

Gender Equality in Engineering: An Institutional Reflection

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■ **THE ATHENA SWAN** Charter is a globally applied framework for fostering and maintaining gender equality within higher education (HE) and research. The original aims of the charter (2005–2015) were to acknowledge commitments to, encourage initiatives for, and recognize achievements in advancing women’s careers in science, technology, engineering, mathematics, and medicine (STEMM) subjects. The charter has evolved and in 2015, Athena Swan was extended to recognize commitment to gender equality across all disciplines, professional and support staff, as well as intersections of gender and race, and trans inclusion. In 2021, following an independent review, the transformed Charter was launched including a commitment to transform gender equality for all gender identities, academic disciplines, and in professional, technical and operational (PTO) directorates. Consequently, criteria for the award of a Charter Mark include recognition of and plans for addressing priority issues, progress toward and success in achieving and transforming gender equality, and, at the highest level of award, contributions to best practice and supporting others.

On behalf of the Department of Electrical & Electronic Engineering at Imperial College London, the authors edited an Athena Swan submission for a Bronze Award. The success of that submission can

in part be credited to the planning, implementation, and results of continuous efforts made to improve gender equality within the Department. This brief commentary summarizes the priority issues that also constituted part of the submission, and will be addressed in the five years before the next submission. However, by putting these issues into a broader systemic and societal context, we aim to promote further reflection and discussion on the findings, and solicit feedback from the wider community engaged in these, and related, activities. This aim is, hopefully, relevant to other STEMM departments with similar historical and cultural profiles,¹ and broader discussion would extend the impact of addressing these concerns within a single institution. Gender equality requires sectoral change, and needs an honest, wide-scope, and iterative review of shared experience, feeding incremental self-improvement toward, if not yet best, at least better practice.

Evidence for the Department’s Athena Swan submission was derived from a variety of sources, including a critical self-evaluation of the Department’s progress with respect to its previous Athena Swan award, an analysis of the data from Departmental surveys, informal interviews with staff and students, and a broader assessment of the literature with respect

¹Following on from the creation of colleges after the Great Exhibition of 1851, Imperial College of Science and Technology was founded in 1907 with the merger of the City & Guilds Institute, the Royal School of Mines, and the Royal College of Science. Traditionally male-dominated and lacking balance without a Humanities school, overall gender equality was only partially addressed by the merger with St. Mary’s Hospital to become Imperial College of Science, Technology and Medicine in 1988, and incorporation of the Faculty of Business in 2003.

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to gender equality. As a result, we identified five key issues to prioritize² when addressing gender equality:

- Reaching critical mass;
- Improving lived and living experience (maintaining critical mass);
- Selection and resource-allocation criteria;
- The misconception of merit in academia;
- Beyond gender equality.

In the following, each of these issues is elaborated in turn.

Critical mass

“Critical mass,” in the context of gender equality, refers to the number or proportion of women in the Department that needs to be reached before gender distinctions are unnoticeable and irrelevant, and in particular dispelling any feelings of isolation or “other.”

Therefore, the first issue, reaching critical mass, is concerned with achieving a more appropriate and representative gender balance. However, it seems that this requires dispelling, as some comments from Departmental surveys indicated, a falsely ingrained belief that this balance can only be achieved at the expense of excellence in teaching, research, and administration (in fact, the evidence suggests that a better gender balance is good for the workforce [1]). While significant progress had been made in appointments that have increased the proportion of female academics in the Department, it seems necessary to emphasize that the Department’s appointments process is thorough and robust,³ and is based on widening appeal not lowering standards. Staff appointments, of whichever gender and at whatever level, are still only made on expectations that they will in time be promoted to a chair. Unfortunately, it can only be evaluated *a posteriori* that a conscious attempt to improve gender balance has demonstrably enriched the department without sacrificing quality; but even then, one can find oneself arguing against a counterfactual,⁴ which is notoriously difficult.

Moreover, this balancing process needs to be done without “othering” or “tokenizing” women who are already working or studying in the Department.

²Prioritization was based on objective evidence, and the subjective need and motivation of those in our diversity team who felt inspired to address certain issues based on their experience and availability.

³Assuming there is no adverse intervention from an external “authority.”

⁴Arguments, for example, of the form “it would have even been better if [men] had been appointed.”

Care has to be taken to normalize success without necessarily proclaiming it. For example, feedback from undergraduates concerning self-congratulatory staff-made claims of “this year, there are $X\%$ female students in the Department” (where X may represent an increase in comparison to previous years, but is still rather less than 50) indicate that it actually increases a sense of “othering,” because it somehow seems to license unwarranted suggestions that these women have only been accepted because of “tokens” or “quotas,” rather than their proven scientific achievements, professional contributions and academic potential. Therefore gender equality initiatives have been “softly” ingrained into everyday culture and Departmental processes. A diversity, inclusivity, culture and equity (DICE) Committee report is a standard agenda item in termly Staff Meetings, and its activities regularly reported in the Departmental Newsletter. During Departmental away days, there are awareness-raising sessions dedicated to discussing existing gender equality measures and possible improvements.

In part, of course, in the United Kingdom at least, a primary obstacle to achieving critical mass is the well-documented “leaky pipeline” metaphor⁵: there are insufficient opportunities for, and entrenched cultural barriers to, gender equality in education and participation in STEMM subjects, from an early age. Consequently, and especially at elite levels of tertiary education, there may simply be insufficient “human resources” for all institutions to achieve their targets of improved gender balance. This situation is deep-rooted and structural; moreover, there are strong arguments that the metaphor is misleading and implies a singular, narrow, conventional pathway to a STEMM career: in fact there are multiple pathways [2], [3] and alternative approaches to recruitment should be tried. However, at a Departmental scale, we can also aspire to be a “beacon” for women inspired by science and engineering who make it through the pipeline but are still perhaps frustrated by the cultural hegemony and outdated stereotypes: there is a place where such dreams and ambitions can be realized.

Lived and living experience

Lived experience is defined as the direct experience or first-hand involvement of a given person

⁵See https://en.unesco.org/sites/default/files/usr2015_kakemonos_gender_en.pdf.

in a specific context, and the knowledge they have acquired from it. However, living experience implies continuous exposure to, and progressive knowledge acquisition of, an organizational context, whereby “experience” is a product of on-going engagement with the roles, structures, processes, and normative culture that define an organization. It is increased awareness of, and required change of perceptions to, the normative culture that is the basis of systemic improvement. Given that the rapid pace of technological development can bring about unanticipated societal change [4] perhaps even faster than it can be analyzed with conventional ethnographic or sociological methodologies, sampling and analyzing present experience becomes as important as reflection on past experience.

It is essential to build on progress toward “critical mass” and gender balance, as identified as the first issue, and ensure through *co-production and participatory consultation in a safe space* that culture and working conditions for women are not poor or inappropriate. Poor quality of experience is likely to undermine both maintenance of gender balance, as well as diminishing further attempts to improve the situation. Therefore, the second issue faced by the Department is to understand both lived and living experience, which means being concerned with the overall “quality of experience” once women are accepted to study or appointed to staff in the Department. A focus on lived experience can help to identify and overcome barriers to participation and progress, while a focus on living experience, using reflection and introspection on existing conditions, provides a more immediate source of information for proactive self-improvement (“self” being both individual and organizational).

For example, in this context, in trying to neutralize the way that language, space and architecture contribute to systemic discrimination [1], the name of the Departmental industry liaison group, previous known as “StAG” (Strategic Advisory Group) was unobtrusively changed to the gender-neutral Industrial Advisory Board (IAB). By “unobtrusively,” we recognized that it is not possible to mandate cultural change, and attempts to do so might provoke resistance (“to the privileged, equality feels like oppression”). Instead, the name was changed ostensibly for reasons of “relevance,” appealing also to the idea of not “othering” mentioned above.

Similarly, focus group discussions revealed that a common experience of women in the department, irrespective of their differences in individual, sectional, institutional, sectoral or societal experience, was continuous low-level micro-aggression. Therefore, to diminish the effect of cumulative experience of workplace prejudice and discrimination, we investigated the possibilities of a poster campaign “This Girl Can [Code]” (inspired by <https://www.thisgirlcan.co.uk/>) with the intention of specifically reminding and encouraging male students to be more mindful of and respectful with their behavior in a laboratory context, complementing the broader poster campaign highlighting College Values (<https://www.imperial.ac.uk/about/values/>).

Selection and resource-allocation criteria

The third issue, concerning selection and resource-allocation criteria, is motivated by two observations. The first observation is that criteria for appointments and promotions, and for admission to postgraduate programs, having been established over a number of years, tend (however unintentionally) to be skewed in favor of those who have had at least a traditional or typical (if not privileged) journey through the educational system: they have not had to spend time and energy dealing with diversity or gender-identity issues, have not experienced or had to overcome the barriers that are commonplace for minority or under-represented groups, and nor have they encountered heteronormative bias. Some initial steps have been taken to address this issue, for example in the appointments process, widening participation initiatives, and reviewing criteria for awards (e.g., of studentships and project prizes) by taking nonstandard career paths or diversity issues into consideration. The intention is for those who enter academia through nontraditional means are on an equal footing, and have equal opportunities, as others.

However, the second observation is perhaps deeper, which is that in the transition from PhD/postdoc research to early career lecturer, the preexisting male dominance tends to skew resource allocation toward male early career researchers. Especially in STEMM subjects, it has been found that the male appointment bias both is a consequence of, and subsequently a cause of, resource allocation within academic institutions [5]. This can isolate women

more and disadvantage their career development at a critical stage. The vagaries of this process influence both retainment, promotion, and progression to senior roles. Supportive access to tangible resources, such as funding (especially travel grants and post-graduate studentship), and intangible resources, such as social networks and mentorship, needs to be provided in an equitable and transparent manner.

Misconception of merit

The fourth issue, the misconception of merit in academia, is derived from the arguments made by Blair-Loy and Cech [6]. Their work shows how academia, and specifically STEM subjects, purports to reward those who demonstrate the best contributions and greatest dedication; but that in fact the achievements of under-represented groups are regarded as less merit-worthy *per se* than their equally productive white cis male colleagues (even by themselves); and moreover, that any work that individual members of such under-represented groups do to advance their collective representation is interpreted as an indication of a lack of commitment to the individual's scientific research. The consequence is simply to further entrench hegemonic privilege. Unfortunately, some of these attitudes are residually observable in survey results: for example the "macho" attitude from staff to PhD students about the need to continuously work on their research, and suggestions that engagement in diversity activities is considered a futile "waste" of time and energy.

However, even these observations focus too narrowly, perhaps, on individual level beliefs and biases: properly identifying and rectifying a systemic inequity requires systems-level analysis and thinking. These are issues that are dependent on national context and are perhaps dependent on generational change: for example, the dominant socio-economic and socio-political systems partially determine the appointment of administrators and in turn the style of administration; these then might effect management priorities and reward structures at a departmental level.

Therefore, in this wider societal context, it is necessary to recognize that the Department does not exist in a vacuum, but rather in a broader institutional and societal context; and in some cases that context is depressingly biased against women [7]. In practice, no department can be insulated from or indifferent to societal developments that

can affect its members from the malign misogyny of social media influencers (not being dignified by name) who can have a pernicious effect on the attitudes of undergraduates, through deliberate social divisiveness, and onto recent national court rulings or metropolitan policing that have likely unsettled Departmental members' sense of control over bodily autonomy, safety, and other women's rights issues.

Lacking direct control over this issue, senior leadership needs to continue demonstrating their commitment to gender equality by example. There are also different approaches to value reward, some for example which rely on recognizing *contribution* which is measurable rather than merit which is subjective [8]: there is so much "invisible" work done which is difficult (if not impossible) to quantify in any "workload allocation model." There is also an opportunity to build on several recent, and promising, initiatives. In our Department, this has included the annual Maria Petrou⁶ Scholarship, established in 2021 to help recruit, retain, and advance the careers of women in engineering through funding for the PhD program; and the annual showcase event aligned with either Women in Science and Engineering (WISE) or International Women in Engineering Day (INWED). These nonexclusive get-togethers serve to share personal narratives and to celebrate the contributions and achievements of female staff and students in the Department.

Beyond gender equality

The fifth and last issue, and by no means an afterthought, is the requirement, without relaxing our commitment to gender equality, to go beyond it and look more broadly at equality of representation across all minority groups. Indeed, from an Athena Swan perspective, all applicants are expected to consider intersectional inequalities; although the particular intersections to focus on would be determined in the local context, based on evidence. Therefore, we need to ensure that infrastructure or processes (e.g., data collection and monitoring frequency) to evaluate intersectional inequalities are in place. This includes representation of people from ethnic minority backgrounds, as well as initiatives to improve the quality of support for and the quality of experience for those with disability and neurodiversity challenges. It also requires a deeper

⁶Professor Maria Petrou: https://en.wikipedia.org/wiki/Maria_Petrou.

consideration of sensitive but complex issues, such as de-colonization of the curriculum and the campus.

THIS ARTICLE HAS reviewed some key issues that have been identified as the main obstacles to overcome, in our context and experience, toward achieving gender equality, or at least a better gender balance. However, we are not only concerned with quantitative metrics, of “leaky pipelines” and “critical mass,” but more urgently need to pay attention to the qualitative metrics too—this is the “semantics” and “pragmatics” derived from lived and living experience that underpin the conception of merit and recognition of contribution. Externally, we share this introspective analysis in the hope that others might find value in our reflection. Internally, we have formulated an Action Plan to address these key issues, and are now acting on it. There is much work still to do. ■

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