive, we must find better ways to recruit, retain and support all students and staff, regardless of physical ability, visible or invisible handicaps, race, ethnicity, sexual orientation, religion, gender, culture, geographical residence, or nationality. We may have to change the way we have structured and organised engineering education itself. SEFI is committed to increasing the participation, inclusion, and empowerment of under-represented segments of society in all venues where engineering is taught, practiced, and supported. We consider the input of gender and diversity research relevant for our strategies, programmes and measures.

*"SEFI is committed to diversity, equality and inclusion within our engineering education community. SEFI will continually review its policies and practices to fulfil this commitment and to ensure that it influences SEFI's activities and liaisons."
(SEFI Diversity Statement)*

Our goal is to create and foster environments where every individual is not only respected, but also feels safe and included. SEFI believes that this can be achieved by nurturing a culture of diversity in recruitment, retention, and advancement within engineering education, engineering technology education, and the engineering profession. Creating such a culture of inclusion **involves everybody** and is not just fixed by special (affirmative) action towards underrepresented groups. It is everybody's responsibility!

While SEFI recognises that steady gains have been made in decreasing gender imbalance and increasing the number of first generation students from non-academic or immigrant backgrounds, and students with visible or invisible disabilities in engineering over the past several years, SEFI still recognizes the need to actively promote diversity. Substantial progress must still be made to achieve **the SEFI vision: a state where engineering education is safe, inclusive and fully empowered by all segments of our societies - globally.**

INCLUSIVE LEARNING ENVIRONMENTS

Instruction

There are many aspects of a learning environment that combine to determine how inclusive it might feel to a diverse range of students and staff. Although it sounds simple, the most important starting point is the appreciation that diversity exists and is something that, if addressed appropriately, can actually strengthen the learning of all students. To do this, instructors must consider that the students with whom they engage are not necessarily like them, in background, in motivation, in outlook or in their learning style.

Of central importance is the culture that surrounds the learning environment. Does it actively promote a diversity of staff (at all levels) to be engaged in the education of students providing role models for a diversity of groups? Does it actively engage in a discussion of diversity in the student cohort? One way in which this might manifest itself is through the context and content of the programme. For example, in design projects, is there an opportunity for students to consider how design for 'the norm' might disadvantage some users? One should also consider the context in which design projects are placed. Do they give students a real context with which they can relate and engage? Are students encouraged to move outside their own personal context and gain an authentic understanding of how diversity helps creativity and innovation, thus improving their designs?

Diversity can be promoted in how we teach and how we interact with students. Are the teaching methods we employ inclusive or do they disadvantage certain groups? Are our teaching methods sufficiently mixed and different to accommodate different learning styles within the student cohort? What about different forms of examination and grading? This might be a function of style, but is also dependent on timing, the physical environment, and even the virtual learning environments we provide to support our students.

Resources and further reading:

- *Gender Inclusive Engineering Education.* (J. Mills, M. Ayre & J. Gill. Routledge, 2010.)
- <https://www.napequity.org/root/>
- <https://www.katalytik.co.uk/services/engineering-education/>
- <https://deansdiversity.asee.org/>
- <http://interengineeringlgbt.com/wp-content/uploads/2015/12/Engineering-Action-Tackling-Homophobia-in-Engineering.pdf>
- <http://interengineeringlgbt.com/wp-content/uploads/2016/08/Powering-up-the-LGBT-in-Engineering-report.pdf>
- <https://spectrum.ieee.org/at-work/tech-careers/why-hire-engineers-with-disabilities-theyre-practiced-problem-solvers>

Teamwork

Although teamwork plays an important role in the development of professional skills, it can also be a source of problems for under-represented students. While recognizing its importance, the potential negative aspects of teamwork must also be understood. Project topics, team roles, assessment, student interactions, and off-campus work are all potentially problematic. Rather than letting students self-select, teams should primarily be formed by the instructor so that individual student characteristics and diversity can be considered. In general, it is best not to have only one member from an under-represented group on a team. Instructors should also assign and rotate team roles to better diversify student abilities and prepare them for the workforce. On the job, engineering graduates must be able to work together with colleagues not of their choosing. Pre-teamwork interventions should be used to teach students about common problems that can exist in teams, and teams should be given a mechanism for problems to be discussed professionally within the group and reported. Students should discuss personal and mutual expectations for teamwork and perhaps list common expectations prior to the project work. They should also list their individual contributions to the team after finishing the project. Finally, project topics should be appealing to diverse groups.

Resources and further reading:

- *Improving the Experiences of Marginalized Students on Engineering Design Teams* (Meadows et al. ASEE Annual Conference 2015 <https://www.asee.org/public/conferences/56/papers/11803/download>)
- Training and Resources for Gender-Inclusive Teamwork (TARGIT) (URL coming soon)
- <https://womensleadership.stanford.edu/team>

SUBTLE, IMPLICIT AND UNCONSCIOUS BIASES

Subtle, implicit and unconscious biases affect both staff and students. Everyone has biases, and even when we are aware of them, they can prove challenging to overcome. Unconscious biases can block solutions, affect how we evaluate people and their work, and shape our perceptions of competence and expectations of behavior for men and women. Training for staff should include active strategies that go beyond identifying bias to address practical approaches to bias management, and should be built around real-life case examples. Training should be in-depth and on-going. Students should also be taught strategies for minimizing implicit and unconscious biases and to understand that stereotyping can lead to prejudice and ultimately discrimination and exclusion. Finally, university management should develop and enforce clear, concrete, specific metrics for appointment, success and promotion of staff. Ambiguous evaluation criteria create an environment where unconscious bias can thrive.

Resources and further reading:

- *Presumed Incompetent: The Intersections of Race and Class for Women in Academia.* (G. Gutierrez y Muhs et al. Utah State University Press, 2012)
- ASEE Safe Zone Workshops and Virtual Community of Practice to Promote LGBTQ Equality in Engineering (Farrell, et al., ASEE Annual Conference 2016), <https://www.asee.org/public/conferences/64/papers/14806/download>
- <https://diversity.ucsf.edu/resources/unconscious-bias-resources>
- <https://hbr.org/2017/04/dont-give-up-on-unconscious-bias-training-make-it-better>
- <http://ctl.yale.edu/ImplicitBiasAwareness>
- https://academicaffairs.ucsc.edu/events/documents/Microaggressions_Examples_Arial_2014_11_12.pdf
- <http://www.genderbiasbingo.com/>
- https://cehs.unl.edu/images/EdPsych/nicpp/NICPP_microaggression_presentation_2015-06-02.pdf

A CONTINUING DISCUSSION

SEFI invites comments and feedback on this Position Paper. Input will be reviewed by the SEFI Working Group on Gender and Diversity, chaired by Dr. Kacey Beddoes. SEFI Members interested in joining the working group are invited to contact office@sefi.be.

This position paper was collaboratively written by the following group. We thank all those from our community who contributed in the creation of this Position Paper, which could not exist without their assistance.

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SEFI is the largest network of higher engineering education institutions (HEIs) and engineering stakeholders in Europe. As an international NGO created in 1973. SEFI contributes to the development and improvement of HEE in Europe, reinforces the position of the engineering professionals in society, promotes information about HEE and improves communication between teachers, researchers and students, reinforces the university-business cooperation and encourages the European dimension in higher engineering education. SEFI is an international Forum composed of HEIs, academic staff and teachers, students, related associations and companies in 48 countries.

Our activities: Annual Conferences, Ad hoc seminars/workshops organised by our working groups, councils and ad hoc committees, organisation of the European Engineering Deans Conventions, Scientific publications (including the European Journal of Engineering Education), European cooperation projects, position papers, cooperation with other major European associations and international bodies such as the European Commission, the UNESCO, the Council of Europe or the OECD. SEFI also participated in the creation of several organisations such as ENAEE, IFEES, EuroPace, IACEE, IIDEA, and of the European Engineering Deans Council.

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