Imperial College London

EDI IN ENGINEERING

UROP Project

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Department of Mechanical Engineering

Executive Summary

The state of equality, diversity, and in inclusion (EDI) in the engineering industry is troubling. The UK has the lowest proportion of female engineering in Europe at just 8%. The RAE reports that although 26% of engineering students identify as BAME, only 6% of professional engineers are non-white(1).

Imperial has made a commitment to embed EDI in the curriculum and atmosphere at college(2). Several other departments and institutions have created modules attempting to address EDI issues through outreach and societal engagement. Additionally, UK chartership competencies specifically require engineers to understand diversity and equality issues(3).

To systemically address these issues within the Department of Mechanical Engineering, we proposed a UROP to develop a new elective module focusing entirely on EDI in Engineering. From student surveys we conducted, 72% agreed there should be more EDI discussion in engineering but only 15% had been involved in outreach and EDI initiatives, signalling a lack of opportunity to act upon their agreement and engage with EDI issues. From alumni surveys, ‘empathy’ ranked the lowest by a large margin when asked which skills the Mechanical Engineering course helped develop.

The initial module design was developed through liaising with EDI academics, outreach charities, the Imperial Education Development Unit, and the Outreach Team. This module will allow students to think in the context of global society, gain an appreciation for EDI issues, and gain practical experience in initiative coordination to improve EDI in engineering. In the autumn term, students will be introduced to the key issues related to EDI through seminars delivered by guest lecturers. Each member of the cohort will be given a logbook through which to evaluate their personal development using reflexive and reflective practice. Then, in groups of 3, students will begin ideating an initiative at Imperial or outreach programme, with a goal to improve EDI in engineering. In the spring term, students will enact this initiative and evaluate its impact.

Contents

Introduction

This UROP project was proposed by three undergraduate students from the Department of Mechanical Engineering at Imperial College. We saw that the Communicating Computer Science, Communicating Physics, and Communicating Mathematics courses at Imperial were successful modules that involved students delivering outreach at local schools, and we wanted to give our students the same opportunities to have positive influence on the community.

We proposed this UROP project with the aim to design a module that would provide students with the skills to understand and address issues to do with equality, diversity, and inclusion within the mechanical engineering industry.

In this report, we detail the work done to create an initial structure for this module, including research that influenced our decisions, and the next steps needed to implement this module within the department.

We believe that students and staff belonging to this department will benefit greatly from having a module focused on issues to do with EDI within Engineering and that the module structure we have designed will catalyse the embedding of EDI within the Mechanical Engineering department.

Why EDI?

Literature Review

The engineering workforce makes up 24.9% of turnover in the UK, consisting of roughly 5.4 million employees across 576,440 enterprises, yet remains an incredibly white and male dominated industry in the UK. The Royal Academy of Engineers report that the UK has the lowest proportion of female engineers in Europe, at 8% of the engineering workforce. 26% of engineering students come from Black and minority ethnic backgrounds yet black and minority ethnic individuals make up only 6% of professional engineers. There have been a range of initiatives to increase gender diversity but despite this, a lack of diversity persists (1,4).

This homogeneity is in direct conflict with the fact there is a strong business case for better equality, diversity, and inclusion in the industry. In 2020, McKinsey reported that companies with more than 30 % women on their executive teams are significantly more likely to outperform companies with fewer than 30 % women executive. This has a knock-on effect on productivity resulting in a substantial performance differential of 48% between the most and least gender-diverse companies. Greater ethnic diversity also has a similar effect, showing that greater racial diversity in companies leads to an increase in productivity of 36 % in 2019. Despite mounting data to support the business case for diversity, within the dataset in the McKinsey report, the number of female executives at UK and US companies has risen by only 5% over 5 years, and globally by 1% over 2 years. Similarly, representation of ethnic minorities in executive teams in US and UK companies has risen by just 6% in 5 years and globally 2% in 2 years(5).

Increasing evidence suggests homogeneity in workforces and slow-moving progress can be due to aspects of the pipeline from school to industry. The Hamilton Commission, a report focused on understanding why Black people are hugely underrepresented in the motorsport industry, attributes this to a variety of systemic factors including university admission, industry practices and even classroom culture. The findings show that although the number of black people studying engineering at university roughly reflects the number of black students in the school system at 5%, only 35% of Black engineering graduates are currently in engineering roles compared to 57% of white engineering graduates(6).

The UCL ASPIRES project, a research group dedicated to understanding underrepresented students' aspirations towards STEM subjects, also corroborates with these findings showing that on a wider scale minoritized students are similarly impacted. ASPIRES reports that socio-economically disadvantaged students are 2.5 times less likely to do triple science. As anecdotal evidence suggests, gatekeeping from triple science discourages students from applying to STEM related degree programs. This project also highlights the substantial relationship between gender and engineering aspirations. Girls are four times less likely than boys to aspire to a career in engineering. Additionally, the profile of girls that are interested is distinctive to other

girls, as this group usually has increased levels of confidence in scientific ability and are less motivated by their desire to help others. ASPIRES also revealed that aspirations towards a career in engineering was more likely to be from students in affluent backgrounds (7,8).

Imperial submitted a Bronze Race Equality Charter application in July 2021 outlining recommendations for ways to embed EDI into the culture at Imperial. These suggestions include a socio-psychological change through better unconscious bias training and face-to-face EDI training. Additionally, the report recommended greater diversity of mentors in mentorship programmes and more representation projects involving the student-run societies. The report also considered possible ways to embed EDI into the physical imagery of the college and the spaces that staff and students interact with (2).

To become a chartered engineer, section D, subsection D3 of the IMechE Chartership Competencies document mandates that chartered engineers demonstrate personal and social skills. This includes the ability to know and manage their emotions but most significantly to have an awareness of the needs of others, especially in relation to diversity and equality. These competencies can be demonstrated through application of diversity and anti-discrimination legislation(3).

Other Department Initiatives

There has been an increased understanding of the need to teach equality, diversity, and inclusion principals to STEMM students. Within Imperial, several departments have set up modules that relate to EDI (The links to details regarding these modules can be found in Appendix A: Other Relevant Modules):

- The ‘Communicating Computer Science’ module, currently run by Dr Jackie Bell from the Computing Department, has been running for 8 years. The module involves students working within a local school to teach a topic within the computer science curriculum. The success of this module encouraged both the Maths department and Physics department to adopt the module structure for their own students.

- The IExplore Module, ‘Social Accountability in Action’, was developed by the Department of Medicine. Students work with diverse local schools to deliver STEMM-based educational sessions. The objective of the module is to highlight the importance of social accountability, especially in the students’ future professions.
- The department of Chemistry is introducing a short mandatory course for undergraduates, called EDI in Chemistry.

While the Mechanical Engineering Department currently runs Unconscious Bias and Active Bystander training, it is not specific to the students and their educational experience, and does not offer a prolonged, or ‘multi-intervention’ course that students can meaningfully learn from. If other departments can offer this teaching or training, it is highly feasible that the Mechanical Engineering department can do the same.

Other University Initiatives

Other Universities have also begun to include more EDI-focused education within their engineering courses and communities (the links to details regarding these modules can be found in Appendix A: Other Relevant Modules):

- The Engineering Department at Durham University have a module called ‘Engineering in Schools’ where their students work alongside teachers in assisting and delivering STEM-related material. Students also design an Engineering project that the school pupils can do. There is a focus of improving public understanding of science and technical communication skills in this module for school pupils of varying abilities.
- The Engineering Department at the University of West England (UWE) have a module called ‘Engineering in Society’ which is also focused on technical communication and public perception of Engineering. Students will experience delivering scientific concepts to both peers and school pupils in this module, to improve their public speaking skills, and will also understand the social responsibilities of a professional engineer, also deemed ‘engineering citizenship’.

- At University College London (UCL), Darren Nesbeth is running an initiative called BAMEhack which is a staff-student collaboration focused on redesigning the engineering curriculum to embed EDI. This project entails researching black and minority ethnic stakeholders and their contributions to an engineering discipline, which are otherwise hidden from the course. The findings will then be used to update and globalise course material.
- The Faculty of Information at the University of Toronto runs a module called 'Accessibility & Inclusive Design'. This module teaches students to recognise the different needs in a diverse user group and provides them with the skills to create "socially responsible" design.

Some of these modules/initiatives engage with EDI more explicitly than others, but each can be seen as justification for the need for such a module in Mechanical Engineering at Imperial, for the course to stay relevant and competitive.

Data from Current Students and Alumni

This section of the report will summarise the key findings from the surveys. The full details and analysis of survey data are found in Appendix B: Survey Data.

Student Survey

A survey was sent out to all current students on the department year-group mailing lists and garnered 60 responses. Of the students who completed the survey, 55% identified as belonging to an underrepresented group. 22% of total respondents were female, and 45% were ethnic minorities (6% mixed, 36% Asian, 3% Black) shown in Figure 1.

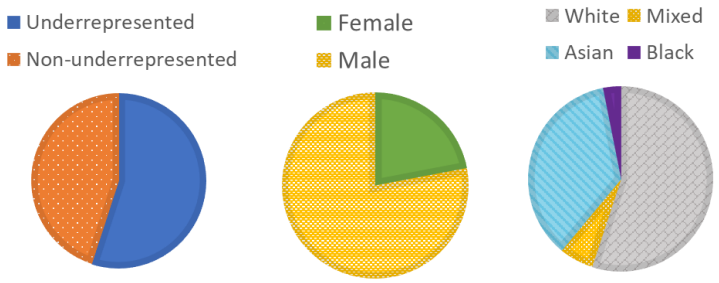

Figure 1: Pie charts showing the gender and ethnic makeup of the students who responded to the survey

The key findings are as summarised:

- It can be concluded that underrepresented students are both more likely to see EDI as important and are also more willing to learn more about EDI related topics than non-underrepresented students, despite representation being non-distinguishing in confidence with discussing EDI issues. This may suggest that some non-underrepresented students discuss EDI issues overconfidently – relative to their perceived importance of EDI or desire to learn more, they are more confident talking about the issues compared to underrepresented students. This evidences the need for this module as a means of ensuring all students' confidence in engaging with EDI issues is backed by an understanding of its importance and an openness to learn more about it.
- Approximately 72% of students agreed that there should be more EDI in engineering with no significant demographic skew in those who replied positively vs those who replied neutrally or negatively. This implies a large, widespread ackowledgement of the lack of EDI in engineering and belief that it should be addressed, justifying the validity of the module's aim. However, the belief that more EDI is needed in engineering does not necessarily imply an engagement with EDI learning and action. Indeed, in a following question asking whether students have taken part in delivering an outreach initiative, only 15% of student had done so. This may be due to a lack of time resource – in the comments section of the survey, several students who mistakenly interpreted the module as an extracurricular stressed that they would not have time to partake in the module alongside current academic expectations placed on them. Offering this module as a 3rd or 4th year elective module may therefore allow those who believe there should be more EDI in engineering to help address this issue without putting a strain on their time resource.
- Students identifying with an underrepresented group were asked whether they had been recipients of targeted EDI initiatives in the past. Only 15% said they had, demonstrating that more could be done to attract underrepresented groups to engineering, with this module helping to fill this need.

- When students were asked whether they were interested in the module and whether they would consider taking it as one of their electives, a significant skew was present in the demographics responding positively compared to those responding negatively, underrepresented students being more likely to reply positively. This is as expected when considering the skew in demographics of students who consider EDI important and who wish to learn more about it. This represents a challenge that should be addressed in the advertising of this module – if the module is disproportionately taken by underrepresented groups, a harmful narrative of placing the onus of improving EDI upon the minorities affected will be further perpetuated.
- Common positive comments included appreciation of the broadening of the course's teaching offered by this module, understanding of its importance in fostering a healthier environment at Imperial and identification of the productive, efficient, and promising approach to EDI improvement that could be facilitated by a dedicated module.
- All student critiques and concerns have been addressed in Appendix B: Survey Data. A common concern was that the Mechanical Engineering course's EDI consideration should take the form of adjustments to core modules or a compulsory short course module to widen the impact. However, this module will collaborate with and accelerate this process of wider EDI integration within Mechanical Engineering, rather than siphoning all EDI consideration.
- Another common concern was that the module would not allow for nuance and will instead prescribe 'politically correct' perspectives. In fact, the module will be highly discussion based, with allocated discussion time within each of the two-hour seminars. Ground-rules for these discussions will not only create a "safe space" for everyone, but also a "brave space" where everyone will have the opportunity to present individual and alternative perspectives without fear of judgement, whilst encouraging an empathetic understanding of the implications of and reactions to the perspectives.

Alumni Survey

A survey was sent to alumni to assess their perceptions of the module's necessity with respect to their post-university experiences and their retrospective opinions of whether there was a gap in the curriculum that this module might fill. 19 alumni completed the survey, of whom 47% identified as belonging to an underrepresented group. 26% of respondents were female, and 68% were ethnic minorities (11% mixed, 26% Asian, 5% Black). Due to the smaller number of respondents in this survey, results were less conclusive. However, the following key finding justifies the need for the module:

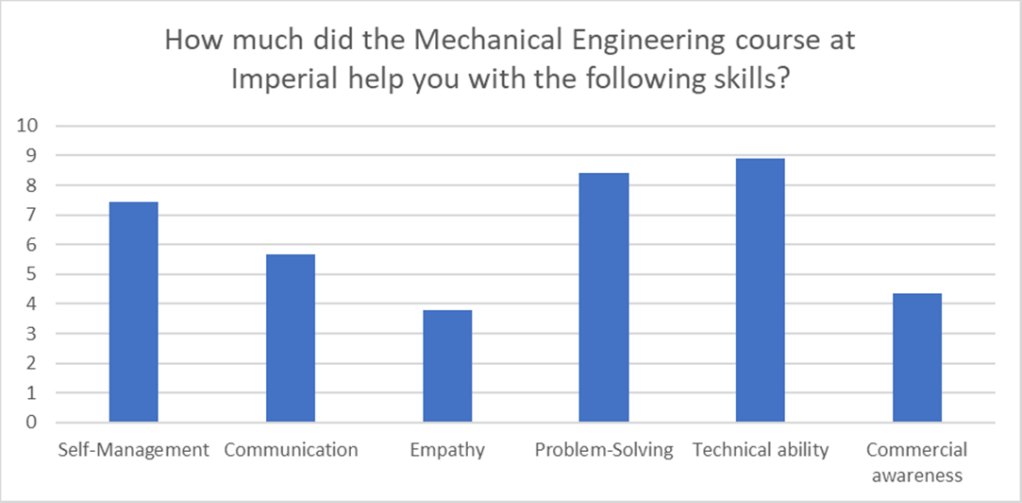

Figure 2: Bar chart showing how much the course helped with key skills

Alumni were asked to rate on a scale of 1 to 10, how much the Mechanical Engineering course at Imperial had helped them to develop six key skills representing those mentioned in the IMechE personal development programme for chartership, or those commonly sought out in commercial environments, shown in Figure 2. The averages for each response were taken. Although self-management, problem-solving and technical ability were each ranked between 7 and 9, communication, empathy and commercial awareness were each ranked lower, between 3 and 6. The proposed module will focus on the development of these skills and will therefore fill a skill-development gap in the curriculum.

Aims, Objectives and Outcomes

An initial detailed module description was developed, including the aims, objectives, and learning outcomes, which can be viewed in full in Appendix D:

Module Aims

- This module will encourage students to critically think about and proactively engage with engineering in the context of global society.
- The module will develop students' appreciation and understanding of equality, diversity, and inclusion (EDI) within the engineering industry, as demanded by the IMechE Engineering Chartership.
- Students will gain practical experience of initiative coordination, allowing them to champion better EDI as well as improving interpersonal skills.

Learning Objectives

- To define EDI and provide an overview of its status in engineering
- To present the importance of EDI in engineering and the positive impact of widening participation
- To present the barriers to better EDI in engineering and the obstacles to removing these barriers
- To present EDI consideration through engineering with a more accessible, empathetic, and inclusive approach to engineering design
- To present the effective design of a positive EDI initiative
- To develop critical analysis and evaluation skills with regards to EDI initiatives
- To develop communication and interpersonal skills in discussing, planning and actioning initiatives
- To develop data gathering skills to classify the impact of initiatives
- To facilitate reflexive practice regarding EDI in engineering

Learning Outcomes

On successfully completing this module, students will be able to:

- Understand the key issues surrounding equality, diversity and inclusion in engineering, STEM and wider society
- Identify actionable methods of embedding EDI into the curriculum
- Devise an initiative at Imperial or outreach programme at a partner school, with a goal to improve EDI in engineering
- Assess the impact of this initiative through qualitative and quantitative measures and communicate results
- Evaluate personal development and changes to thinking through reflexive practice

These learning outcomes have been designed to align with the coursework that the students will be assessed by.

ECT Credits

The course will count for 6 ECT credits as students taking this module are expected to dedicate 150 hours towards it across the two terms. The summary of student timetabled hours is described in Table 1. The total number is greater than 150, however the tutorial sessions will act as drop-in sessions. A full breakdown of how the ECT hours is divided up is shown in Appendix C:

Table 1: ECT Hours student should spend on the module each term

	Autumn	Spring	Summer
Lectures & Seminars	22	-	-
Tutorials	3	22	-
Private study	31	22	-
Group work	6	55	-
Subtotal	62	99	
Total	161		

Course Content and Teaching Methods

Structure and Timeline

The module will run for two terms: the first term will outline the current equality, diversity, and inclusion issues the Engineering industry is facing and provide tools to tackle this; the second term will allow students the opportunity to design, enact, an evaluate an EDI initiative of their own in groups of 3. It is envisioned that, at least initially, the number of students in the cohort will not exceed 21. This is for ease of running and to ensure greater adaptability as any issues are ironed out.

Each week of the first term, there will be a 2 hour seminar in which the lecturer will speak for 1 hour and a moderated discussion and initiative brainstorming session will take place for the second hour. In weeks 9-11, there will be an optional 1-hour tutorial slot after this in which the module leader will discuss project planning and address any questions students may have. In the second term, the seminars will be replaced by 2-hour tutorials in which the module leader will discuss project planning, enacting, and report writing with each of the student groups in allocated supervision slots.

Table 2: Timeline of the module week-by-week

Week no.	**Topics**
1	**Introduction to module** Begin logbook use
2-3	**Introduction to equality, diversity, and inclusion (EDI)**
4-5	**EDI in Engineering: issues in industry and inclusive design**
6	**'Inreach': Embedding EDI in Imperial** Introduction to Individual Coursework
7-9	**Outreach** Week 8: Individual Coursework due Week 9: Choose group project and team; begin planning initiative
10	**Impact assessment of EDI initiatives**
11	**Initiative Design Specification (IDS)** Tutorial covering how to formulate IDS in 2-hour seminar slot

12 – 14	**Initiative planning** Week 12: Pitching idea to collaborator using finished IDS Using feedback to iterate initiative design
15-19	**Enacting initiative**
20-22	**Evaluating initiative** Week 22: Report and logbooks due

Seminars

After extensive dialogue with academics, outreach organisers and charities, key themes that demanded understanding and discussion emerged. A seminar format was chosen as it allows students and lecturers to engage in continuous dialogue. Each seminar has a potential guest lecturer that has expressed interest in leading. It should be noted the names provided are entirely provisional. A full breakdown of potential collaborators is included in Appendix C:.

Introduction to the Module – *Module Leader*

This seminar will serve to introduce this unique module and set the tone for the year as one valuing open and honest dialogue. The structure of the module will be discussed alongside the individual and group coursework, the seminar topics, and the methods of assessment. The module leader will introduce the concept of safe spaces and brave spaces. These ideas will provide a basis for the guidelines of discussion that should be followed to facilitate productive conversations. Additionally, students will be given a logbook and introduced to the idea of reflective and reflexive practice and how it can be used in personal, professional, and academic life. Within this seminar, students will be asked what equality, diversity, and inclusion means to them and what they expect to learn from this course.

What is Equality, Diversity, and Inclusion? – *Sara Camacho Felix*

The first guest lecture in the course will be given by an EDI academic and will focus on the terminology surrounding equality, diversity, and inclusion issues. It will outline the key EDI problems facing higher education and engineering and support these claims with data. The concept of widening participation will be introduced and the three models to better EDI will be discussed. This will include: the structural model, which focuses on the

institutional biases that lead to discrimination; the deficit model which focuses on targeted training of those in underrepresented groups; and the socio-psychological model which looks at the unconscious individual biases.

Perspectives, Privilege, and Power - *Sara Camacho Felix, Ashraf Hoque, Sara Rankin*

This seminar will focus on lived experiences of discrimination, demonstrating the value of qualitative data when trying to address equality issues. Led by one or several EDI academic guest lecturers, this seminar will open a discussion about what the nature of privilege and discrimination is and how it relates to power structures. Students will be asked the question: In discussions about inequality in higher education, where does the responsibility lie? Should it fall on underrepresented groups to do the work to create a more equitable and inclusive environment?

Why is EDI important in Engineering? – *Maria Farkas, Leila Guera*

This seminar will detail the work of the Imperial Business School's new award-winning module, 'Working in Diverse Organisations' and outline the business case for diversity in engineering. It will detail why diverse workforces are more successful and how neurodiverse workforces can lead to greater innovation.

Inclusive Design: Human Factors and Ergonomics – *Nate Macabuag, Soh-Yon Park*

After detailing why greater diversity and a more inclusive culture in the engineering industry is needed, Soh-Yon Park and other design engineers will discuss how to embed EDI into the design process. There will be a discussion of user base subsets typically disregarded by design and the ways in which inclusive design methods can build elegant solutions that work for all. In this practical seminar, students will be given the task: 'design a product for someone who doesn't look like you'.

'Inreach': Embedding EDI within Imperial Culture – *Kate Ippolito*

In this seminar, Kate Ippolito will discuss how we can embed more equitable and inclusive practices into Imperial culture using the novel term 'Inreach'. It will discuss how widening participation schemes do not usually extend to the institutional culture, what role do faculty and the student body play in integrating greater equality, diversity, and inclusion into higher education institutions. Most importantly, it will outline the ways in which we

can take action within our own communities at Imperial and the initiatives that are already in motion. There may be potential for an analysis of a case study in this seminar, for example, LSE's development of a toolkit to 'internationalize the curriculum'.

Introduction to Outreach – *Melanie Botrill, Mark Richards, Sunday Popo-ola, Simon Foster*

This seminar will be led by outreach officers and coordinators at Imperial. It will introduce the concept of outreach and why and how should you target specific groups with this initiative. It will outline the planning and costing of outreach initiatives, how to deliver effective outreach and ways to coordinate teaching with the school curriculum. There will also be a brief discussion of safeguarding and behavior management.

Science Capital and the Equity Compass – *Julie Moote, Spela Goldec*

Julie Moote and Spela Goldec, STEM inclusion researchers working on the UCL ASPIRES project, will deliver a lecture on their work on engineering aspirations and making informal science learning a more equitable and inclusive space. Julie will cover what science capital is and how it can be used to transform pedagogies. Spela will introduce the equity compass which can be used to aid a social justice mindset.

Neurodiversity and the Importance of Inclusive Outreach – *Sara Rankin*

Sara Rankin will lead a seminar on how educational and HE environments can be a hostile environment for neurodiverse individuals. She will introduce novel terminology, including terms like twice exceptional, and detail her work with 2e neurodiverse people and her work on the 2empower project. This seminar will encourage a discussion of how we can use inclusive outreach to make engineering more accessible to neurodiverse individuals.

Assessing the Impact of EDI Initiatives – *Sam Bailey, Kate Ippolito*

The final seminar will focus on how to evaluate EDI initiatives. Led by outreach evaluation coordinators at Imperial or potentially members of the EDIC, it will discuss how to structure surveys, forms, and focus groups. The seminar will also discuss what constitutes high quality evidence of EDI initiative impact, detailing how to interpret qualitative and quantitative data and the merits and drawbacks of both. Finally, it will consider the methods to effectively communicate impact evaluation.

Assessment and Marking

Reflective and Reflexive Logbook (25%)

Overview

The logbook will act as a guide for the students' learning and critical thinking. After each seminar in the Autumn term, students will respond to prompt questions based on each week's topic in their logbooks to structure their thought processes and to encourage reflexive thinking. Answers to the previous week's questions may be discussed in seminars.

In the second term, students will also start to record the process of designing their EDI-focused initiative. They will be encouraged to continue logging their personal growth, utilising the reflective and reflexive practice skills they have gained, but there will not be a compulsory set of questions to answer.

Reflective vs. Reflexive

The reflexive aspect of the logbook was suggested by Sara Camacho Felix, during a discussion about the limitations of generalized reflective practice.

Reflexive practice is best defined as a perspective or stance, by which the practitioner identifies their role within the context of the situation and understands that their existence in the situation influences how they interact with it. Reflexive practice is not the same as reflective practice, however, as Fook best puts it, "a reflective process and a reflexive stance are not mutually exclusive and it is possible that the methods of reflective practice, used similarly to deconstructive methods, might aid a person in becoming more reflexive." (9)

Therefore, the logbook structure has been designed to allow the students to extend their learning from thinking about EDI issues within wider society, to identifying their role in society and how this in turn can affect the EDI issues seen.

The skills gained through focused and dedicated logging of thinking easily applies to the design-focused logbooks students are familiar with. They will be encouraged to write and sketch in the logbooks as they usually would.

Example Questions

The questions set at the end of each seminar will reflect the content learned that week and act as an introduction to the next week's topic.

For example, if the current week's topic is 'Why is EDI Important in Engineering?' and the following week will be 'Inclusive Design: Human Factors and Ergonomics', examples of questions may be:

- What factors hinder diversity in industries?
- Are these factors different across the globe?
- How does your life experiences affect the design choices you make?
- Have you ever had to use scissor made for our non-dominant hand? How does your experience with scissors differ from someone whose dominant hand is different to yours?
- Think about the past products you have designed. Can the product be used with the same ease for both left-handed and right-handed people?

Marking

The Logbook will count for 25% of the marks for this module.

To achieve the full marks for this assessment component, the student must:

- Answer all set questions fully
- Demonstrate reflective and reflexive practices by challenging their own personal assumptions, habits, or values within the subject being reflected upon, with consideration of influences they have on the subject itself.
- Demonstrate continual learning by linking their current reflection to previous seminar topics and the experiences and viewpoints shared by others from the seminar.
- Clearly describe the feelings, thoughts and questions that arise throughout the module, and document how they change as the student continues learning.

The marks will be awarded based on how much the student has engaged with the topics and evidence of their development in the documentation of their thought processes.

Individual Coursework Component (10%)

Overview

The individual coursework component will be given to the students in Week 6, following the lecture and seminar on the topic: ‘Inreach: Embedding EDI within Imperial Culture’.

Students will choose a core topic from or aspect of the Mechanical Engineering course to analyse. They will also focus their analysis on just one of the themes regarding EDI in the curriculum outlined by the Advance Higher Education Institute.

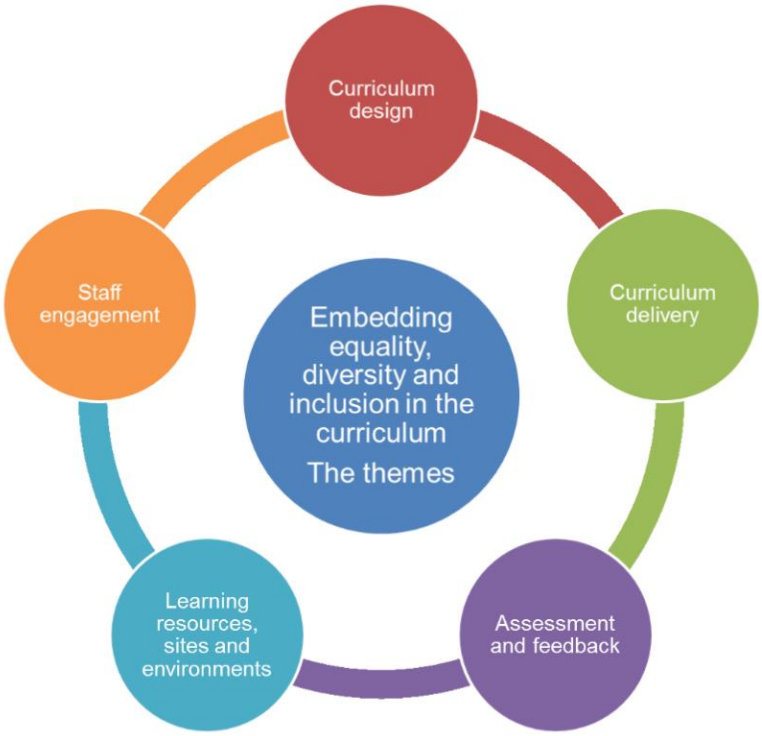

Figure 3: The different ways in which one can embed equality, diversity, and inclusion in the curriculum(10)

After guided analysis using the techniques explained in the Advance HE document, the student will then propose actionable solutions for embedding of EDI into the curriculum. These proposals and justifications will be handed in for assessment in Week 8.

Justification

The individual coursework component allows students to identify issues and shortcomings to do with EDI within the communities and structures to which they belong.

The process of finding solutions to these issues almost acts as a practice run for the group project they will complete later in the course.

Previously, it was envisioned that the individual task would be to appraise a past EDI initiative, as a case study activity. However, the task to propose changes to embedding EDI into the curriculum was chosen over appraising a case study as it takes a more active stance to dealing with EDI issues and would allow students to practice the same skills in both their individual and group project. In doing this exercise, the problem-solving skills they gain will directly relate to EDI initiatives, which they can continue to use in their workplace or community following graduation.

Marking

To achieve the full marks for this assessment component, the student must:

- Accurately identify areas of shortcomings in the curriculum of their chosen module, based on the Advance HE guidelines
- Communicate thoughts on own experiences of the curriculum and evaluate how that may differ from peers.
- Propose focused and specific actions that can be implemented successfully between academic years, with no detrimental effect to dissemination of the technical aspects of the course.
- Provide logical justification of proposed action that references the course content.

Example of Coursework Structure

Core Module chosen: *ME1 Thermodynamics*

Theme: *Curriculum Delivery – relating course material to students' personal experiences*

Analysis: *The only examples of powerplants are in the UK/Western countries. As a home student, I was used to seeing examples of western feats of engineering, which limited my understanding of the engineering industries in other countries. For me, I could easily relate my learning to the power plant that is near my hometown in the UK. For international students, they never see examples of their local power plants and without just cause. Three of the five largest natural gas power plants are located in Japan, however these are never mentioned in lectures or tutorial questions. This can alienate students who*

come from Japan or East Asian countries for whom these examples are the ones they are most familiar with.

Proposed action: *Explain and compare powerplant designs from around the world and compare their efficiencies. In tutorial questions, namedrop examples from around the world.*

Justification of action: *By including examples from around the world, students benefit from perceiving engineering as an international industry. Ethnic minority students will feel better represented if examples of engineering are taken from areas that match their background and culture. Students may also be encouraged to seek out careers in other countries or find companies that have branches around the world, as they often have opportunities for exchanges across their branches.*

Group Project (45%)

Overview

This project will allow students to expand their learning beyond the seminar room.

In groups of 3, students will either design an EDI initiative at Imperial or work with a partner school to design an engineering outreach initiative, embedding equitable and inclusive teaching practices in their initiatives. Each group will choose from a list of project proposals or have the option to self-propose an initiative. Each group will work with a professional collaborator.

During the design and running of the initiative, students will have regular supervision sessions with the course leader to discuss the project progress. Students will complete an intermediate piece of coursework, an initiative design specification, during the design phase to provide focus and ensure their project is feasible and well thought-out. They will then action their initiatives throughout Spring term.

After implementation, they will have the opportunity to appraise their work and assess their impact with their collaborators and the module leader. Their learning journey and experiences in actioning an EDI-focused initiative will be written up in a report as the final marked assessment piece.

Project Proposal List

The list of proposed projects allows students to choose from a range of different projects to match their interests. The projects will be largely categorized into outreach or ‘inreach’ projects.

They are also given the choice to propose their own project if they feel particularly passionate about a certain aspect; in the ‘Communicating Computer Science’ course in the Computing department, many students opt to work with their old schools, and we would like our students to be able to do the same.

Outreach initiatives may be facilitated through the Imperial Outreach department, who have a range of connections with partner schools. Examples of possible engineering outreach initiatives are:

- After school engineering clubs
- Collaboration with current Imperial Outreach projects
- One-to-one mentoring schemes
- Teaching packs/toolkits for teachers to implement
- Development of online Outreach events

Students will need to consider the target audience of their initiative when choosing a project or school to work with. We aim to target schools with either a high number of FSM (free school meals) and or EFL (English as a foreign language), as it appears to be the best indicator of whether a school needs more support(11).

‘Inreach’ initiatives may be proposed by members of staff across college who wish to collaborate with students on an initiative, for example, collaborating with Supporting the Identity Development of Underrepresented Students (SIDUS) project at Imperial.

Other ‘Inreach’ ideas could include:

- Implementing a reverse mentoring scheme within the department
- Creating resources to help educate staff members on topics learnt in module’s first term
- Embed EDI into the course material of an entire course module

Currently, several groups or individuals have proposed ideas for projects they would like to collaborate with students on, shown in Table 3.

Table 3: List of proposed group projects and respective collaborators

Project Description	Contact of collaborator
Neurodiversity-focused outreach	Sara Rankin
Online engineering outreach event for autistic students	Sara Rankin
Community engagement project at the White City Campus: e.g. • Hackathons • Creating teaching toolkits for teachers to teach engineering concepts themselves • Afterschool clubs	Priya Pallan, Imperial Community Engagement Team
Career talks at an all-girls school	Jonathan Jeffers
1-to-1 mentoring schemes for students in secondary schools	Jasneet Kaur Taak, Accelerate Mentoring
Project work to do with Representation	Wayne Mitchell, Imperial as One
Partnering with the SIDUS project (Supporting the Identity Development of Underrepresented Students)	Tiffany Chiu, Educational Development Unit
Create a toolkit for lecturers within the Mechanical Engineering department to use when embedding EDI into their courses	Department
Design and implement a reverse mentoring scheme within department	Department
Design a programme similar to the BAMEhack programme at UCL (contact Darren Nesbeth for more information on this) for our students to take part in	Department

Initiative Design Specification

The initiative design specification (IDS) component of the group project is envisioned as an intermediate step toward delivering the final initiative. It will not count for marks until it is included in the final report for submission. This task was chosen as it would allow students to use the familiar structure of a product design specification and apply it to an initiative rather than a product. Students will be expected to complete the IDS by the end of first term.

An example IDS structure may look like one shown in Table 4:

Table 4: An example of an initiative design specification for an afterschool engineering club

Project Description:	Deliver an afterschool engineering club to a primary school with a high percentage of free school meals (FSM).		**Resources and action required to fulfil aim**
Aim	**Justification**	**Criteria to evaluate against**	
Run the club for 5 consecutive weeks	*Multiple interventions is better to inspire kids to pursue a subject*	*n/a*	*Liaise with teacher to ensure the sessions fit within term time*
Create hands-on activities that are cheap and easy to implement.	*The club and its activities should make engineering as accessible as possible. Therefore, the cost of materials should be minimised, and teachers should feel confident in running the activities themselves.*	*Cost of materials <£15 per session/activity.* *Teachers will rate the activity based on how confident they'd feel running it.*	*List the materials needed for each activity and a budget guide.* *Create an information pack with instructions to help the running of the activities*
The engineering club must maximise its capacity for students with FSM	*Students with FSM are less likely to have as many opportunities to engage with engineering as their peers do.*	*The percentage of FSM students participating in the club must be equal to or greater than the percentage of FSM students in the year group the club is advertised to.*	*Liaise with teacher to implement a selection process for the club, where students with FSM are given priority*
Materials delivered in the club must be appropriate for children with neurodiversity: • *Fonts are dyslexia-friendly*	*The materials and resources should be inclusive to everyone:* • *If text is easier for dyslexic people to read, it is easier for everyone to read.*	• *n/a*	• *Use a dyslexia-friendly font, such as Arial*

• *Have an anonymous question forum*	• *Students with anxiety may feel more comfortable asking questions this way, and most students will be excited with the prospect of using tablets*	• *The time taken to implement the use of tablets shouldn't detrimentally affect the time that students are engaged with content. If this occurs, an alternative to tablets may be more appropriate.*	• *As the school has tablets in their classrooms, use mentimeter during sessions to collect questions* *Ask school/teacher if this is feasible*

Marking

The final report of the group project will be how the assessors determine the project grade. Students must still show engagement with the project throughout its duration, including completing the IDS and responding to feedback from supervisors. While a report is the format of assessment, the students' ability to write a report is not the key aspect assessed and rather the rationale behind the project development and the student's reflexive reflection on the process of enacting the initiative.

The group project makes up 45% of the module. To achieve the full marks for this assessment component, the student must:

- Develop an IDS with thoughtful aims, justifications, criteria for success, and steps to fulfil the aim.
- Collaborate with peers and other involved members of the project
- Show continual learning throughout the project by reporting on their responses to feedback given on the project and reflections to developments to their initiative design.
- Demonstrate critical thinking when assessing the impact of their initiative
- Work professionally and communicate effectively with collaborators of the project
- Test the initiative's success against the IDS and other parameters
- Show understanding of limits to measuring the success of an EDI focussed initiative

Conduct of Task (20%)

Overview

The conduct of task component measures how well the student has responded to the course content and their attitudes towards a different style of learning. This component of assessment will comprise of a peer assessment mark and a supervisor mark, each making up 10% of the module (20% weighting in total for this component).

Peer Assessment

Group projects will often contain a peer assessment aspect of the mark. The fact that marks are allocated in this way can spur people to pull their weight if they are marked by peers and teaches teamworking skills. However, there is a growing level of discontent with processes of peer assessment emerging, with factors such as actual and perceived racial and gender stereotyping and related rejection-sensitivity playing a part(12).

The peer assessment process is not perfect; however, it is hoped that students taking this module will have a better understanding of these factors affecting peer assessment when grading their fellow team members. Prior to the peer assessment submission, a tutorial and online discussion based on EDI-related issues to peer assessment will be held.

Reasonable Adjustments vs Inclusivity

This module heavily focuses on discussion amongst peers to broaden perspectives and encourage more meaningful and reflexive learning. However, it may be the case that some students cannot attend all seminars in person. College policy is that reasonable adjustments must be made to accommodate students, however, is often only applicable to students who have a declared disability.

Given the module is centred around equality, diversity and inclusion, the module structure itself should be inclusive of everyone, regardless of whether they have declared their disability to college or not. It would be against the ethos of the module to assess conduct of task solely on in-person discussion.

Therefore, the Teams chat/forum set up for the module will allow discussion to happen outside of the in-person classroom. This will also enable students to contact guest lecturers with questions and comments, which all students of the course can see.

Marking

This component makes up 20% of the module.

To achieve the full marks for this assessment component, the student must:

- Demonstrate an open and receptive attitude towards task/module/ideas
- Contribute to meaningful discussions in class or on forums with peers that test their ideas and challenge their own perspectives
- Show self-awareness and reflexive, reflective practice in discussions with peers and in their teams
- Show continual learning through linking ideas to concepts from previous seminars
- Work well in a team

Constructive Alignment

Table 5: Constructive alignment table showing how each part of the module aligns with student-focused intended learning outcomes

	Define the key terms, 'equality', 'diversity' and 'inclusion', and explain how they are related to engineering, STEM and wider society.	Evaluate personal development and changes to thinking through reflection in the context of reflexive practice.	Identify actionable methods of embedding EDI into the curriculum	Devise and action an initiative within Imperial or as an outreach programme at a partner school, with a goal to improve EDI in engineering	Assess the impact of this initiative through qualitative and quantitative measures and communicate results
What is Equality, Diversity, and Inclusion	✓	✓			
Perspectives, Privilege, and Power	✓	✓			
Why is EDI Important in Engineering?	✓	✓			
Inclusive Design: Human Factors and Ergonomics	✓	✓			
'Inreach': Embedding EDI within Imperial Culture	✓	✓	✓	✓	
Introduction to Outreach	✓	✓		✓	
Science Capital and the Equity Compass	✓	✓		✓	
Neurodiversity and the Importance of Inclusive Outreach	✓	✓		✓	
Assessing the Impact of EDI Initiatives	✓	✓	✓		✓
Reflective and Reflexive Logbook	✓	✓			
Individual Coursework Component			✓		
Group Project				✓	✓
Conduct of Task		✓			

Staff Roles

We envision that there will be four main departmental roles in the running of the module: the Module Leader, the Associate Module Leader, Module Administrators, and the Additional Examiners. These roles will supplement the externally held roles of the Guest Lecturers and Project Collaborators.

The Module Leader will lead the further development of the module before its running, moderate all the seminars, run all tutorials and, alongside the Additional Examiners and the Associate Lead, assess the coursework submissions.

The Associate Lead and Module Administrators will conduct the module's administrative work. The administrative work will involve organising and liaising with the Guest Lectures and Project Collaborators for the academic year in progress as well as the successive one. It is expected that the Administrators will be members of the UG Office.

The estimated hours of commitment during the running of the module are as follows:

- **Seminars – 22 hours:**

  2-hour seminars every week during the first term

- **Assessment – 30 hours:**

  Individual Coursework Assessment – 10 hours (30 minutes each)

  Group Project Coursework Assessment – 10 hours (1-1.5 hours each)

  Logbook and Conduct of Task Assessment – 10 hours (30 minutes each)

- **Tutorials – 24 hours:**

  1-hour tutorials in the last 2 weeks of the first term

  2-hour tutorials every week during the second term

- **Admin – 40 hours:**

  2 hours of admin every week during the first term and the first 9 weeks of the second term

These will be distributed between the roles as follows.

- **Module Leader – 61 hours:**

  22 hours of seminar moderating; 24 hours of tutorial leading; 15 hours of assessing

- **Associate Module Leader – 25 hours:**

  20 hours of admin; 5 hours of assessing

- **Module Administrators – 20 hours**
- **Additional Examiners – 10 hours**

The distribution of the hours is summarised in Table 6 below.

Table 6: Estimated breakdown of staff hours

		All staff					Course Lead				Associate Lead and Administrators			Additional Examiners	
Term	**Week #**	**Seminar**	**Assessment**	**Tutorials**	**Admin**	**Total**	**Seminar**	**Assessment**	**Tutorials**	**Total**	**Assessment**	**Admin**	**Total**	**Assessment**	**Total**
Autumn	**1**	2			2	4	2			2		2	2		
	2	2			2	4	2			2		2	2		
	3	2			2	4	2			2		2	2		
	4	2			2	4	2			2		2	2		
	5	2			2	4	2			2		2	2		
	6	2			2	4	2			2		2	2		
	7	2			2	4	2			2		2	2		
	8	2			2	4	2			2		2	2		
	9	2	5		2	9	2	5		7		2	2		
	10	2	5	1	2	10	2	5	1	8		2	2		
	11	2		1	2	5	2		1	3		2	2		
Spring	**12**			2	2	4			2	2		2	2		
	13			2	2	4			2	2		2	2		
	14			2	2	4			2	2		2	2		
	15			2	2	4			2	2		2	2		
	16			2	2	4			2	2		2	2		
	17			2	2	4			2	2		2	2		
	18			2	2	4			2	2		2	2		
	19			2	2	4			2	2		2	2		
	20			2	2	4			2	2		2	2		
	21			2		2			2	2			0		
	22			2		2			2	2			0		
			10			10		5		5	5		5		
Easter			10			10				0			0	10	10
						116				**61**			**45**		**10**

Next steps

There are several avenues to build on the work of this UROP. Firstly, a permanent module leader must be selected. After surveying staff, there are two options for associate module leader, but no clear potential candidates for module leader. From this we conclude it may be advantageous to hire a module leader externally either from within Imperial or outside of the university. Several faculty members, outside of the department and who are involved with targeted outreach projects at Imperial, have expressed interest in this role. Although the priority should be placed on finding a module leader from within the department, finding someone passionate and knowledgeable about these issues would improve the quality of the module considerably. This might dissuade fears about quality control issues even if the module leader is external to the mechanical engineering department.

The course curriculum also needs to be developed further through liaising with those who have agreed to guest lecture. A potential reading list has been developed and a resources library has been generated to further evolve the teaching materials used in this module, shown in Appendix E. The rubric for each assessment also requires further consideration to align with intended learning outcomes and fulfil the 6 ECTS. Further consideration is also required of where the module will fit in the timetable.

Additionally, a school survey was developed and sent to schools that already have links with Imperial through physics outreach, however, due to the summer holiday, insufficient responses have been collected. The module leader should collect more responses about what teachers think of this program and whether they would be happy to facilitate outreach initiatives at their schools.

It should also be noted that for each survey, responses are still being collected and more data is coming in. The Qualtrics school survey and the Microsoft Form for collaborators survey will have new responses that require further analysis. Additionally, the alumni survey has not been shared with the full alumni network due to GDPR restrictions so it may need to be shared more widely in the future.

Finally, there should be consideration of budget and how funding will be acquired. We estimate this may include DBS checks for the 21 students in the cohort, funding for each of the 7 group projects, and funding for the payment of guest lecturers. There are multiple avenues to acquire grants due to the module's focus on STEM outreach. Grant schemes like the Ingenious grant could give the module leader access to a set amount of money that could be used each year to fund DBS checks and group projects. Additionally, organisations like The Wellcome Trust and The Wolfson Foundation alongside Imperial's Societal Engagement Seed Fund should be explored to acquire funding. The EDI Seed Fund, managed by Stephen Curry, and the Excellence Fund for Learning and Teaching Innovation at Imperial should also be considered.

Conclusion

The module structure detailed in this report is the best design we have produced within the time and resource constraints of our project. As we hand over the implementation of this module to the department, we understand that there is a lot of work still to be done, and that there will likely be further changes made to this module design.

The module is designed to equip our graduate engineers with the skills to understand and address EDI issue when they start working within industry. The seminars are run in a way that provides students with background knowledge on EDI, then enables them to link these concepts with Engineering and design. Students learn to look inwards, both in reflexive reflection and in looking at the communities to which they belong. Learning about outreach, and specifically effective and targeted outreach will also encourage them to think about what they can do to help less privileged and underrepresented communities, whether they identify with these groups or not.

Choices regarding the coursework structure and running of the group project initiative were made with consideration of previously successful project structures within Imperial and the advice given by EDI specialists.

We appreciated that funding, resource and administration are large obstacle to overcome before the department can offer this module to students. However, we think that these efforts are well worth the positive influences this module will have for every

Mechanical Engineering student that graduates from Imperial College, and the industry overall. The implementation of this module therefore hinges on whether the Mechanical Engineering department at Imperial recognises the value of greater EDI in engineering and the module as a means to achieving this.

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Appendix

Appendix A: Other Relevant Modules

Communicating Computer Science | *Department of Computing, Imperial College*

Contacts:	Jackie Bell
Link:	Module description: https://www.imperial.ac.uk/computing/current-students/courses/60003/ Minutes from meeting with module lead: shorturl.at/pxzJX

Communicating Physics | *Department of Physics, Imperial College*

Contacts:	Vijay Tymms, Kayleigh Murphy
Link:	Module description: https://www.imperial.ac.uk/physics/students/current-students/undergraduates/lecture-courses/undergraduate-options/communicating-physics/

Communicating Mathematics | *Department of Mathematics, Imperial College*

Contacts:	Emma McCoy, Lynda White
Link:	Module description: https://imperiallondon.sharepoint.com/sites/UROP-ME-ProjectFiles/Shared%20Documents/Project%20Files/1%20RESEARCH/Resources/Module%20Development/M3T%20information%202008-9.pdf

Social Accountability in Action | *STEMM I-Explore & Department of Medicine, Imperial College*

Contacts:	Beth Golding, Jenna Mollaney

Links: Module description can be found on page 11 of the following document: https://imperiallondon.sharepoint.com/sites/UROP-ME-ProjectFiles/Shared%20Documents/Project%20Files/1%20RESEARCH/Resources/Module%20Development/Year-2-STEMM-modules.pdf

Minutes from meeting with module leads: shorturl.at/avB29

A paper was written assessing the impact of the module(13). Key points are as summarised:

- Novel teaching programme developed in FoM at Imperial: med students based at a local primary school aiming to develop the students' teaching skills + center social accountability in curriculum. Similar past service-learning projects shown to:
    - Improve communication skills
    - Increased empathy
    - Improve social understanding of health
- Service learning – embed students in community project, responding to a specific need.
- Med students in final 2 yrs of 6 yr degree. Participated in program in 2018/19. First visit: observe + build relationship with pupils. Then developed a teaching-based session with teacher support. Second visit: delivered a 2 hr teaching session to pupils under supervision.
- Paper based on interviews + written reflections agree with the learning outcomes from past service-learning projects. Effective way of learning dynamic teaching skills
- Teachers note benefit of aspirational figure for pupils + improved engagement from pupils
- Perceived long term impact on pupils and increased interest in HE.
- Service-learning potential tool in improving link between higher ed and local communities + raising aspirations of younger people. Could be a useful method of tackling problems of inequality in HE, one of the major problems in widening participation

- Key LO of this module: enshrine the importance of social accountability and doctors as educators in curriculum.

Demonstrated the importance of early intervention in outreach. Many widening participation schemes focus on older students and the application process.

EDI for Chemistry | *Department of Chemistry, Imperial College*

Contacts: Anna Barnard, Kim Jelfs

Notes: Not a module but a short compulsory course. Contact the names above for more details.

Accessibility & Inclusive Design | *Faculty of Information, University of Toronto*

Contacts: Sambhavi Chandrashekar, sambhavi.chandrashekar@utoronto.ca

Link: https://imperiallondon.sharepoint.com/sites/UROP-ME-ProjectFiles/Shared%20Documents/Project%20Files/1%20RESEARCH/Resources/Module%20Development/INF2165H-Accessibility-Inclusive-Design-Fall-2020%20(1).pdf

BAMEHack | *Department of Engineering, UCL*

Contacts: Darren Nesbeth, d.nesbeth@ucl.ac.uk

Notes: Not a module – a staff-student collaboration initiative focused on redesigning the engineering curriculum to embed EDI.

Link: https://imperiallondon.sharepoint.com/sites/UROP-ME-ProjectFiles/Shared%20Documents/Project%20Files/1%20RESEARCH/Resources/Module%20Development/BAMEhack%20BAGFP%20100221%20ext.docx?web=

Engineering into Schools | *Department of Engineering, University of Durham*

Link:	https://www.dur.ac.uk/faculty.handbook/module_description/?year=2021&module_code=ENGI4321

Engineering in Society | *Department of Engineering, University of the West of England*

Contacts:	Laura Fogg-Rogers, Laura.Foggrogers@uwe.ac.uk
Notes:	Unique module that pairs the student engineers with pre-service teachers taking BEd degrees on to be peer mentors to each other
Link:	https://blogs.uwe.ac.uk/science-communication/engineering-in-society-new-module-for-engineering-citizenship/ https://imperiallondon.sharepoint.com/sites/UROP-ME-ProjectFiles/Shared%20Documents/Project%20Files/1%20RESEARCH/Resources/Module%20Development/Engineering%20and%20Society%20specification.pdf

Appendix B: Survey Data

Student Survey Results

A survey was sent to all students in the course to assess student perceptions, to record interest in the modules, opinions on its planned structure and content, and evidence for the module's necessity. 60 students completed the survey, of whom 55% identified as belonging to an underrepresented group. 22% of respondents were female, and 45% were ethnic minorities (6% mixed, 36% Asian, 3% Black).

"I'm confident in discussing EDI Issues"

Approximately 80% of students replied positively to the statement, with the remaining 20% being neutral or replying negatively (Figure 4). There was no significant skew in the percentage of underrepresented students amoungst those replying positively compared to those replying non-positively. These results were encouraging and showed

that the vast majority of students were confident in sharing their perseption of EDI issues.

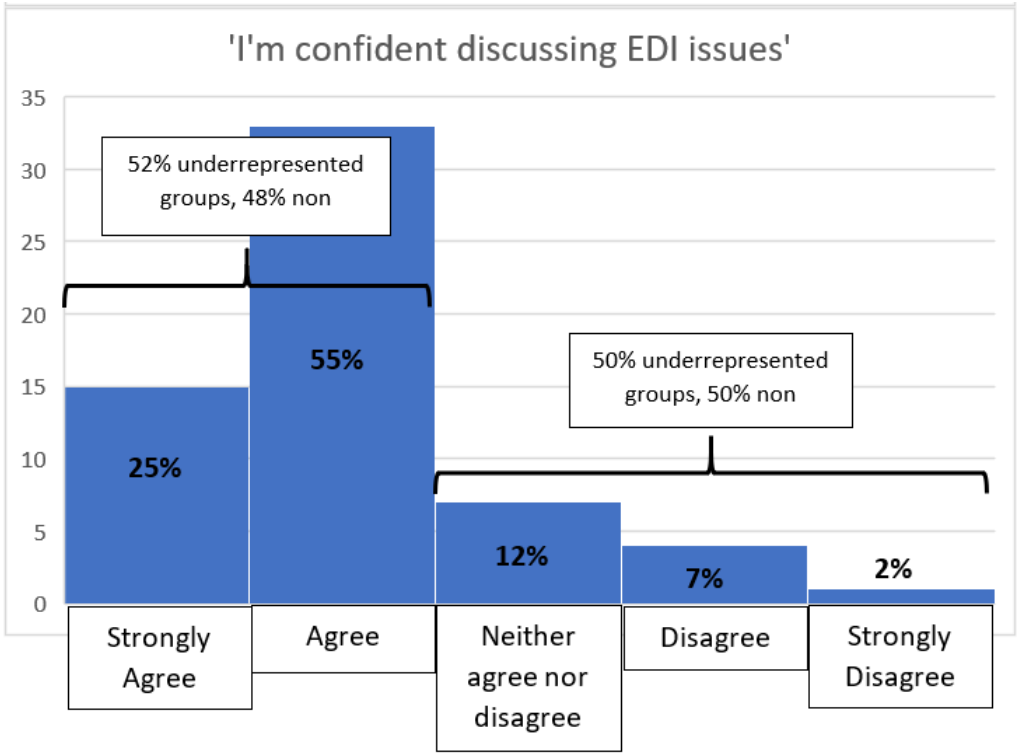

Figure 4: Bar chart of survey responses to 'I'm confident discussing EDI issues

“EDI is important to me”

Once again, approximately 80% of students replied positively, with 20% replying neutrally or negatively (Figure 5). However, for this question, some skew was present in the demographics of students replying positively (59% underrepresented) to those replying otherwise (36% underrepresented). This implies that the majority of students who are neutral or opposite to equality, diversity and inclusion are from lesser affected demographics.

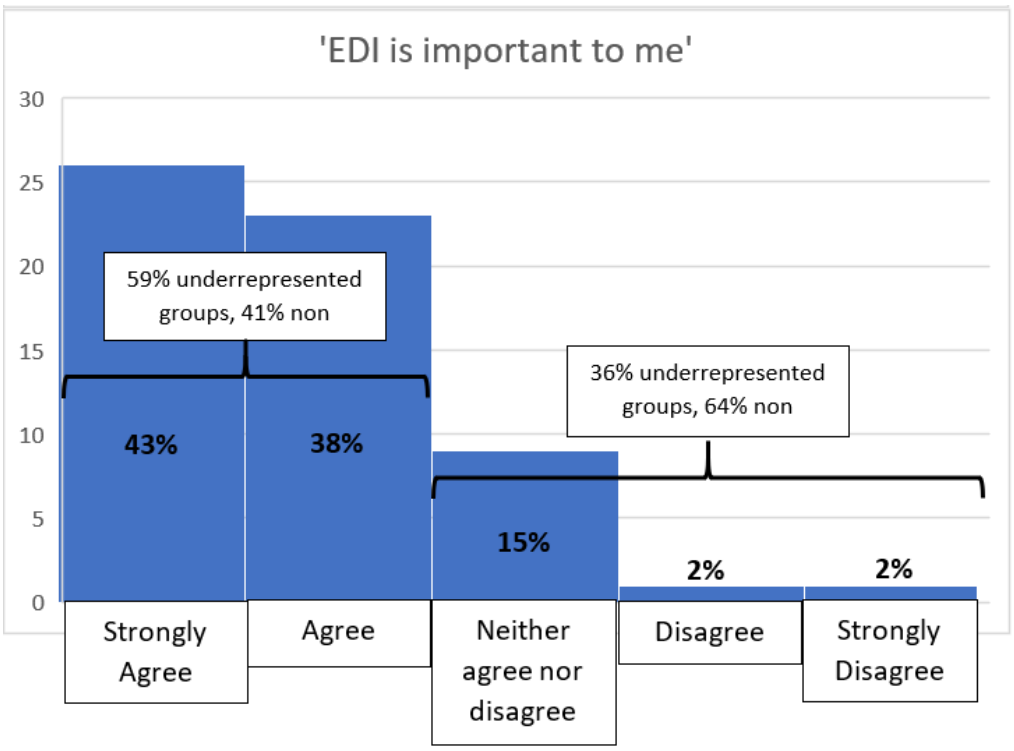

Figure 5: Bar chart of survey responses to 'EDI is important to me'

“I would like to learn more about EDI”

Approximately 60% of students replied positively, with 40% replying neutrally or negatively (Figure 6).

For 60% of students surveyed, this module therefore meets their learning interest. A slight skew was present in the demographics of students replying positively (58% underrepresented) to those replying otherwise (42% underrepresented). Along with the previous question, it can be concluded that underrepresented students are both more likely to see EDI as important, and are also more willing to learn more about EDI related topics than non-underrpresented students, despite representation being non-distinguishing in confidence with discussing EDI issues. This may suggest that some non-underrpresented students discuss EDI issues overconfidently – relative to their perceived importance of EDI or desire to learn more, they are more confident talking about the issues compared to underrepresented students. This evidences the need for this module as a means of ensuring all students’ confidence in engaging with EDI

issues is backed by an understanding of its importance and an openness to learn more about it.

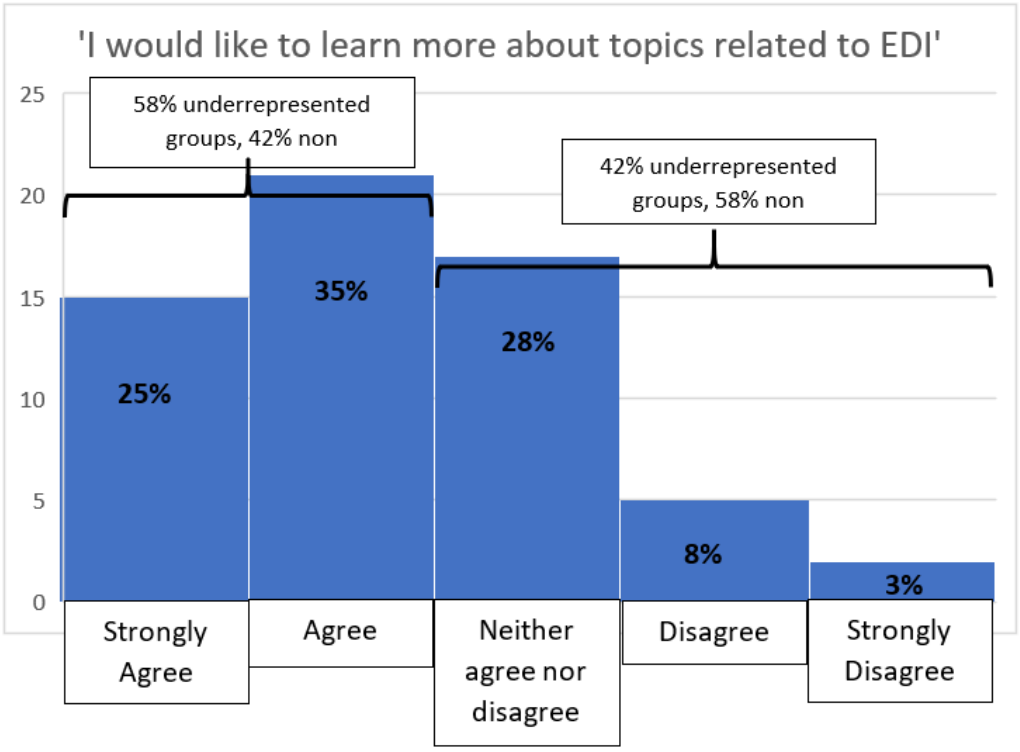

Figure 6: Bar chart of survey responses to 'I would like to learn more about topics related to EDI'

“There should be more EDI in engineering”

Approximately 72% of student replied positively with no significant demographic skew in those who replied positively vs those who relied neutrally or negatively (Figure 7). This implies a large ackowledgement of the lack of EDI in engineering and belief that it should be addressed, justifying the validity of the module’s aim. However, the belief that more EDI is needed in engineering does not necessarily imply a willingness to engage in EDI learning and action. Indeed, in a following question asking whether students have taken part in delivering an outreach initiative, only 15% of student had done so. This may be due to a lack of time resource – in the comments section of the survey, several students who mistakenly interpreted the module as an extracurricular stressed that they would not have time to partake in the module alongside current academic expectations

placed on them. Offering this module as a 3rd or 4th year module may therefore allow those who believe there should be more EDI in engineering to help address this issue without putting a strain on their time resource.

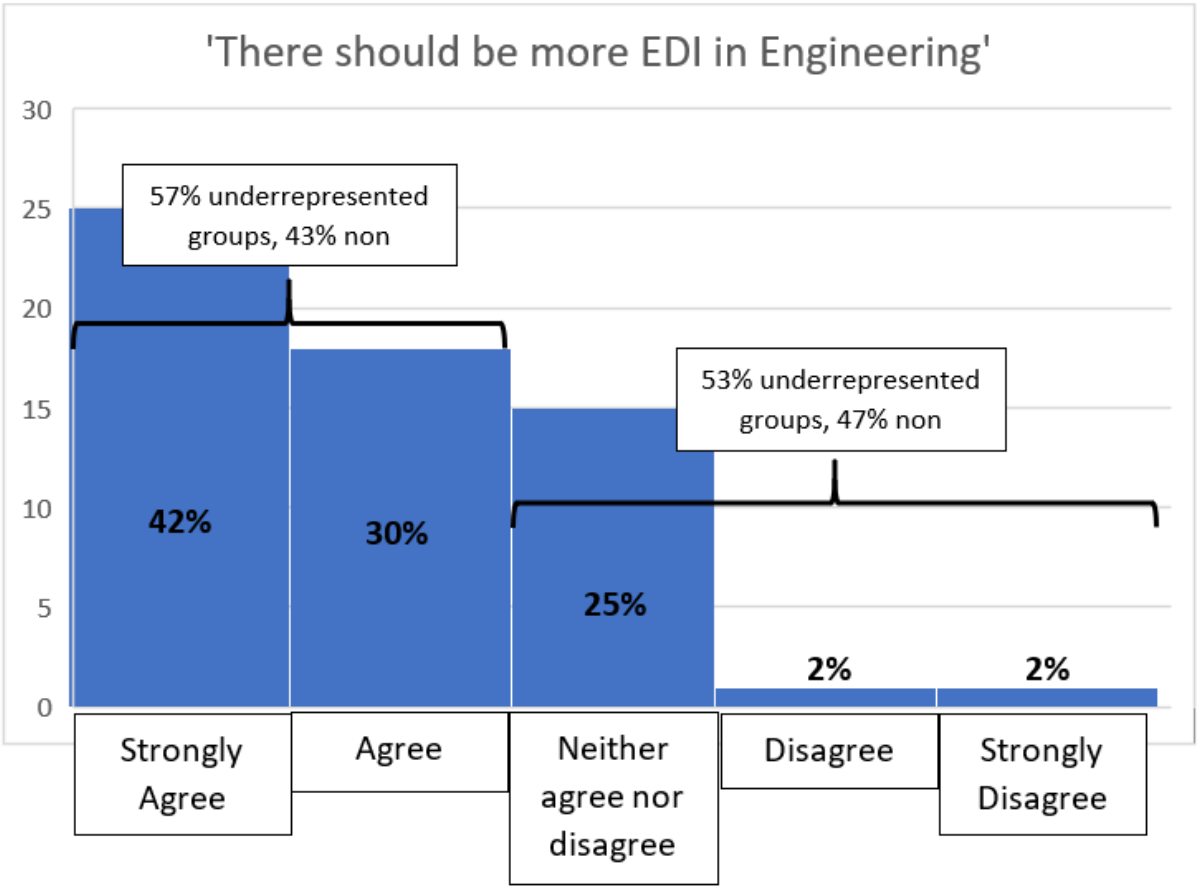

Figure 7: Bar Chart of survey responses to 'There should be more EDI in Engineering'

Targetted EDI Initiatives

Students identifying with an underrepresented group were asked whether they had been recipients of targetted EDI initiatives in the past. Only 15% said they had, demonstrating that more could be done to attract underrepresented groups to engineering, with this module helping to fill this need.

Gauging module interest

Students were given a brief description of the module based on the module design at the time. They were then asked whether the module sounded interesting to them (Figure 8). 25% said yes, with 30% saying no and the remaining 45% saying maybe. Students were also asked whether they would take the module as one of their electives (Figure 9) – answers were less positive with 17% saying yes, 32% saying maybe and 50% saying no. This is natural considering students typically are interested in more modules than there are available elective slots, meaning they must prioritise.

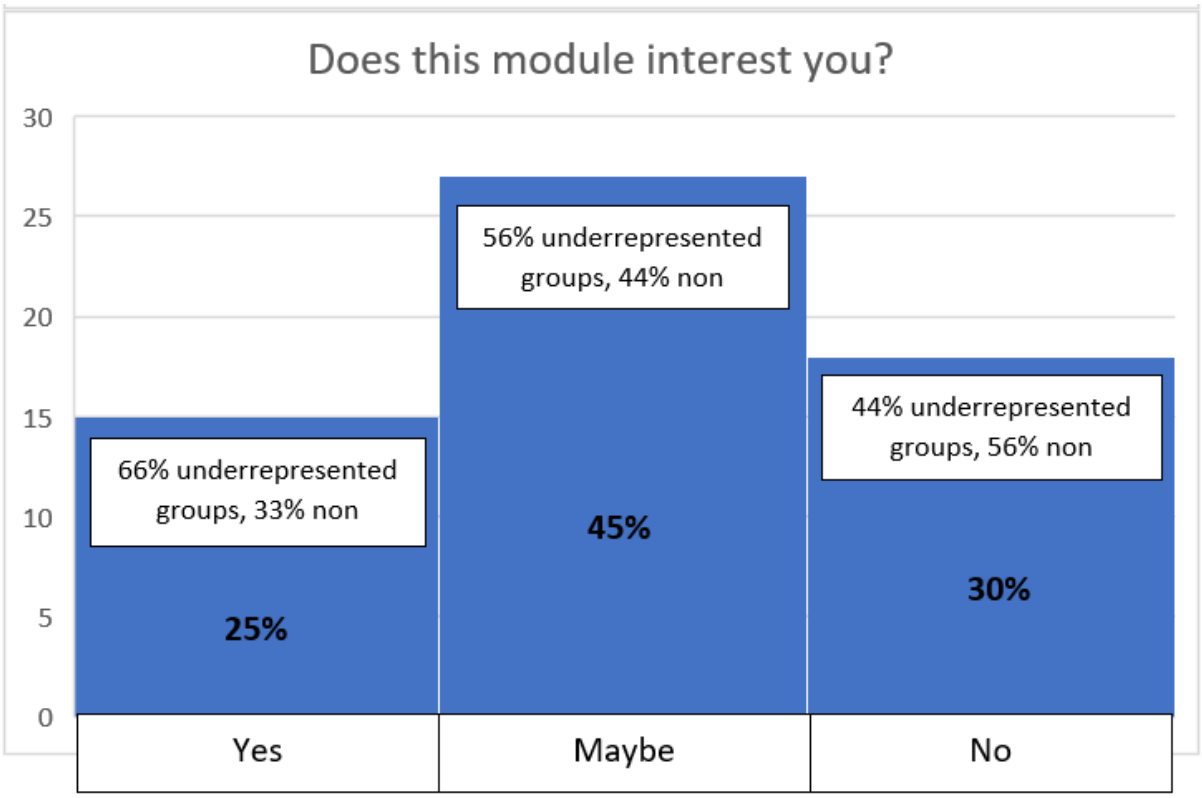

Figure 8: Bar chart of survey responses to 'Does this module interest you?'

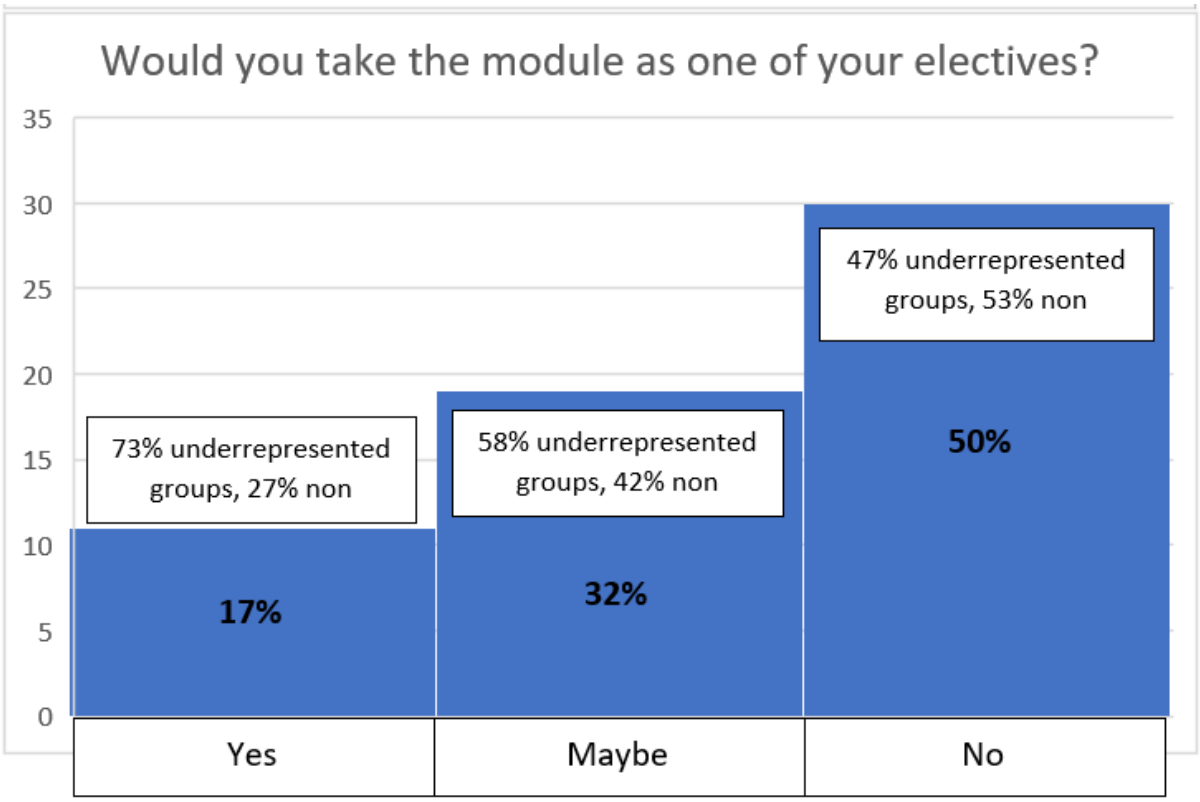

Figure 9: Bar chart of survey responses to 'Would you take this module as an elective?'

Comments were gathered justifying students' answers, which have been categorised and addressed below. A common comment explaining student hesitancy (relative to the proportion of positive responses to the previous statement questions) was that there was insufficient detail on what the module will comprise and how it will be assessed. This is a fault of the survey structure – students would have been able to answer this question with greater clarity had it been placed after the subsequent questions that illuminate the module's structure, teaching methods and content.

In both questions, a significant skew was present in the demographics responding positively compared to those responding negatively. This is as expected when considering the skew in demographics of students who consider EDI important and who wish to learn more about it. This represents a challenge that should be addressed in the advertising of this module – if the module is disproportionately taken by underrepresented groups, a harmful narrative of placing the onus of improving EDI upon the minorities affected will be further perpetuated.

The survey comments were as summarised below, categorised into praises and critiques.

Praise for the module:

- Would make engineering education more holistic
  - Benefits of EDI only realised during group work activities and placement year – would not have considered otherwise so module fills a gap
  - Would enjoy variety of doing a less technical module
- Would help to foster a healthier culture at Imperial, in engineering and in society
  - Students have inadequate understanding / awareness of EDI and discrimination is too common in Imperial culture
  - Will help students understand minority groups better and be educated enough on EDI issues to become allies
  - Will help ensure that quality of people's engineering work is only thing that matters, rather than who they are
- Structured and focused approach to EDI through a dedicated module is best way to educate and address issues

Table 7: Common critiques / concerns regarding the module

Critique/concern	**Response**
• May be better to incorporate EDI consideration into other parts of the course rather than as a separate module, e.g.: - Incorporate into Professional Engineering Skills - Make groups for project work modules more diverse - D+M lecture related to group working in an EDI-friendly way - Important for everyone to learn about EDI by integrating into core syllabus rather than having to compromise upon technical learning by taking this module	The EDIC has called for greater integration of EDI into the module syllabi of courses at Imperial. It is true that this is a more pervasive method of encouraging EDI consideration. However, this module will collaborate with and accelerate this process of wider EDI integration within Mechanical Engineering, rather than siphoning all EDI consideration. Through the individual coursework task and the 'inreach' options of the final project detailed in the Assessment and Marking section. The module will facilitate integration of EDI consideration into the department and College culture, enacting ideas such as those suggested in the comments above.

• Likely to mainly attract underrepresented demographics – 'preaching to choir'	As mentioned previously, this is a potential issue that must be addressed in the module's advertising. It is hoped that once the module has been put in place and is run for a couple of years, the embedding of EDI into the core curriculum and department culture will encourage more widespread investment in EDI and thereby see a less skewed demographic of students taking the elective.
• Concern that module will encourage adverse effects in social dynamics - Friction between underrepresented and overrepresented groups - Make underrepresented groups feel 'othered' due to special attention given to their experience - Create victim mentalities in minority groups	These comments highlight the need for the module. There is an underlying assumption here that the issues resulting from a lack of EDI are fabricated. This must be rectified through education on EDI issues and how EDI improvement is beneficial. The resistance to acknowledging and discussing EDI suggested by these comments are also indicative of an insidious "sweep it under the rug" mentality – it is believed that the issues will disappear if they are simply ignored and met with inaction. Of course, these issues will only be heightened if ignored. The module will instead teach students, through practical first-hand experience, how actions and initiatives can help to improve EDI and tackle the implicit issues.
• Concern that there will not be room for discussion / nuance - Concern that module will prescribe political correctness and performative action - Presenting opinion as fact without allowing for alternative perspectives - Concern that undoing of 'natural' demographic skews will be encouraged	The module will be highly discussion based, with weekly two-hour seminars comprising of a one-hour lecture and one hour discussion and brainstorming session as detailed in Seminars. Ground-rules for these discussions will not only create a "safe space" for everyone, but also a "brave space" where everyone will have the opportunity to present individual and alternative perspectives without fear of judgement, whilst encouraging an empathetic understanding of the implications of and reactions to the perspectives.
• Concern that an entire module dedicated to EDI in engineering would be unnecessary - Concern that there is not enough content related to EDI to comprise a whole module	There is certainly more than enough complex and non-trivial content on EDI to fill a whole module. The sentiment that there is nothing complex to be said about EDI implies a highly surface-level consideration of EDI, which itself justifies the need for this module. As

- Teaching will feel too 'common sense' - Learning can be done by having conversations / reading online so teaching through a university module is redundant - Concern that university-level teaching would not be possible on this topic - Too soft – would not look good on CV to have non-technical module	highlighted by the resources collated and contacts established during this summer project, EDI issues can be studied to a high level from perspectives including but not limited to politics, sociology, psychology, anthropology, economics, history, design, business.
• Module is too social-studies-like for an engineering course	This comment, like the previous, implies a reductive perspective on non-STEM learning. Students should be made aware that, although they have chosen to take a STEM subject, they must develop thoughts and ideas on topics other than STEM theory to be well-rounded, functional members of society. The broadening experience of taking this non-STEM module is not only enriching for students themselves but is a signal to potential employers of their versatility and sensitivity, as well as their aptitude for big-picture thinking, teamworking and management. Non-STEM elective modules are nothing new (e.g. BPES, I-Explore) and the teaching syllabus already acknowledges a need for all engineers to have some social insights as exemplified by the Professional Engineering Skills module, given engineering does not occur in isolation to wider society.

Alumni Survey Results

A survey was sent to alumni to assess their perceptions of the module's necessity with respect to their post-university experiences and their retrospective opinions of whether there was a gap in the curriculum that this module might fill. 19 alumni completed the survey, of whom 47% identified as belonging to an underrepresented group. 26% of respondents were female, and 68% were ethnic minorities (11% mixed, 26% Asian, 5% Black). It should be noted that the smaller number of respondants in this survey introduces a greater variance and less significance should be given to the demographic percentages of each subgroup of respondants.

Alumni were asked whether they felt the engineering industry to be diverse and inclusive. The results were inconclusive, with 47% replying negatively and 53% replying neutrally or positively as shown in Figure 10. Although this question was posed to all participants, those respondents who do not work in the engineering industry were filtered out to give the following results: of the 12 participants working in the industry, 58% disagreed or strongly disagreed, 25% were neutral and 17% strongly agreed. This implied that those alumni who had worked in the engineering industry were more likely to identify a lack of diversity and inclusion within it. The module proposed will raise awareness of the EDI issues in the engineering industry among all alumni and will also help to address the EDI issues themselves through a pipeline effect.

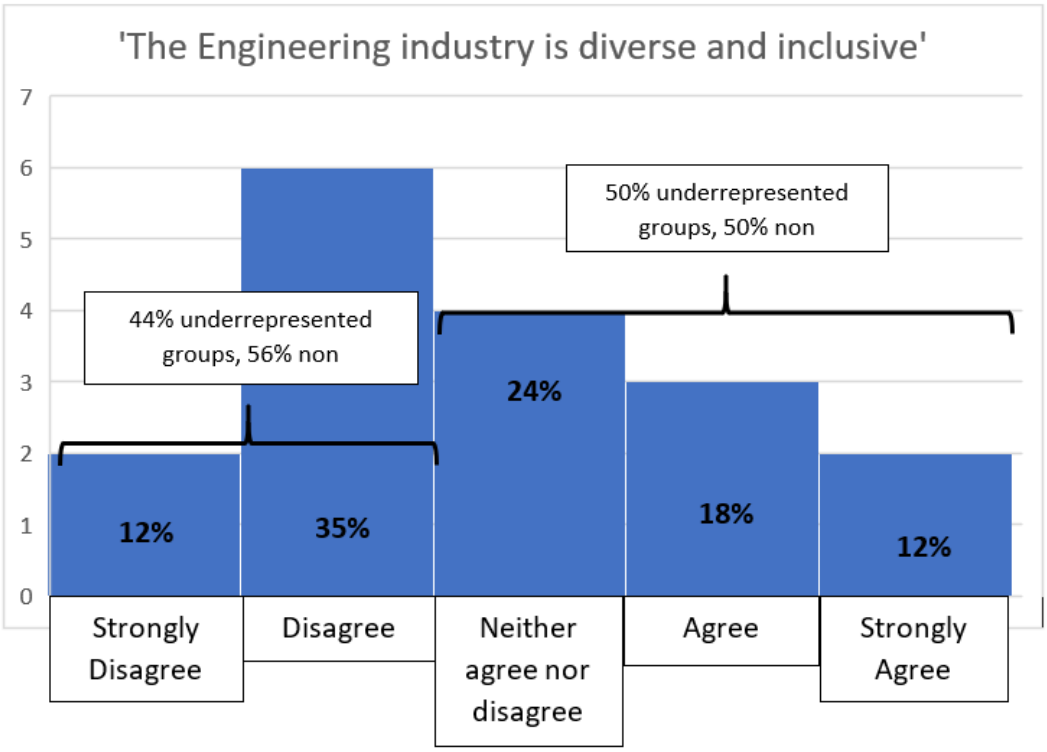

Figure 10: Bar chart of responses to 'The Engineering industry is diverse and inclusive

Alumni were asked whether they understood issues related to EDI in the engineering industry. As shown in Figure 11, approximately 70% of respondents replied positively, implying a reasonably strong understanding. There was a slight skew in the demographics of respondents, with those identifying with underrepresented groups likely to respond more positively. Filtering out those respondents not in the engineering industry saw 75% of respondents replying positively, with 67% of those respondents being from underrepresented groups (a greater skew than the results for all respondents).

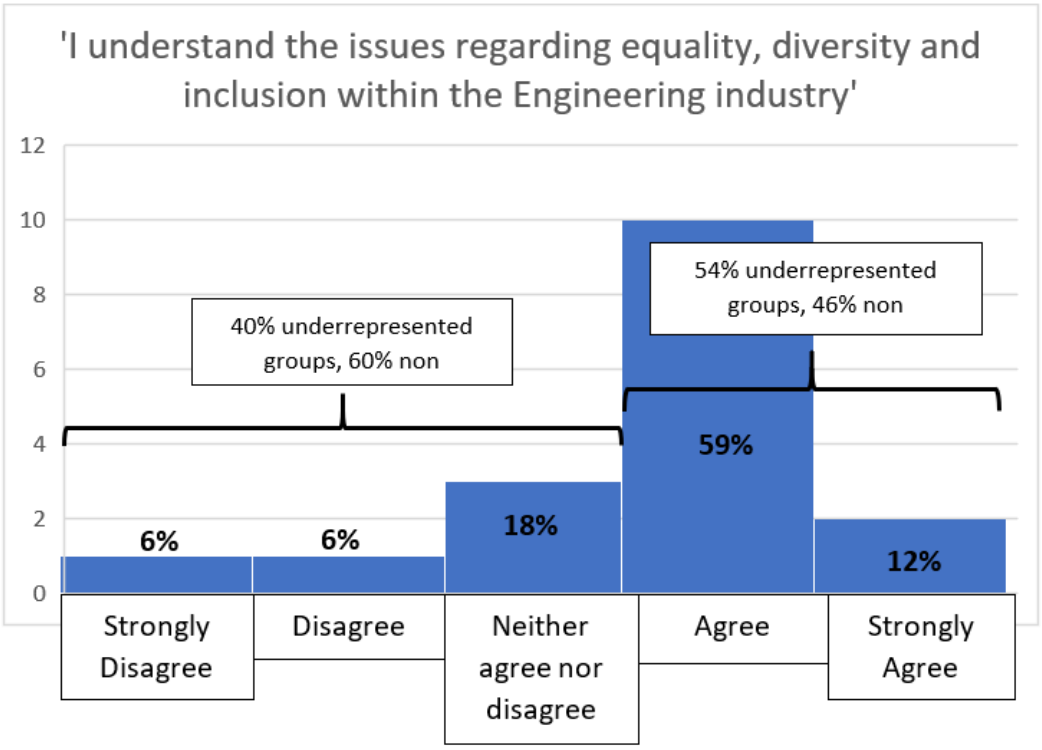

Figure 11: Bar chart to show responses to 'I understand the issues regarding EDI within the Engineering Industry

Alumni were asked whether they understood the issues regarding EDI in wider society. Responses were similar to the previous question, with approximately 70% replying positively. Among those replying negatively or neutrally, an apparent skew was present with 80% being from underrepresented groups. Although this may seem surprising, it must not be given too much weight since only 5 respondents comprised this subgroup, with 3 responding neutrally.

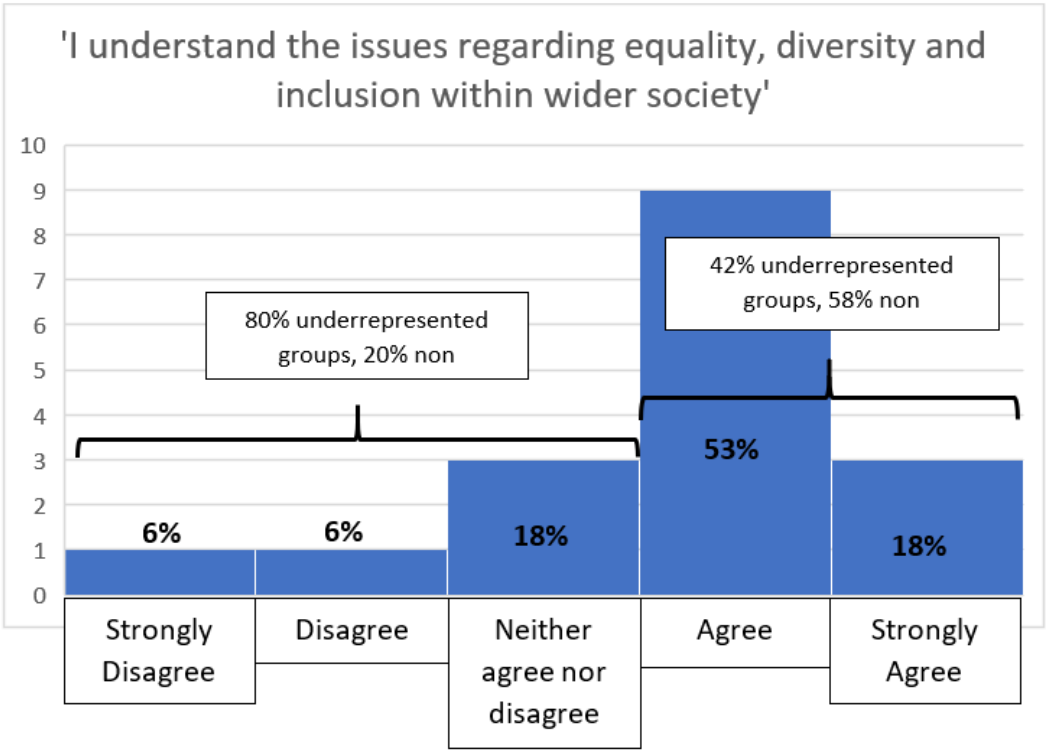

Figure 12: Bar chart of responses to I understand issues regarding EDI within wider society

The respondents working in the finance sector were asked whether they felt the sector to be diverse and inclusive – 3 responses were recorded, each agreed or strongly agreed. The respondents working in the consulting sector were asked whether they felt the sector to be diverse and inclusive – there was only one response, which disagreed. All respondents working outside the engineering sector were asked whether diversity was a factor when choosing to work outside of the engineering sector – 5 responses were recorded, 1 agreed and all the others either disagreed or strongly disagreed. Each of these results were responded to in too small numbers to constitute conclusive results.

Alumni were asked whether they wish they knew more about EDI at their current or past jobs. As shown in Figure 13, there was not a strong preference either way, with 47% of respondents replying positively and the remainder replying neutrally or negatively. 63% of positively replying respondents were from underrepresented groups, representing a significant skew in importance placed upon EDI in a working environment and willingness to learn more.

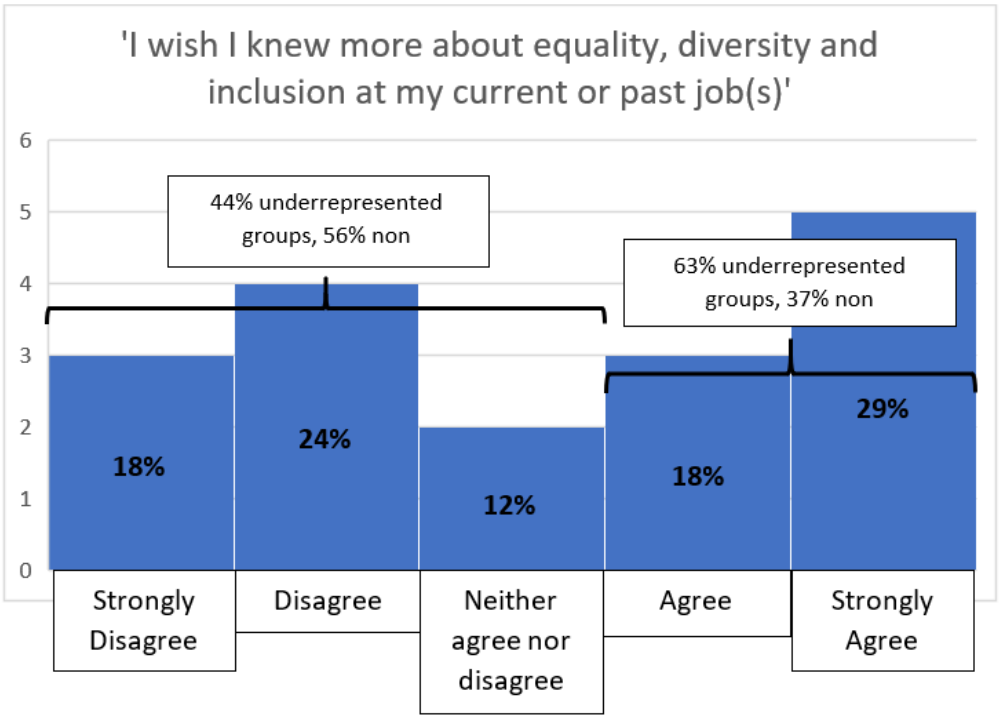

Figure 13: Bar chart of responses to 'I wish I knew more about EDI at my current/past job

Alumni were asked whether the culture at their company was equitable, diverse and inclusive. As seen in Figure 14, 30% of respondents replied negatively, with the remainder replying positively or neutrally. There was a slight skew in the demographics answering each way, with those replying negatively being 60% from underrepresented groups, potentially implying an increased likelihood of members from underrepresented groups perceiving a lack of EDI.

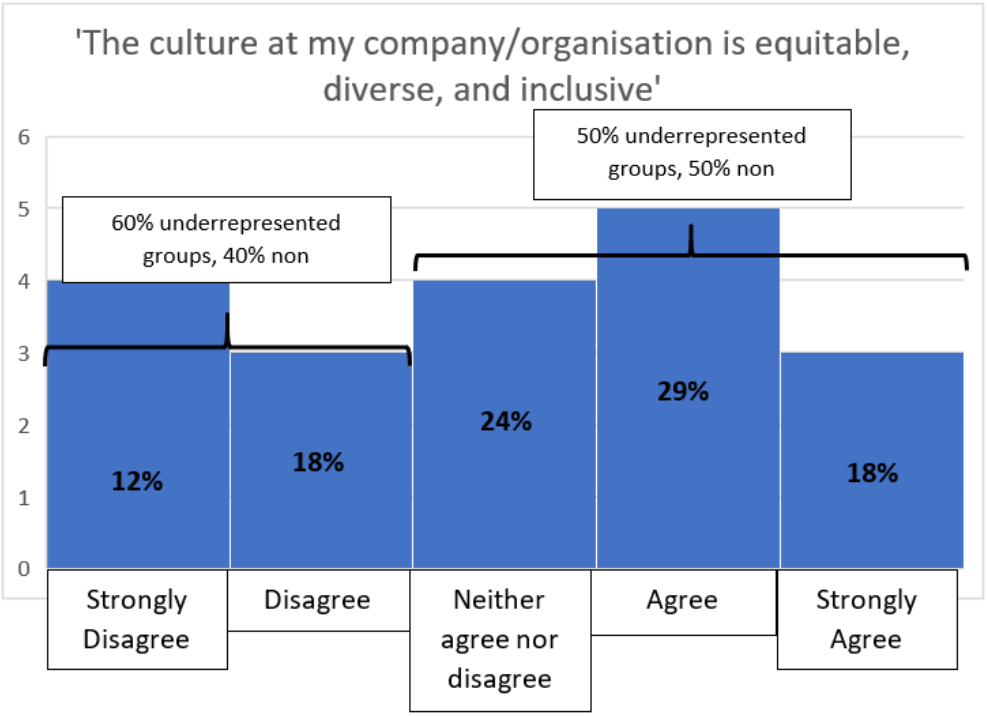

Figure 14: Bar chart of responses to 'The culture at my company is equitable, diverse, and inclusive

Alumni were asked whether they are more likely to take a job if the workforce is diverse. As seen in Figure 15, 59% of respondents replied positively, with the rest replying neutrally or negatively. There was a strong skew in demographics replying either way, with 70% of those replying positively being from underrepresented groups compared to only 29% of those replying neutrally or negatively being from these groups. It is natural that those from underrepresented groups place a high importance on having a diverse workplace, but for positive change to be truly mobilised, everyone should have an investment in diverse workplaces.

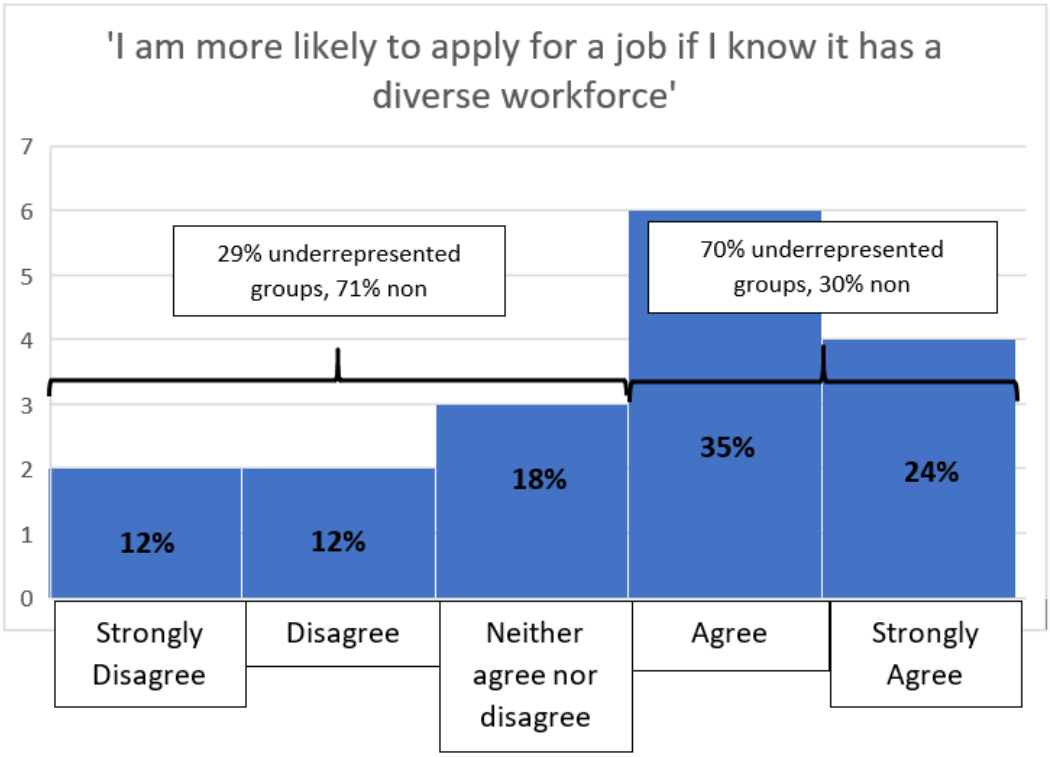

Figure 15: Bar chart of responses to 'I am more likely to apply for a job if I know if has a diverse workforce

Alumni were asked to rate on a scale of 1 to 10, how much the course had helped them to develop the skills listed. These skills were chosen as they were either mentioned in the IMechE personal development programme for chartership or are commonly sought out skills in commercial environments. The averages for each response are as shown in Figure 16. Although self-management, problem-solving and technical ability were each ranked between 7 and 9, communication, empathy and commercial awareness were each ranked lower, between 3 and 6. The proposed module will focus on the development of these skills and will therefore fill a skill-development gap in the curriculum.

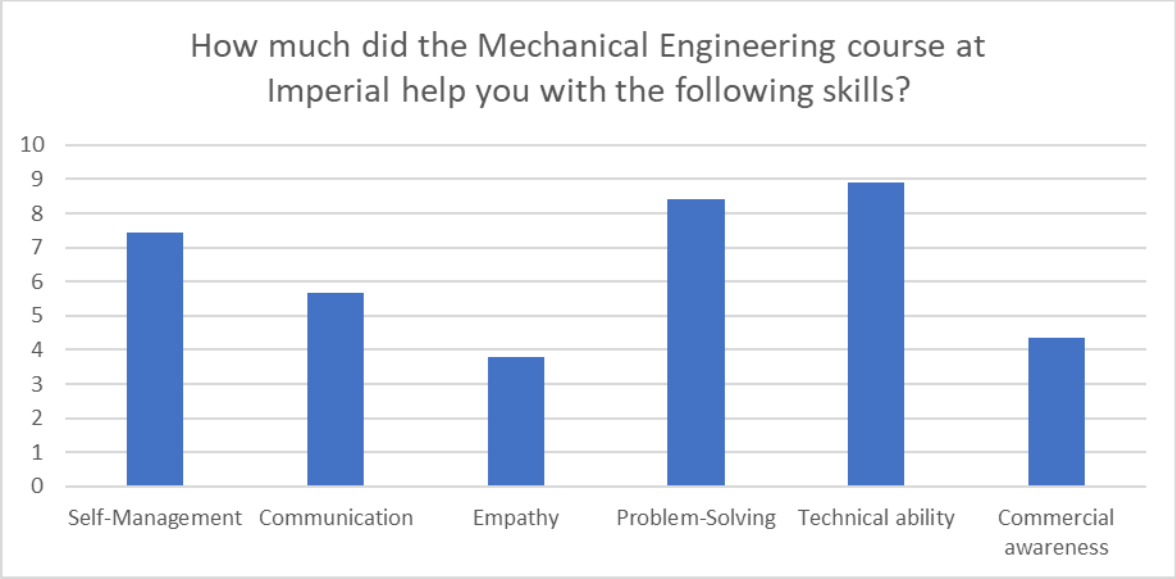

Figure 16: Bar chart of average responses to 'How much did the course help you with the following skills'

Appendix C: Collaborators and ECT Hours Breakdown

List of Potential Collaborators

Lecturer name	Area of Expertise	Role in module	Teaching hours	Alternatives
Dr Mike Richards	STEM Outreach	Guest lecturer - Introduction to Outreach, Outreach project collaborator	2	Imperial Outreach team
Dr Sunday Popo-ola	STEM Outreach	Guest lecturer - Introduction to Outreach, Outreach project collaborator	2	Imperial Outreach team
Dr Simon Foster	STEM Outreach Officer	Guest lecturer - Introduction to Outreach, Outreach teaching materials, Outreach project collaborator	2	Imperial Outreach team
Dr Wayne Mitchell	STEM Outreach and Imperial as One Co-Chair	Outreach teaching materials, Outreach project collaborator	0	Imperial Outreach team
Dr Melanie Botrill	STEM Outreach Team	Outreach teaching materials, Guest Lecturer - Introduction to Outreach,	2	Imperial Outreach team
Dr Julia Moote	UCL ASPIRES project Engineering research	Teaching materials Guest lecturer - Science Capital	2	Another member of ASPIRES team
Dr Spela Goldec	UCL ASPIRES project Engineering research	Teaching materials Guest lecturer - Equity Compass	2	Another member of ASPIRES team
Prof Sara Rankin	FoM	Guest lecturer - Neurodiversity and accessible outreach; Perspectives, privilege, and power Inreach/Outreach project collaborator	2	Able@Imperial
Prof Jonathan Jeffers	Outreach	Outreach project collaborator	0	
Dr Sara Camacho Felix	EDI Specialist	What is EDI?	4	Another EDI specialist: Jason Arday, Dina Belluigi, EDIC: Kani Kamera
Nate Macabuag	Founder of Koala Prosthetics	Guest lecturer - Inclusive Design: Human Factors and Ergonomics	2	RCA Human Centred Design
Soh-Yon Park	Imperial Design Engineering and	Guest lecturer - Inclusive Design: Human Factors and Ergonomics	2	RCA Human Centred Design

	Design Justice Network member			
Ross Tierney	Human Centred Design Consultant, Design engineer for Andiamo	Guest lecturer - Inclusive Design: Human Factors and Ergonomics	2	RCA Human Centred Design
Dr Ashraf Hoque	EDI Specialist	Perspective, privilege, and power	2	Another EDI specialist
Dr Tiffany Chiu	Imperial EDU and EDI researcher	Inreach project collaborator	0	
Jasneet Kaur Taak	Accelerate Mentoring Organisation	Outreach teaching materials, Outreach project collaborator	0	
Maria Farkas	Imperial Business School Diverse Workplaces Module Leader	Guest lecturer - Why is EDI important in Engineering?	2	
Leila Guera	Imperial Business School Diverse Workplaces Module Leader	Guest lecturer - Why is EDI important in Engineering?	2	
Sam Bailey	Imperial Outreach Impact Evaluator	Guest lecturer - Assessing the impact of EDI initiatives	2	
Kate Ippolito	Principal Teaching Fellow in Educational Development in the Centre for Higher Educational Research and Development	Guest lecturer - 'Inreach': Embedding EDI within Imperial Culture, Assessing the impact of EDI initiatives	2	
Darren Nesbeth	UCL BAMEhack Organiser	Teaching materials - Individual Project	0	

In addition to this table, a full list of contacts established can be found at this link: https://imperiallondon.sharepoint.com/:x:/r/sites/UROP-ME/Shared%20Documents/General/Project%20Log.xlsx?d=w0924ec7ea5de408ba01a1971ded12ead&csf=1&web=1&e=1hZxKU

Potential ECTS hours

A table was developed to visualise how the 6 ECTS totalling to 150 hours would be spent by a student taking this course. The blue refers to a seminar, the yellow refers to

group project work, the orange refers to private study, and the green refers to a tutorial which may be optional. In total, A student may spend 161 hours on this course which roughly satisfies the ECTS criteria.

Term	Week #	Teaching hours								
Autumn	1	Module Intro		LB	LB					
	2	Intro to EDI		LB	LB					
	3			LB	LB					
	4	Importance of EDI		LB	LB					
	5			LB	LB					
	6	Inreach		LB	LB	CW	CW	CW		
	7	Outreach		LB	LB	CW	CW	CW		
	8			LB	LB	CW	CW	CW		
	9			LB	LB	Plan		IDS		
	10	Impact		LB	LB	Plan		IDS		
	11			LB	LB	Plan		IDS		
Spring	12	drop-in		Plan					LB	LB
	13	drop-in		Plan					LB	LB
	14	drop-in		Plan					LB	LB
	15	drop-in		Enact					LB	LB
	16	drop-in		Enact					LB	LB
	17	drop-in		Enact					LB	LB
	18	drop-in		Enact					LB	LB
	19	drop-in		Enact					LB	LB
	20	drop-in		Enact					LB	LB
	21	drop-in		Report					LB	LB
	22	drop-in		Report					LB	LB

Appendix D: Detailed Module Description

Module Aims

This module will encourage students to critically think about and proactively engage with engineering in the context of global society. The module will develop students' appreciation and understanding of equality, diversity, and inclusion (EDI) within the engineering industry, as demanded by the IMechE Engineering Chartership. Students will gain practical experience of initiative coordination, allowing them to champion better EDI as well as improving interpersonal skills.

Learning Objectives

- To define EDI and provide an overview of its status in engineering
- To present the importance of EDI in engineering and the positive impact of widening participation
- To present the barriers to better EDI in engineering and the obstacles to removing these barriers
- To present EDI consideration through engineering with a more accessible, empathetic, and inclusive approach to engineering design
- To present the effective design of a positive EDI initiative
- To develop critical analysis and evaluation skills with regards to EDI initiatives
- To develop communication and interpersonal skills in discussing, planning and actioning initiatives
- To develop data gathering skills to classify the impact of initiatives
- To facilitate reflexive practice regarding EDI in engineering

ECTS units: 6 (150 hours)

Learning Outcomes

On successfully completing this module, students will be able to:

- Understand the key issues surrounding equality, diversity and inclusion in engineering, STEM and wider society

- Identify actionable methods of embedding EDI into the curriculum
- Devise an initiative at Imperial or outreach programme at a partner school, with a goal to improve EDI in engineering
- Assess the impact of this initiative through qualitative and quantitative measures and communicate results
- Evaluate personal development and changes to thinking through reflexive practice

Module Syllabus

During the autumn term, students will cover the theory aspect of the course through a series of lectures. Each lecture will be run by a guest lecturer (from within or outside of the College) who specialises in the topic being taught. Directly following the lecture will be a seminar, in which the students will have the opportunity to engage in a moderated discussion and brainstorming session with lecturers.

The lecture series will be broadly divided into the following topics:

Introduction to EDI – what does equality, diversity, and inclusion mean; where does discrimination come from; lived experiences of discrimination; power structures; structure, culture, and agency; possible approaches to improving EDI and limitations of each

Why is EDI relevant in engineering – human factors and ergonomics within design; the business case for EDI, including why diversity is important in the workplace

Inreach – embedding EDI into Imperial culture; thinking critically about EDI considerations in the college and department; considering university decolonisation

Outreach – equitable and inclusive approaches to facilitating societal engagement with engineering; neurodiversity and the importance of accessible outreach; concept of the Equity Compass and the Science Capital approach to teaching science in schools; safeguarding and behaviour management

Impact assessment of EDI initiatives – qualitative and quantitative evaluation of outreach programmes; possible shortcomings of data-driven evaluation; the difficulty in capturing the full impact of initiatives

In the spring term, students will partake in a group project to enact an EDI initiative in collaboration with a professional partner. Regular drop-in supervision sessions will provide guidance and structure during this term of group work.

Coursework will include:

Logbook: In the first term, students will respond to prompt questions after each seminar, guiding their self-reflection. In the second term, students will record their initiative design process and personal growth throughout the module, utilising the concept of reflective and reflexive practice.

Individual Coursework: Students will assess the EDI considerations of a mechanical engineering module and suggest ways to embed EDI into the course.

Final project: In groups of 3, students will design and action an EDI initiative in collaboration with a professional partner, chosen from a list of project proposals or self-proposed. If the project is an inreach initiative, the partner may be a researcher or faculty member, whereas if it's an outreach initiative, this may be the Imperial Outreach department, a school, or a mentorship platform. After implementation, they will appraise their work and assess their impact. Each group will be regularly meet with the supervisor and professional partner to discuss the project progress. The final output of this project is a 3000-word report.

Examples of possible Engineering Outreach Initiatives:

- After school engineering clubs
- Collaboration with current Imperial Outreach projects
- One-to-one mentoring schemes
- Teaching packs/toolkits for teachers to implement
- Development of online Outreach events

Examples of possible Engineering Inreach Initiatives:

- Collaboration with Supporting the Identity Development of Underrepresented Students (SIDUS) project at Imperial
- Representation projects collaborating with Imperial as One or other staff networks

- Implementation of a reverse mentoring scheme within the department

Teaching Methods

This module will enable students to act as partners in their own learning. They will be encouraged to share their own experiences and research aspects of equality, diversity, and inclusion within STEM that speak to them. The first half of the module will introduce the problems within engineering surrounding EDI and consider potential solutions, through lectures and seminars. The second half of the module will take a more practical approach to learning, allowing the student to actively engage with the wider community to tackle EDI issues in engineering.

Duration: Autumn and Spring Terms: 22 weeks

Summary of students timetabled hours

	Autumn	Spring	Summer
Lectures & Seminars	22	-	-
Tutorials	3	22	-
Private study	31	22	-
Group work	6	55	-

Assessments

Submission	Submission date	Max mark
Project Report	Week 22	45
Logbook	Week 22	25
Individual Coursework	Week 8	10
Conduct of task (Supervisor Assessment)	N/A	20
Total marks	-	100

Appendix E: Teaching materials and Reading List

Introduction to module		
Title/Author/Access	Keywords	Key Points

Reflective Practice Toolkit/ Cambridge https://libguides.cam.ac.uk/reflectivepracticetoolkit	Reflexive practice; Logbook	• Pathway 1: Beginners
		  ○ Reflective practice is the ability to reflect on one's actions to engage in a process of continuous learning
		  ○ Why? Reflection is a key part of emotional intelligence, can help creativity, helps to consider the bigger picture. Reflection can help you challenge some assumptions you make about people and situations and see things from a new perspective
		  ○ How? Ask questions: What did I learn? What do I need to learn more about? Why did I feel the way I did? I wonder what would happen if? Reflection is a continuous process,
		  ○ Models of reflections: ERA Cycle; Driscoll's What Model; Kolb's Experiential Learning Cycle; Gibb's Reflective Cycle.
		• Pathway 2: Intermediate
		  ○ Barriers to reflection and how to avoid them
		  ○ Reflective writing involves critically analysing an experience, recording how it has impacted you and what you plan to do with your new knowledge. Analytical rather than descriptive.
		  ○ Applications of reflective writing
		  ○ Free writing

Safe Spaces, Brave Spaces: Diversity and Free Expression in Education(14)	Safe and Brave spaces	• The case for diversity • The case for free expression • The problem of Hate Speech • Why diversity and free expression debate matters
The Art of Effective Facilitation: Reflections from Social Justice Educators, Ch. 8(15)	Safe and Brave spaces	• Introduction to the term • Tools for effective moderation when discussing social justice in educational environments

NAPSA Policy and Practice series: safe spaces and brave spaces(16)	Safe and Brave spaces	• Historical context
		• Actionable ways this could be implemented on campus
		• Recommendations:
		  ○ Adopt the use of the term brave spaces
		  ○ Encourage intersectional conversations about movement-building, advocacy, and the role of campus environments to better understand the evolution of safe spaces over time.
		  ○ Refer to campus activities—including multicultural, LGBTQIA, and women's rights organizations—that likely have working definitions regarding safe spaces on college campuses.

What is EDI?		
Title/Author/Access	Keywords	Key Points

Students' reception of peer assessment of group-work contributions: problematics in terms of race and gender emerging from a South African case study(12)	Rejection-sensitivity; EDI in group work	• In HE does peer assessment enhance the learning of students in increasing diverse cohorts? • Paper recognises the impact of students own conceptions on the quality of their own learning. • Student perspective on peer assessment of group work contributions. • Questionnaires to get perspectives and attitudes • Growing measure of discontent with process of peer assessment emerged including actual and perceived racial and gender stereotyping and related rejection-sensitivity. • Can spur people to pull their weight if they are marked by peers; teaches teamworking skills • Implications: can demotivate students as conflicts are emboldened by the threat of a negative peer assessment; 'allows individuals a platform for personal vendettas'. • *"We don't feel seen as black people. And so, you'd give me lower marks. Not because I didn't perform, not that I didn't represent myself well, but because you guys just didn't notice me. (black female, plenary)"* • Should not presume the group working environment and peer assessment will always enhance learning

Doing Equity and Diversity for success in HE: Chapters 1, 2, and 4/
Dave S. P. Thomas and Jason Arday(17)
	EDI in HE in South Africa	• A review of the past and a look into the future
		  ○ A diverse society needs diverse solutions: Academic amnesia – unconscious bias, institutional amnesia. Causes racism to embed itself into attitudes which limit EDI progress in society. Must understand the system to negotiate it.
		• EDI or Decolonisation: The Big Conundrum
		• Identity and Belonging for Outliers, Space Invaders and Others within the Brick Walls
		  ○ Recruitment, retention, and progression written by Professor Emeritus Heidi S Mirza
		  ○ Fighting racism and its relationship with well-being. Should the onus of activism fall on the oppressed?
		  ○ The politics of access in HE. Reflecting on 'Inclusion' and the negative effects it can have on the wellbeing of minorities. Operating within a problematic hidden current of academic 'success'
		  ○ Challenges facing aspiring BAME leaders in academics.
		  ○ Benefits of understanding and interrupting systemic racism

The Equality Act 2010(18)	EDI legislation	• Brings together and replaces previous legislation such as the race relations act 1976 and the disability discrimination act 1995
		• Covers discrimination types:
		  ○ Direct
		  ○ By association
		  ○ By perception
		  ○ Indirect
		  ○ Harassment
		  ○ Victimisation

Higher Education Outreach to Widen Participation Toolkit for practitioners: Overview/ HEAcademy(19)	Case for WP	• Why is WP important in HE?
Perspectives, privilege, and power		
Title/Author/Access	Keywords	Key Points

Factors influencing underrepresented groups' participation in STEM(20)	EDI Data; STEM Matched-Background Mentorship	• Goal:
		  ○ understand beliefs and experiences of underrepresented US students pursuing STEM
		  ○ Gain insight into their preferences for mentors that are gender and ethnicity matched
		  ○ Understand environmental and psychological factors associated with decision to pursue STEM
		• Data supporting the case for ethnically and gender diverse mentors in STEM
		• Conclusion:
		• educators should focus on inclusive learning by highlighting the accomplishments of diverse STEM professionals to help strengthen the feelings of STEM belonging.
		• Consider student mentorship preferences, facilitate interactions with matched-background mentors

Young, female and Black; Heidi Safia Mirza/ Book	Lived Experiences, Access and Attainment	• Personal experiences of professor emeritus Heidi Safia Mirza in 1992 after the Battle of Lewisham and the New Cross Fire. Seminal Sociological Text. • Challenges the widely held myth that black women consistently underachieve at school and industry levels. • What is meant by educational underachievement, the black family, and black womanhood in Britain
Why is EDI important in Engineering?		

Title/Author/Access	Keywords	Key Points
Unleashing Different: Achieving business success through disability	Business case for EDI	• 1.3 billion people in the world that identify as having a disability • Major companies are targeting this market as customers and as employees
Diversity Wins: How inclusion matters(5)	EDI in Executive fields	• Third McKinsey Report on the business case for diversity in the workplace • How can inclusive environments and diverse executive teams lead to more productivity • How profitability correlates with EDI
Inclusive Design: Human Factors and Ergonomics		
Title/Author/Access	Keywords	Key Points
Mismatch: How Inclusion shapes design/ Kat Holmes	Inclusive design; human centred design	• How inclusive design methods can build elegant solutions that work for all
Inreach: Embedding EDI within Imperial Culture		
Title/Author/Access	Keywords	Key Points

BAME awarding gap toolkit/ UCL(21)	Attainment and awarding gap	• Addressing disparities in degree outcomes between UK home BAME and white undergrads
		• What is an inclusive curriculum?
		• What does ‘belonging’ mean?
		• What are safe spaces
		• Tips.
		  • Use a diverse range of resources and contextualise you content
		  • Increase your own pedagogical knowledge
		  • Reflect on your own biases and assumptions about students
		  • Conduct a prior knowledge assessment
		  • Expose students to potential BAME role models
		  • Model inclusive behaviour, language, and attitudes

		• Learn and pronounce students' names correctly • Use microaffirmations: recognise, validate, actively listen, affirm.
Towards inclusive STEM Classrooms: What role do faculty play?	Strategies to embed EDI in universities	• How widening participation schemes do not usually extend to institutional culture • Unexamined biases in university institutions can prevent diverse students from thriving and persisting in STEM • CPD programs limit discussions of diversity to 'comfortable' topics, missing opportunities to explore deeper issues relating to faculty privilege, implicit bias, etc. • Presents a set of social science concepts to extend to STEM courses to inform efforts at inclusive excellence

Strategic Enhancement Programme: Internationalising the curriculum toolkit/ Sara Camacho Felix et. al	Embed EDI into curriculum; global citizenship; case studies	• Each chapter discusses definitions, the topic's importance in relation to learning and teaching, and tools to facilitate this
		  ○ Intercultural dialogue
		  ○ Global citizenship and values in intercultural engagement
		  ○ Positioning of the academic
		  ○ Design of curriculum and assessment
		  ○ International collaboration and exchange
		  ○ Communications
		• Case studies

Introduction to Outreach		
Title/Author/Access	Keywords	Key Points
Higher Education Outreach to Widen Participation Toolkit for practitioners: Partnership/ HEAcademy(22)	Outreach toolkit	• Why should you partner with internal and external organisations? • Creating partnerships and identifying its purpose and the benefits and drawbacks • How to manage the project and risk of the partnership

Higher Education Outreach to Widen Participation Toolkit for practitioners: Targeting/ HEAcademy(23)	Outreach toolkit	• Why and how should you target specific groups with outreach? • Developing prioritisation models • How to manage this targeting approach
Higher Education Outreach to Widen Participation Toolkit for practitioners: Programmes/ HEAcademy(24)	Outreach toolkit	• Purpose of outreach programmes and events • Planning and costing the event • Safeguarding and behaviour management • Coordinating with curriculum and project and session delivery
Science Capital and the Equity Compass		
Title/Author/Access	Keywords	Key Points

YESTEM Teaching Toolkit http://yestem.org/tools/		• Equity compass(25)
		  ○ Difference between Equity and equality.
		  ○ Equitable practice includes how and why you do something rather than just considering what is done. Thinking about the underlying principles.
		  ○ Aids social justice mindset. Consider the multiple dimensions of equity
		• Core Equitable Practices(26)
		  ○ Dynamic and adaptable
		  ○ Work across settings and time
		  ○ Work as a system of practice: not a one-off approach. Integrative
		  ○ Approach: Welcome and legitimise youths lives, communities, histories, presents, and hoped-for futures; disrupt dominant and unjust power relations; support equitable youth outcomes
		• Recognizing(27)
		  ○ Anti racist practice
		  ○ Recognise many stem learning materials were designed in alignment with white, male, cis, western perspectives. Women, people of colour as outsiders

		○ Valuing this knowledge. ○ Reflect: ○ Act: • Reseeing and Reshaping (28) ○ Seeing the terrain (eg. Science learning institutions, people, opportunities) and youth assets and interests as they are an as they could be in relation to each other. ▪ Connect STEM to everyday experiences and loved ones ▪ Challenge what counts as STEM expertise ▪ Access resources and social networks not available in school ○ Reshaping, meaning organising for new possibilities in science learning by facilitating connections between youth, people, resources, and opportunities • Reclaiming (29) ○ Restructuring power relations and centres youth in shaping the social + physical spaces of STEM. ○ More likely to meet youth needs by supporting youth ownership • Critically being with (30) ○ Relational and ethical practice foregrounds the present experiences of youth ○ Meet youth where they are • Embracing humanity (31) ○ Learning is not only about what and how people think but how people feel ○ Relational and ethical practice foregrounds seeing humanity in youth, our interdependence and our context and histories • Authority sharing ○ Gives youth opportunity for their knowledge and practices to be centered in informal stem learning ○ Youth viewed as experts because of who they are and what they know

		• Co-designing(32)
		  ○ ISL designed with and not just for young people. Part of reclamation
		• Shifting narratives (33)
		  ○ What and who counts in stem is an urgent crucial part of equitable, meaningfully inclusive ISL practices.
		  ○ Who does STEM and how should STEM be done

The science capital teaching approach toolkit (34)	ASPIRES project; YESTEM; equitable and inclusive science teaching	• Definition of science capital
		• Student engagement with science and why it varies
		• Outcomes of student capital approach
		• Teaching approach
		  ○ Personalising and localising
		  ○ Eliciting, valuing, and linking
		  ○ Building the science capital dimensions
		• Reflective diaries
		• Evaluating progress

Neurodiversity and the importance of inclusive outreach		
Title/Author/Access	Keywords	Key Points
Diversifying the engineering pipeline through early engagement of Neurodiverse Learners	ADHD in engineering	• Highlights the need for WP programmes to target potential students with ADHD • Highlights how university engineering programmes can be a hostile environment for students with ADHD • Greater support of ADHD students within current university engineering programmes • Case for a neurodiverse engineering workforce
An operation definition of Twice-Exceptional learners: Implications and Applications/ Reis et Al.	Twice-Exceptional	• Novel definition of type of neurodiversity is proposed • Highlights lack of inclusion in learning styles for certain neurodivergent people
2eMPower: Resources https://www.2empoweruk.org/index.php/resources/	Neurodiversity; Twice-Exceptional	• General resources and academic publications on 2e

Assessing the impact of EDI initiatives		
Title/Author/Access	Keywords	Key Points

Using standards of evidence to evaluate impact of outreach/ Office for students	Outreach impact assessment	• Guide aims:
		  ○ to help outreach providers to strengthen evaluation of the impact of outreach
		  ○ to understand what constitutes high quality evidence
		  ○ to guide the selection of evaluation methods to generate evidence of impact
		  ○ highlights practices to strengthen generation and use of evidence
		  ○ case studies and signposts further sources
		  ○ relevance to other aspects of access and participation strategies

Access and participation standards of evidence/ Office for students	Outreach impact assessment	• Guidance on good standards of evidence
Evaluation self-assessment tool/ Office for students	Outreach impact assessment	• Excel spreadsheet to evaluate outreach initiative design and implementation
Higher Education Outreach to Widen Participation Toolkit for practitioners: Evaluation/ HEAcademy(35)	Outreach impact assessment	• What is evaluation? • Method of planning and implementing evaluation • How to interpret the qualitative and quantitative data • Methods of communicating the impact evaluation. I.e., report writing