

Equality, Diversity and Inclusion (EDI) in the Chemical Engineering Curriculum: Working in Partnership with Students to Create Sustainable Practices

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Abstract

Having suitable provisions in place to support equality, diversity and inclusion (EDI) has become increasingly important throughout higher education. In our chemical engineering department, we are currently exploring strategies that would actively enhance and promote EDI whilst aligning the provisions to the curriculum. In this paper, we discuss some of the work we have been doing in partnership with our student body on developing sustainable practices – that builds on earlier work which focused on defining and identifying EDI practices. We have identified 5 key areas of particular interest to us: improvements to our student-to-student peer review system, a departmental charter for staff and students, constructive changes to the programme handbook, a resource developed by students for students, and changes to the content and delivery of certain modules that could accommodate EDI, or the identification of modules/courses that do. As part of the research/verification process, a limited amount of survey data was collected from students to help us establish underlying issues and how suggested sustainable changes might be perceived. In conducting this work, certain challenges have arisen as well as opportunities.

Introduction

In this introductory section, we set the scene and explain the rationale for the project reported upon in this paper. A working definition of equality, diversity and inclusion (EDI) is an important first step with a suitable one provided by the University of Edinburgh who suggest that: *'[EDI provision] means promoting an inclusive, fair, respectful and welcoming culture in which all staff and students can flourish.'* Useful definitions are provided for each of the terms individually: equality enables individuals to access the same opportunities, diversity concerns valuing the difference between people, and inclusion is a measure of how safe and welcome people feel in their environment.¹ This is simpler in theory than in practice as inclusive, fair and respectful are subjective terms, especially for students and staff from

¹ It should be pointed out that the terminology used in the UK is somewhat different to that used in the USA whereby diversity, equity and inclusion (DEI) efforts are discussed. Equity differs from equality in that equity implies every individual is provided with what they need to succeed.

multi-cultural backgrounds with differing values and beliefs. There is little doubt though, that EDI and EDI-related provisions are increasingly becoming popular terms in higher education parlance in English-speaking countries [1][2][3]. In the UK particularly, measures have been taken nationally (for example the introduction of the Equalities Act 2010) [4] and initiatives championed throughout higher education to ensure that knowledge and resources are available to support any work that is done in this area [5][6]. EDI is often referenced in tandem with The Equalities Act (2010) and together these terms are used to highlight the notion that by law there are nine protected characteristics of discrimination² and that professional environments should actively encourage and celebrate EDI and make suitable provisions for it.

Much of the reported work in this area occurs within students' lived experiences, but usually outside of their day-to-day learning. It has proved somewhat harder to ensure that EDI provisions become a central and embedded part of the curriculum [7]. Yet, engineering curriculums perpetuate whiteness, masculinity and heteronormativity and experience a stereotype threat that influences the performance and persistence of ethnic minorities and women [8]. In a higher education setting, simple changes can make a big difference. For example, different forms of assessment have been introduced into curriculums in order to create a level of fairness between students of different genders [9]. Similarly, cross-cultural awareness courses have been introduced to educate namely the indigenous populations of a country (for the UK context this would be Anglo-Saxon Britons) on how to negotiate cultural differences in learning [10]. The examples that are provided here show that efforts are being made to improve the sense of awareness throughout higher education of EDI and provide some training and resources to enhance EDI-related provisions. However, the initiatives are usually isolated pockets of activity that rarely happen fast enough or go far enough [11]. Yet, students can face tremendous barriers to their learning and sense of enjoyment when provisions are not in place. In higher education, students can feel marginalised and often express concerns of feeling as if they do not belong [12]. It is acknowledged though, that on occasion, the learning environment might be non-conducive for accommodating EDI. For example, Bunbury [6] reported on the needs of disabled students not being met often due to a lack of awareness, training and knowledge on the part of members of staff. The curriculum

² The characteristics of discrimination are: age, disability, gender, gender reassignment, marriage/civil partnership, pregnancy, race, religion, sexual orientation

itself might not be inclusive with most of the seminal literature that is included for further reading produced by male, Caucasian researchers resident in Anglophilic countries [5]. Additionally, students themselves also marginalise one another with those who self-identify as coming from lesbian, gay, bisexual, transgender + (LGBT+) backgrounds often hiding their sexuality from peers through fear of being harmed in some way [13].

When confronted with these collective obstacles of non-existent benchmarks (due to subjectivity), isolated pockets of activity, and students feeling a sense of seclusion, it becomes imperative to unpack current provisions when considering EDI. Therefore, this work is conducted in response to exploring our departmental offering and meaningfully revising it for the benefit of students and staff. As the educational context helps determine what EDI provisions and resources are most necessary, it is important to describe the backdrop of our own teaching-learning environment. Our department is in a UK-based research-intensive institution which ranks among the top 20 globally. In our chemical engineering department, approximately half our students (140 per year) are from East Asia and the other half from the UK/Europe. Roughly 35-40% of our population is made up of females and we have a very small proportion (5-7%) of students from widening participation backgrounds. In this paper, we report on the work done in investigating our current provision with respect to EDI and how it can be improved.

Methodology

In this section, we provide a brief overview of the work that has been done to date in the 2 phases of the project we are reporting on in this paper (currently ongoing).

Phase 1

In the initial phase of this project, a student partner, Mason was recruited. As part of his assignment he explored EDI by definition and understanding within our department through both literature and empirical research. Mason conducted 2 focus groups with staff and collated some quantitative data from 11 students who completed a survey he had designed. A summary of his findings revealed that: there was no shared understanding of EDI between staff and students, EDI was not a natural part of the curriculum which was too prescriptive to accommodate it, and students were negatively affected by the lack of EDI awareness. Following-on from deliberation and discussion of these findings with staff and student representatives in a student-staff liaison meeting, several initiatives that potentially enhanced

EDI were identified for further attention. These included recognising points in the curriculum where technical content or teaching was EDI-centric or could be modified to incorporate elements of EDI whilst ensuring examples provided are socially relevant [8], a robust revision of the student peer-review system, and modifying or creating information-based resources to better reflect EDI provisions e.g. the programme handbook. Finally, we considered engaging students to design and develop their own material for educating their peers about EDI.

In completing Phase 1 of the project, Mason concluded:

“Testimonial evidence has revealed a number of interesting themes and interrelationships with respect to EDI in the undergraduate chemical engineering programme. The theme of prescriptive and innate skills and the compatibility of all students with the programme’s learning outcomes and educational delivery was of primary interest. Furthermore, several philosophical perspectives on the nature of higher education and how these are embedded into particular courses such as the first-year design project and teaching and assessment styles arose, which have implications for EDI especially considering the many intersections of culture, gender, age and socio-economic status in the student body.”

Phase 2

As a follow-up to the outcomes of Phase 1, a second student, Emerald partnered with us to work more concretely on the suggested initiatives in terms of helping to direct our eventual outputs and the process of dissemination. Emerald produced some useful ideas on EDI and conducted some follow-up research during phase 2, whereby students were invited to complete surveys on their experiences and understanding of EDI. 57 students in total started the survey which is just over 10% of our student population, although this number reduced in places as the survey went on. Admittedly, the number of respondents is comparatively small, but the responses provide us with meaningful insights on student perceptions and behaviours, and thus a useful starting point in terms of filling gaps and supporting EDI-related provision going forward.

Results

The results presented here pertain to phase 2 of this work.

Demographic data of the respondents

The demographic data of the respondents is provided. Data on students' year of study, gender, sexual orientation, ethnic orientation, and whether they have a disability is provided in figures 1-5 respectively.

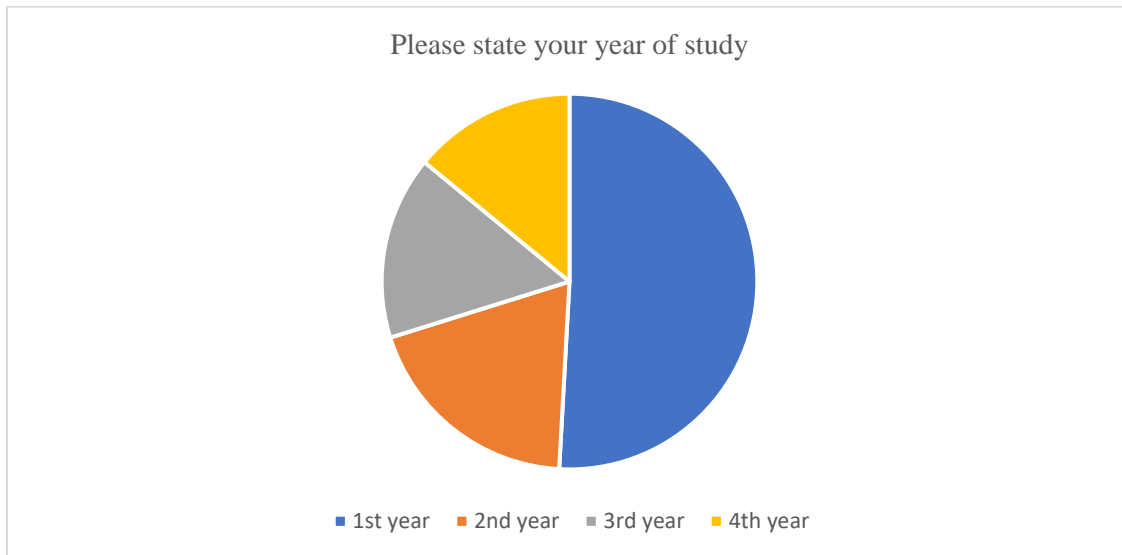


Figure 1: Pie chart of student respondents' year of study (57 responses)

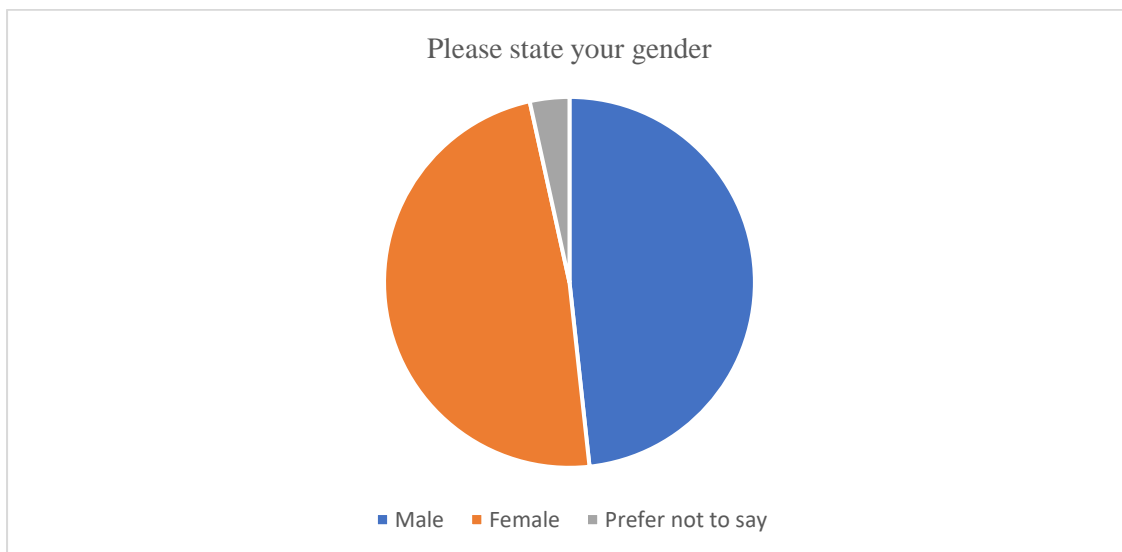


Figure 2: Pie chart of student respondents' gender (57 responses)

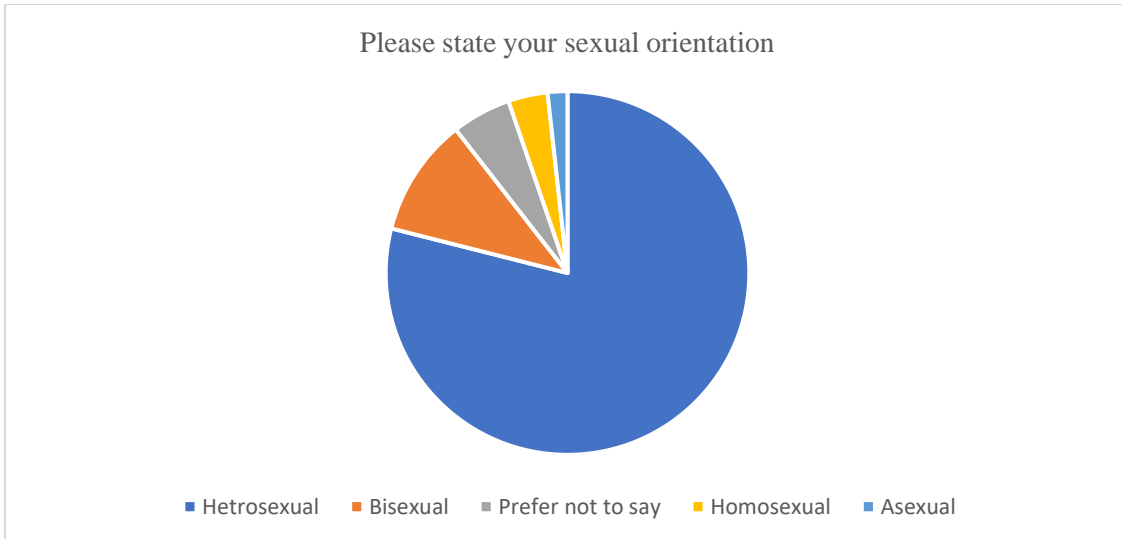


Figure 3: Pie chart of student respondents' sexual orientation (57 responses)

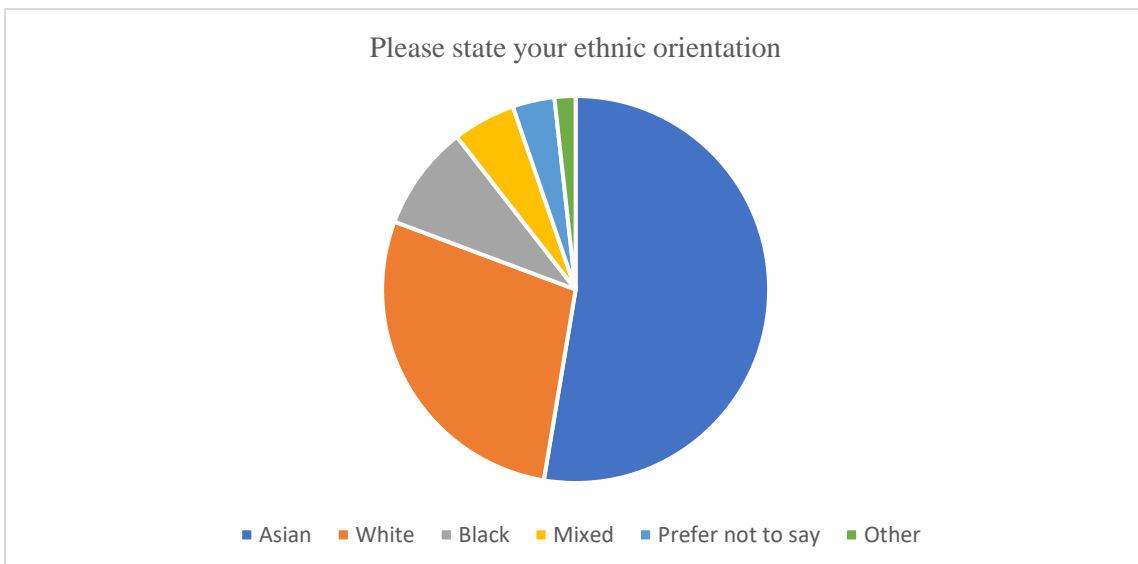


Figure 4: Pie chart of student respondents' ethnic orientation (57 responses)

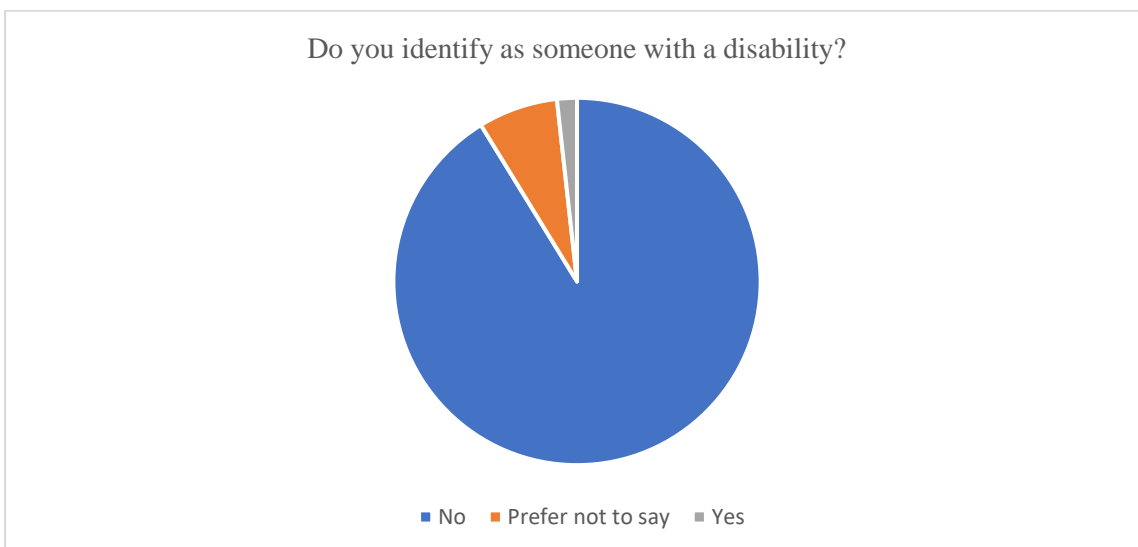


Figure 5: Pie chart on whether students identify as disabled (57 responses)

Responses in relation to select survey items

Some of the student responses are conveyed in the following figures. In terms of the results shown in this paper, we have focused on: 1. Students' perceptions of EDI and EDI-related provisions (figures 6-8) 2. Whether particular values/behaviours invoking EDI come across (figures 9-11). These results suggest that of the students that responded, there is a good degree of understanding and appreciation of EDI-related activity in general although further work could be done.

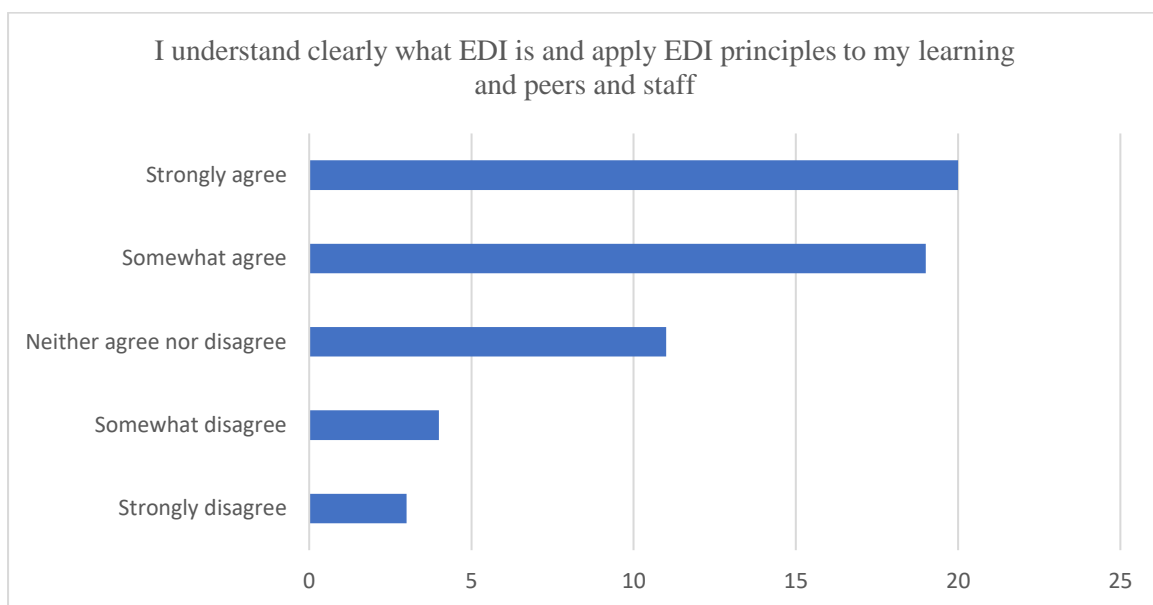


Figure 6: Graph of student responses to understanding EDI and its principles (57 responses)

When students were asked to provide examples of their familiarity of EDI principles and where they exercised such principles, the following was recorded as open-text comments:

- TBH [to be honest] I never heard of EDI
- Talking to people in my class regardless of socio-economic and cultural identity
- By being respectful to others. Trying to show empathy.
- Always talking to all members of the group. Main barriers are language/culture, but trying to make everyone feel included in the work.
- Peer assessment comments which are usually anonymous is when most things are revealed. A couple of friends had bad experiences of this.

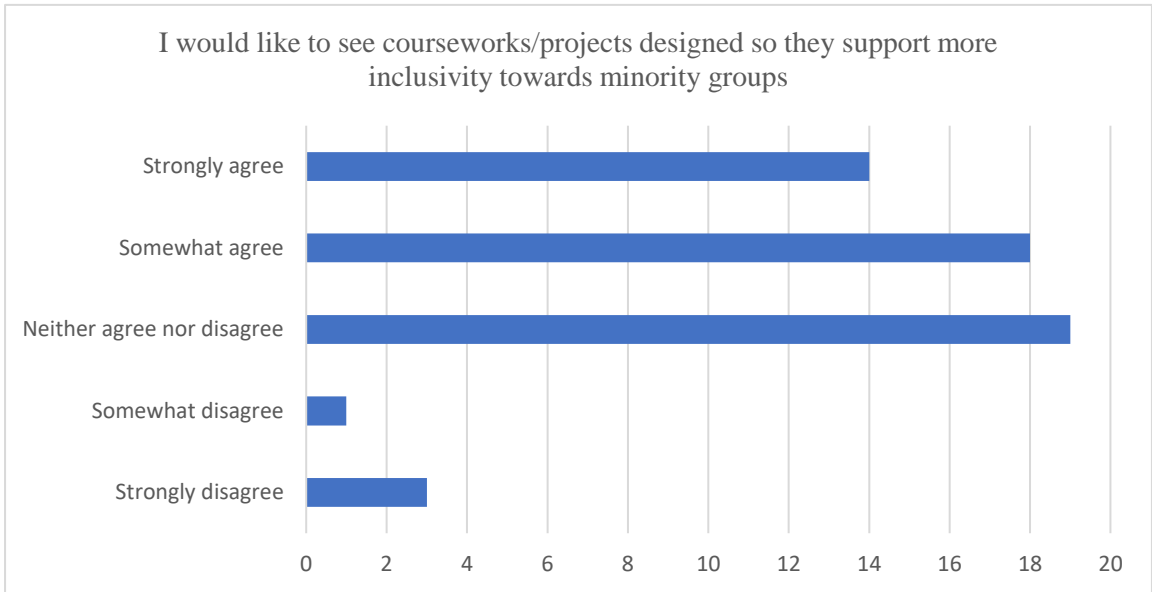


Figure 7: Graph of student responses to supporting better inclusivity in assessments (55 responses)

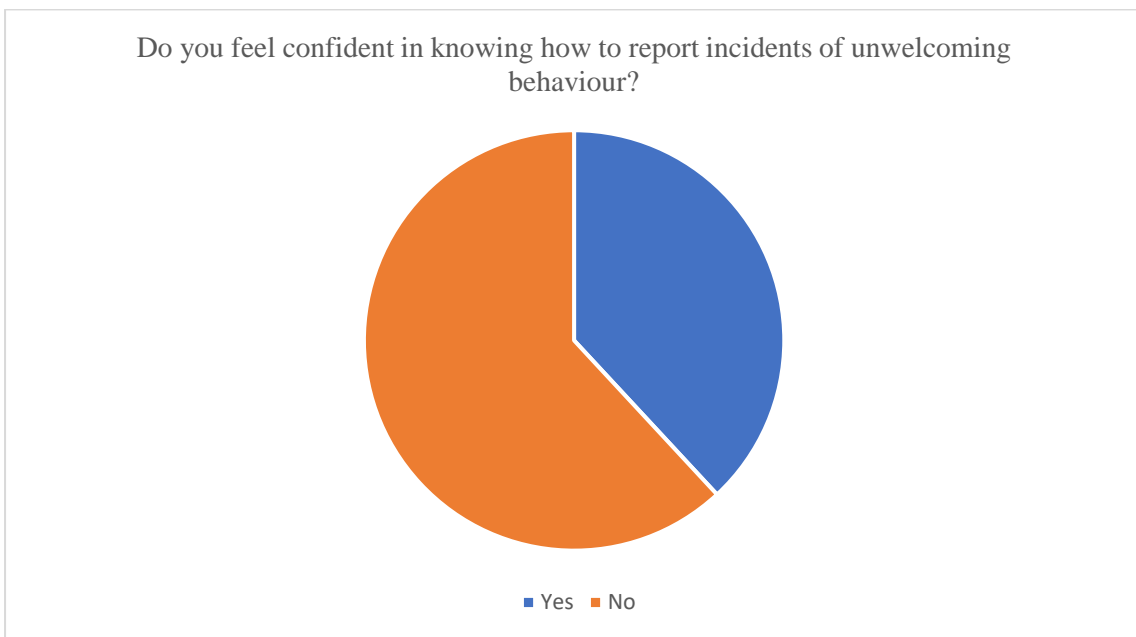


Figure 8: Pie chart of student responses to confidently reporting incidents of discrimination (42 responses)

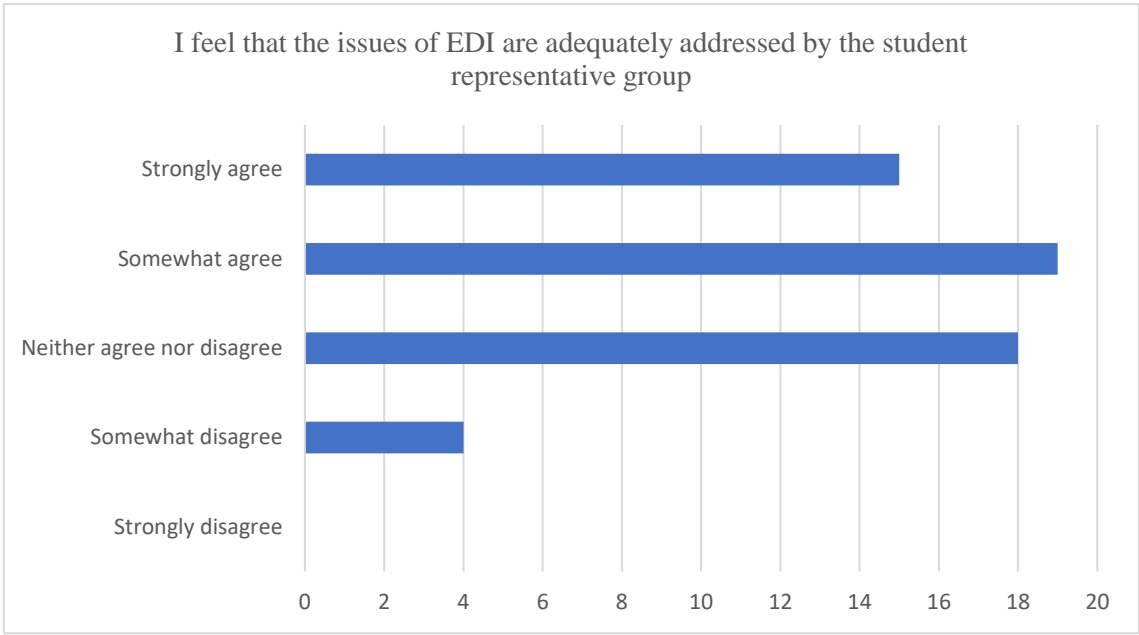


Figure 9: Graph of student responses to EDI being addressed by student representatives (56 responses)

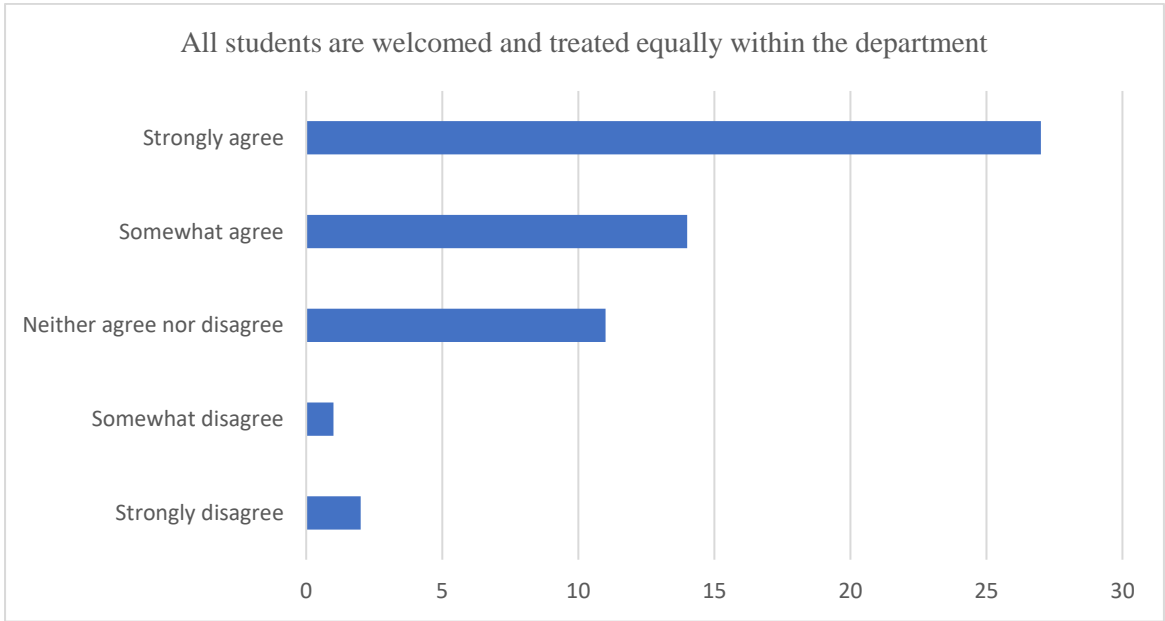


Figure 10: Graph of student responses to feeling welcome and included (55 responses)

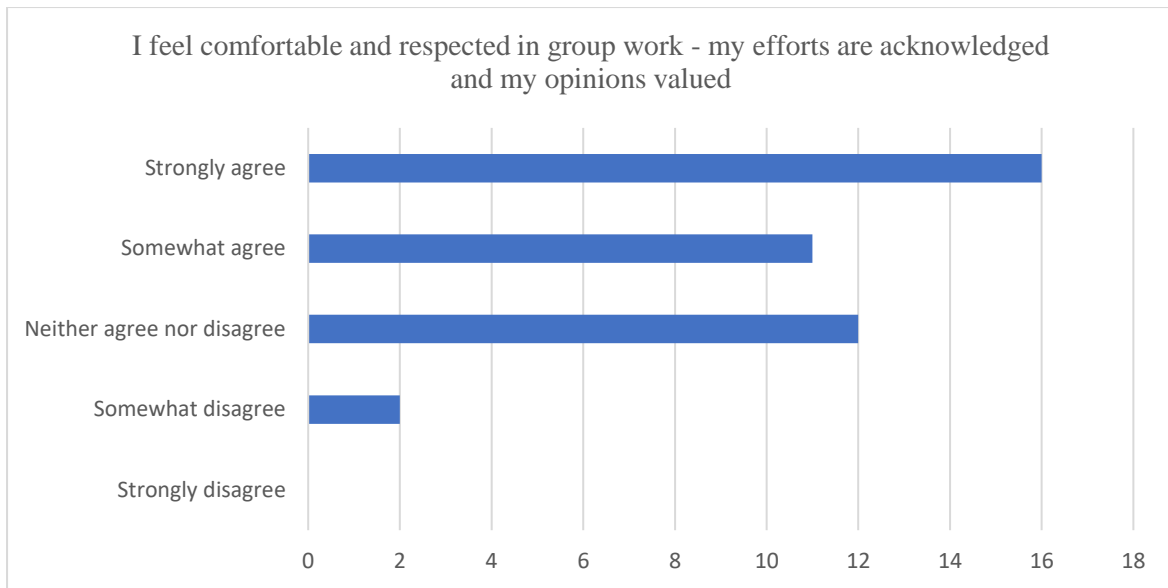


Figure 11: Graph of student responses to being treated fairly in group work (41 responses)

In completing Phase 2 of the project, Emerald concluded:

“Peer feedback is a big problem area. A code of conduct ought to be created which students need to read and sign each time before they submit feedback, and this should be reviewed carefully before being released back to the student body to avoid damage caused by false accusations/ bad language ... Other things matter also matter. For example, course contents including course description should be carefully reviewed regarding EDI, especially in the way of wording. The design of coursework/ problem sheets/ lecture materials/ projects could be made more inclusive for minority backgrounds, or at least brought to the students’ attention to consider how things could be different if set in a different background.”

Discussion

An analysis of our findings suggests that nearly a third of the number of students that answered that survey question, did not have a clear understanding of EDI and either strongly disagreed, disagreed or nether agreed nor disagreed with the statement that they understood and applied EDI provisions (18 from 57 which accounts for 31.6%). This in itself is problematic, especially as earlier research suggests that students in higher education setting do not believe that EDI matters to their future career prospects [14]. Furthermore, A sizeable number of students were unaware of how to report incidents of inappropriate behaviour with a total of 26 from 42 respondents (62%) uncertain as to how to do this. An initial assessment of this data suggests that the awareness of what EDI is and the protection available against different forms of discrimination needs to be better understood and acted upon as there is some vagueness among the student body. A departmental charter has been suggested as one

mechanism through which this can be achieved. The information that might go into such a document includes: an understanding of departmental commitments on EDI, how to recognise and report an incident within the department, and information on the wider support available. It is important to us, that the charter goes beyond institution-wide protocols and policies and is of direct relevance to staff and students within our department. Furthermore, our programme handbook ought to be more EDI-focused where possible. For example, maps of the campus can include the location of gender-neutral toilets and step-free access points. Equally, helpful prose on our departmental working culture and environment can be included in the handbook along with the mandatory information on module content and schedules – which can also be adapted to highlight points in the curriculum where EDI exists.

One of the initial problems identified by our student body was related to the no stakes peer-to-peer assessment (or review) system; 14 students out of 41 (34.1%) neither agreed nor disagreed, somewhat disagreed or strongly disagreed when asked if they felt comfortable and respected in group work which accounts for a large proportion of the students that responded to the survey. As part of our peer review process, students are required to provide comments for one another following group work which consists of labs and projects taking place in each year of study. Comments for each student are anonymised and at times these can be blunt and hurtful, whereas if orchestrated appropriately peer assessments can improve students' morale, motivation and throughputs [15]. In our context, for example, cultural differences (reflected as language and learning differences) between students are, at times, unfairly commented upon. Admittedly, students might be experiencing some form of microaggression under such circumstances which they are unable to articulate and respond to, and the desire for equity becomes a more pressing one than that for equality [16]. Peer assessment therefore becomes an important space to better educate students about (mostly subtle) forms of discrimination and appropriate language. An agreed protocol needed to be developed. As such, points raised from students themselves were: students ought to be considerate in general, lecturers should emphasise respectful choice in language/wordage (and not just quality and honesty), students ought to undertake training on the code of conduct before providing feedback, teamwork sessions ought to be introduced prior to any major project, and action ought to be taken if students report discriminatory comments. Related to this stance on peer assessment, is the notion of inclusive assessment. A significant proportion of the student respondents (32 out of 55 accounting for 58.2%) thought that assessment was not inclusive enough for minority

groups, despite recent curriculum changes to include more coursework. Literature supports the argument that very little has changed in terms of tried and tested assessment methods e.g. closed exams, and that student choice and universal design for assessment need to be better prioritised going forward [17].

As part of the planned updates, it is important that students take some ownership of discussion and activity around EDI and that it resonates with them and their lived experiences. Our findings suggest that a proportionally significant number of student respondents – 22 out of 56 (39.3% disagree at some level or neither agree/disagree) felt that their elected student representatives either failed to or were indifferent to adequately addressing EDI, even though students were made to feel welcome (with 41 out of 55 – 74.5% agreeing to this statement). Based on this response, we would suggest students play a more active role in the education of EDI among their own peer groups. To this end, we have approached our student representatives (both academic and wellbeing officers across the 4 years) to produce material that would help educate and inform other students about EDI in a way that has personal meaning. Wellbeing in particular is of prime importance, due to the stress culture under-represented students experience along with a perceived lack of empathy [8]. We are currently looking to produce short TikTok-style videos that could be embedded into something broader to promote active learning [18]. Importantly, the incidents/stories told within those videos need to be context specific and pick up on the issues students themselves face. TikTok videos have been used to great effect in education with LearnOnTikTok being accessed billions of times for individuals to learn new things e.g. medicine and healthcare, food and drink [19].

In conclusion of this work, we would attest to the view that EDI is difficult to embed into a curriculum, especially when it is subjective by definition and does not naturally lend itself to teaching a science or engineering-based subject. As part of this ongoing project, we have examined our teaching-learning environment, relationships between students (and staff to a lesser degree), and communications as a starting point from which to consider how best to move forward with a proposed strategy and plan of action. It has led us to some subtle changes e.g. a revamping of our protocols with respect to peer assessment, and some more definitive and robust ones e.g. especially-produced material by students for education

purposes. The use of students as partners throughout this work has helped to expand our vision and understanding of the concerns and opportunities available. We envision the reporting of this work as providing space for continual sharing of practice and ideas on how to tackle EDI. Our work is in progress, but by making some early (and much needed) improvements in this way, we hope to create a better lived experience for all our students.

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