THE UNIVERSITY OF
MELBOURNE

Diversity in STEM Review

Submission to the Department of Industry,
Science and Resources

10 May 2023

Executive Summary

The University of Melbourne welcomes the opportunity to contribute to the Diversity in STEM review.

As outlined in the University's institutional strategy, *Advancing Melbourne*, and the accompanying *Diversity and Inclusion Strategy 2030*, the University recognises the immense value that diversity adds to our institution. It ensures that our education and research benefits from a wide range of perspectives and experiences. This enhances our ability to find real-world solutions to some of society's key challenges. By establishing a welcoming and inclusive environment, the University is also able to attract and retain talented staff and students.

Unfortunately, many groups of people – including women, Indigenous people, people with disability, people from low socioeconomic and culturally diverse backgrounds, and LGBTIQA+ people – remain underrepresented in science, technology, engineering, mathematics and medicine (STEMM). The Government currently funds a wide range of diversity in STEMM initiatives which has helped increase participation, particularly for women. However, the pace of change is slow.

The issues faced by these groups do not begin at university. Many students from underrepresented groups lose confidence and interest in STEMM as early as primary school. This means that early intervention is crucial. For example, role models can have a significant impact in lifting students' interest and aspirations, allowing them to envisage themselves in a STEMM career. Noting this, the University has implemented school outreach programs that involve university students and scientists from a wide range of backgrounds, encouraging greater participation and self-efficacy in STEMM. The Government could provide additional funding for these types of outreach programs to ensure sufficient scale.

People from diverse backgrounds continue to face barriers as they enter post-secondary education. Many of these barriers are not unique to STEMM. For example, evidence suggests that the current system of capped university funding locks many disadvantaged students out of higher education, regardless of their discipline. Similarly, many students from underrepresented groups struggle to fully participate and succeed at university due to financial pressures. This means that the Australian Government must address access and equity in higher education more broadly to increase diversity in STEMM.

It is timely therefore to review current programs aimed at supporting greater diversity within STEMM disciplines and the workforce. A new, cohesive approach is needed, which seeks to improve the participation, retention, and success of all underrepresented groups across the entire STEMM pipeline. Measures must target recruitment, retention, and promotion to address the "leaky pipeline", where representation declines at higher levels of academia. Government programs could consider adopting aspects of the University's programs, which have led to significant improvements. For example, the University has used women-only recruitment rounds to boost the number of women employed within the STEMM faculties. This has been highly successful, with subsequent recruitment rounds (open to all genders) attracting a much greater number of female applicants.

Other programs, such as mentoring programs and fellowships that support those who have faced extraordinary personal circumstances, may also aid retention and promotion of underrepresented groups in STEMM. For example, the Faculty of Medicine, Dentistry and Health Sciences (MDHS) runs a Mentoring for Promotion Program aimed at female and non-binary academics. This has had great success, with most participants gaining promotions. The University has now established the Athena Swan STEP Program, an institution-wide pilot based on the MDHS program.

The University recognises that diversity in STEMM cannot be viewed in isolation from broader equity and access issues. Therefore, the Government will need to consider measures that support participation and success of disadvantaged groups in education (including through adequate school resourcing to support Year 12 completions), if it wishes to enable greater representation in STEMM. Government support programs into university and then the academic/research pathway are an important complement to University-based activity.

The University also acknowledges the need for ongoing institution-level actions to enhance diversity and inclusion in STEMM. However, the Australian Government can support these efforts through coordinated policy settings, ongoing investment in evidence-based programs, and strategic interventions at key transition points in the STEMM pipeline.

For more information, please contact Pip Nicholson, Deputy Vice-Chancellor (People and Community) on p.nicholson@unimelb.edu.au or 03 8344 2608.

Recommendations

The University of Melbourne recommends that the Australian Government:

1. Work with State and Territory Governments to incentivise more STEMM-qualified people to pursue (Foundation - Year 12) teaching (including through paid internship models) and provide professional development in STEMM for existing teachers.

2. Work with Universities and other STEMM organisations to provide career advisors with timely, relevant and helpful information on the range of STEMM careers and pathways available.

3. Fund outreach programs that offer school students from underrepresented groups with relatable role models in STEMM.

4. Ensure that future higher education funding models support greater access for underrepresented groups, including in the STEMM fields.

5. Review income support available to university students, including the level of support and eligibility requirements, to ensure underrepresented groups can participate in STEMM.

6. Adjust stipends through small but meaningful reforms, including linking the base rate to a reputable cost-of-living index and ensuring part-time stipends receive tax-free status.

7. Address gaps in the Higher Education Disability Support Program and Indigenous, Regional and Low-SES Attainment Fund to ensure that underrepresented groups are adequately supported in higher education.

8. Encourage STEMM employers to consider alternative approaches to staff recruitment, including targeted recruitment (e.g. women-only), and review recruitment and promotions processes to remove barriers for underrepresented groups, including unconscious bias.

9. Consider simplifying Performance Relative to Opportunity sections in ARC and NHMRC grant applications.

10. Develop a national fellowship program to support those who have faced extraordinary and compounding personal circumstances that have limited their STEMM progression, similar to the University's Momentum Fellowships.

11. Provide Universities with additional funding and resources for initiatives that foster safe and inclusive workplaces.

12. Co-invest in programs that support international experiences for underrepresented groups, including Indigenous researchers in STEMM.

13. Continue supporting women in STEMM programs, while ensuring that application processes are streamlined to reduce administrative burden.

14. Establish new programs to support broader forms of diversity in STEMM. This could include the establishment of new Fellowships within the ARC Australian Laureate Fellow Scheme to support Indigenous researchers, as recommended by the ARC Review, or researchers with disability.

Response to review

The importance of diversity

The University is committed to improving diversity and inclusion across the board, as outlined in *Advancing Melbourne* and the *Diversity and Inclusion Strategy 2030*. Fully embracing diversity and inclusion means that our education and research benefits from a range of knowledge systems and standpoints. This aids our capacity to resolve complex real-world problems, form partnerships, and attract and retain talented staff and students. Noting this need, the *Diversity and Inclusion Strategy* outlines a range of goals, outcomes, and strategic priorities to achieve our long-term vision: a thriving, fair and diverse university community working together respectfully to make a difference to each other and in the world.

As part of this strategy and in compliance with the *Gender Equality Act* (Vic, 2020), the University has developed a Gender Equality Action Plan (GEAP) 2022-2025. This lays out a series of actions under the following focus areas: career progression; workplace flexibility; appropriate workplace behaviour; and the gender pay gap. It acknowledges that despite gains made through an ongoing focus on addressing systemic barriers to access, inclusion and equity, the University still has much work to do. It also recognises the compounding impact of intersectionality on the experiences of staff and students of diverse identities and backgrounds. For example, gender inequality may be compounded by other forms of disadvantage, including those based on disability, ethnicity, race, religion, sexual orientation and other attributes.

Beyond the GEAP, the University has launched a comprehensive new Disability Inclusion Action Plan (DIAP), and its first LGBTIQA+ Action Plan. A new Indigenous Strategy is in development and this year will see the development of an Anti-racism Action Plan. Taking a whole-of-University approach, the plans bring together a focus on barriers experienced by staff, students, visitors, and partners to reinforce the notion that we are one University community, as articulated in our *Advancing Melbourne* strategy. Development and implementation of these plans are consultative, with input from staff and students including those with lived experience.

These plans and strategies seek to improve the diversity and culture of our whole institution, not just the parts relating to STEMM. However, our STEMM faculties are also pursuing their own diversity and inclusion initiatives. For example, the Faculty of Science created its Diversity and Inclusion Action Plan. It also published its *Gender Equity Strategy* in 2020, which outlines initiatives to achieve gender equity for female, trans and gender diverse staff and students. Data on diversity at the University is provided at **Attachment 1**.

The University of Melbourne is proud to hold a Science in Australia Gender Equity (SAGE) Athena Swan Bronze Award for our commitment to improve gender equity and diversity at the institution. The award recognises that the University has established a strong foundation for eliminating gender bias and developing an inclusive workplace for staff of all genders and has created an action plan to build upon opportunities and address identified challenges.

Our Athena Swan Taskforce, with academic and professional staff representatives drawn from across the University, oversees the delivery of the Athena Swan Action Plan. This identifies five key priority areas: preventing and responding to sexual misconduct; academic promotions processes; academic career interruptions; academic recruitment procedures; and an inclusive culture for trans and gender diverse staff and students. The University is working towards applying for Athena Swan Silver accreditation in 2027, which requires achievement of five 'Cygnet' awards (one for each action plan focus area), a self-assessment report, and a new action plan.

Diversity in STEMM at the University of Melbourne

The University offers a wide range of programs to improve the diversity of our STEMM student and staff cohorts. Some of these programs are outlined below (with further programs outlined in **Attachment 2**):

Melbourne Indigenous STEM Education Program (MISEP)

MISEP is a series of Indigenous-led, hands-on, curriculum-based workshops that aim to engage high school students with Indigenous STEM knowledges. The team is made up of First Nations Science students who engage with a range of schools across metropolitan and regional Victoria. The workshops have been developed by Indigenous students and

academics, Elders and knowledge holders, as well as other academic experts.

Dungala Kaiela Research Fellows Program

The University of Melbourne's Department of Rural Health partners with the Melbourne Poche Centre for Indigenous Health and the Kaiela Institute to offer the Poche Dungala Kaiela Research Fellows Program. This program supports First Nations PhD students from the Goulburn Valley (Yorta Yorta Country) to undertake their research while living in the region. In 2022, four First Nations women completed their PhDs through the program including, for example, Yorta Yorta woman Dr Sharon Atkinson-Briggs whose PhD was focused on novel ways to deliver diabetes education to First Nations people.

Science Gallery STEM Centre of Excellence

Delivered in partnership with the University of Melbourne and the Victorian Department of Education and Training, the STEM Centre of Excellence at Science Gallery Melbourne opened in August 2021. Embracing scientific and artistic inquiry alike, learning programs are designed in collaboration with 25 local Melbourne metropolitan partner schools and aim to foster the development of transferable 21st century skills for school students. Partner schools include the Victorian College of the Deaf, St Joseph's Flexible Learning Centre and the Melbourne Indigenous Transition School.

Programs are aligned to Science Gallery exhibition themes and content, including mental health and wellbeing through the MENTAL exhibition and First Nations knowledge and STEM practice through Emu Sky, and are led by trained educators and learning facilitators who are current University of Melbourne students.

The Future of STEM is Women

In 2022, the University's Future of Work Lab ran a pilot program with Year 9/Year 10 students to raise girls' awareness of and interest in STEM careers and to encourage subject choices in senior secondary school. The pilot was run with Gladstone Park Secondary School in Hume Council, which is low SES, high migrant and ethnically/racially diverse.

This schools-based training program for young women is strategically designed to dispel the myth that young women must choose between social sciences or STEM subjects. This 'either or' logic often pushes young women out of STEM pathways and into the humanities early in their schooling due to a lack of confidence, low self-efficacy, and inadequate careers advice. Instead, the Future of Work Lab illustrates that workers will be best positioned if they integrate Social Science and STEM knowledge. The program provides students with an understanding of future of work trends and the importance of human and hard skills that can be transferred across both fields.

Science Delivery

Science Delivery is aimed at increasing the participation of students from low SES and regional areas in STEM. Volunteer University of Melbourne students are recruited and trained as presenters, and they deliver 1.5-2hr incursions to metro and regional high schools in low socioeconomic (low SES) areas during a two-week roadshow. By participating in the program, presenters develop their communication and teamwork skills and act as role models for the high school students by telling their own stories of success.

The program has been very successful, with both students and presenters indicating that the program is a rewarding and enriching experience. In 2022, 88% of students said they enjoyed the program and 90% learnt something new. More than half of the students were more interested in studying science after the session and 69% were more interested in going to university.

Diversity and Inclusion Grants

The Faculty of Medicine, Dentistry and Health Sciences (MDHS) offers Diversity and Inclusion Grants which support academic staff to undertake scholarly-based work that contributes to the implementation of the Faculty's culture of equity, diversity and inclusion for all staff and students. MDHS awards two grants each round. Grants include a maximum award of $25,000 for salary and research-related expenses. Seven research teams have already been funded by this program. For example, in 2022 A/Prof Ada Cheung was awarded a grant to develop best-practice guidelines for including trans and gender diverse people in research.

Women in Science Emerging Researcher (WISER) award

The Women in Science Emerging Researcher (WISER) award, launched in 2020, aims to address the significant attrition of female staff within the early career stages. This in turn leads to low participation of women in senior research and leadership. Awarded by the Faculty of Science, WISER targets female researchers who have excelled in their chosen

research fields and are potential leaders of the future. In September 2022, <u>Associate Professor Elizabeth Hinde and Dr Helen Green received WISER awards</u>. The $25,000 award is continuing in 2023.

Addressing diversity throughout the STEMM pipeline

School initiatives

Evidence suggests that attitudes towards STEMM form (and often start to diverge for underrepresented groups) from early education onwards. By the age of 12-13, girls generally have lower levels of confidence in STEM subjects compared to boys. For example, at that age, just over half of girls surveyed were confident in their ability in engineering, while just under two-thirds of boys were confident. By high school, that gap had widened (30% of girls were confident in engineering compared to 55% of boys).[1]

Aspirations for STEM careers are also established at an early age. By 12-13 years old, less than a quarter of girls indicated they would like to have a STEM career, compared to over half of boys. This gap remained through high school, with girls' aspirations lowering as they age. The gap was even more pronounced for girls with intersecting identities – for example, 12% of Indigenous primary and secondary school girls indicated they would like to have a STEM career, compared to 42% of Indigenous boys.

Aspirations can be informed by a range of factors – lack of interest, seeing STEMM subjects as too hard, not understanding the relevance, or not understanding the wide range of STEMM-related careers that exist. Some students from underrepresented groups, such as students with disability or Indigenous students, may also suffer from the "soft bigotry of low expectations"[2] – schools may not see STEMM as a viable pathway for some students due to unconscious and conscious biases. These attitudes then lower those students' aspirations and become self-fulfilling.

This means that diversity in STEMM initiatives need to commence in primary school and continue through high school, ensuring underrepresented students are supported to pursue and succeed in STEMM subjects. Some measures are explored below.

Role models

We know that the presence of role models in STEMM can have a significant impact on underrepresented students' interest in those fields of study and work. A European study by Microsoft found that girls frequently cited a lack of role models in STEM as a key reason they didn't pursue a career in the sector.[3] A survey of educators commissioned by the Department of Industry, Science and Resources also emphasised the need for relatable role models within STEM to help Aboriginal and Torres Strait Islander girls identify with STEM careers.[4]

Acknowledging this importance, many of the University's outreach programs to schools specifically seek to provide role models for underrepresented groups in STEMM. For example, the <u>Residential Indigenous Science Experience</u> (RISE) is an annual week-long camp held in Naarm (Melbourne) for Aboriginal and Torres Strait Islander students in Years 9 and 10, run by the Faculty of Science. RISE was developed in 2012 to improve representation of Aboriginal and Torres Strait Islander students in STEM fields. As part of the program, students meet Indigenous scientists and students, enabling participants to envisage themselves in those roles. Student feedback for the program has been overwhelmingly positive. The Government could support these types of programs through additional funding, to ensure they are able to reach sufficient scale and impact.

Recommendations

- *Fund outreach programs that offer school students from underrepresented groups with relatable role models in STEMM.*

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[1] DISR, *STEM Equity Monitor,* https://www.industry.gov.au/publications/stem-equity-monitor/primary-and-secondary-school-data/youth-perceptions-and-attitudes-stem, (accessed 19 April 2023).
[2] G Innes, *National Press Club Address,* https://humanrights.gov.au/about/news/speeches/national-press-club-address
[3] A Trotman, *Why don't European girls like science or technology?,* https://news.microsoft.com/europe/features/dont-european-girls-like-science-technology/, (accessed 19 April 2023).
[4] DISR, *STEM Equity Monitor,* https://www.industry.gov.au/publications/stem-equity-monitor/data-focus/focus-engaging-aboriginal-and-torres-strait-islander-girls-stem, (accessed 19 April 2023).

Teachers and careers counsellors

There is strong evidence that teachers with STEMM qualifications feel more confident teaching STEMM, are more likely to see STEMM as important for future careers, rate their ability to explain different STEMM careers higher and feel more confident connecting STEMM content with real-world applications compared to those without STEMM qualifications.[5] It is therefore crucial that Governments work together to incentivise more STEMM-qualified people to pursue teaching, and provide professional development in STEMM for existing teachers.[6] Noting the importance of role modelling, programs to incentivise STEMM-qualified teachers should target individuals from underrepresented groups. This could include paid internship models (such as the University's Master of Teaching (Secondary) Internship) which provide students with a professional salary while they learn on the job, encouraging mid-career professionals.

Career advice can also play a large role in student choices. However, only 55% of those who provide career advice rate their ability to provide advice on STEMM pathways as high or very high.[7] There is a need to provide career advisors with timely, relevant and helpful information on the range of STEMM careers and pathways available to students to ensure they support a diverse mix of students to pursue STEMM. Many universities already assist with this, but this is generally ad hoc, and does not necessarily capture schools with the greatest student diversity. A holistic approach supported by government is therefore necessary.

Recommendations

- *Work with State and Territory Governments to incentivise more STEMM-qualified people to pursue (Foundation-Year 12) teaching (including through paid internship models) and provide professional development in STEMM for existing teachers.*
- *Work with Universities and other STEMM organisations to provide career advisors with timely, relevant and helpful information on the range of STEMM careers and pathways available.*

University student recruitment and support

Access to university places

While barriers to STEMM start from early childhood and primary education, students from underrepresented cohorts can face additional challenges when transitioning to post-secondary education. Many of these challenges are not unique to STEMM but apply across higher education.

For example, demand-driven university funding between 2012 and 2017 led to a marked increase in enrolments from low SES students. Between 2012 and 2017, commencing low SES enrolments grew by 25%, compared to 16% for all commencing domestic undergraduate enrolments. However, these enrolments fell after demand-driven funding ended. Between 2017 and 2021, commencing low SES undergraduate enrolments fell by 5.6%, compared to 1.1% growth for all domestic undergraduate enrolments. A cap on university places has the potential to lock disadvantaged students out of the higher education sector (particularly as demand continues to grow), potentially stifling the pipeline of those students into STEMM courses and careers. The Government should consider this as part of the Universities Accord process.

Recommendations

- *Ensure that future higher education funding models encourage greater access for underrepresented groups, including in the STEMM fields.*

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[5] https://www.industry.gov.au/publications/stem-equity-monitor/primary-and-secondary-school-data/teachers-and-career-advisers-perceptions-and-attitudes-stem, (accessed 19 April 2023).

[6] See the Invergowrie Foundation STEM Report, *Girls' Future – Our Future*, for further information. This report, co-authored by representatives from the UoM and Deakin University, made a number of recommendations to improve gender diversity in STEM, including the provision of professional development in STEM for teachers.

[7] DISR, *STEM Equity Monitor,* https://www.industry.gov.au/publications/stem-equity-monitor/primary-and-secondary-school-data/teachers-and-career-advisers-perceptions-and-attitudes-stem, (accessed 19 April 2023).

Support for cost of living

Similarly, we know that cost of living is a key concern for many equity groups in higher education. Financial stress has a significant impact on the academic performance of low SES and first in family (FiF) students.[8] Financial pressures are also much more likely to have a negative impact on university life for Indigenous students than for non-Indigenous students.[9] Adequate levels of income support are therefore essential to ensure that students from underrepresented groups can participate and succeed at university, regardless of their discipline.

Specific barriers also exist at the higher degree by research (HDR) level. For example, the Research Training Program (RTP) offers a base and maximum stipend rate for full-time students. In 2023, the base is just under $30,000, with a maximum of approximately $47,000. Stipends are generally tax-exempt; however, even after tax, the base rate is still set below minimum wage (approximately $37,000 after tax). At about $574 a week, this means it is below the Henderson Poverty Line of $611.27 for a single person. This may discourage people, particularly from low SES backgrounds, from pursuing an HDR.

Additional barriers exist for those wishing to undertake an HDR part-time (including those with caring responsibilities and/or those with significant cultural responsibilities, disabilities, chronic health conditions or mental health conditions). Part-time stipends do not enjoy the same tax-free status that is provided to full-time stipends, putting those students at a disadvantage. As a result, many HDR students find it difficult to support themselves financially. A Universities Australia survey from 2017 found that almost 40% of all domestic HDR students received financial support from their family or partners. More than three-quarters (78%) of domestic full-time HDR students reported they were in paid employment.

That same survey found that Indigenous HDR students were more likely to be worried about their finances compared to all domestic students (72% compared to 55%). More than a quarter of Indigenous HDR students reported that they regularly went without food or necessities.[10] Again, these barriers are not specific to STEMM. However, it will be challenging to boost the number of underrepresented people in STEM without addressing broader equity and access issues.

Recommendations

- *Review income support available to university students, including the level of support and eligibility requirements, to ensure underrepresented groups can participate in STEMM.*
- *Adjust stipends through small but meaningful reforms, including linking the base rate to a reputable cost-of-living index and ensuring part-time stipends receive tax-free status.*

Other supports

Beyond financial support, there is a need for wrap-around supports to ensure that underrepresented groups succeed in their STEMM studies, noting that these groups tend to have lower subject success rates than average. For example, in 2022 undergraduate UoM students with disability in STEMM had a subject success rate of 87%, compared to 91% for all students. The gap was similar pre-pandemic. However, this gap was halved during the height of the pandemic – the rate for students with disability in 2020 was 91% compared to 92% for all students, and 89% compared to 91% for all students in 2021. This difference may have been due to the availability of online learning during the pandemic. Universities will need to consider how these students can be supported to fully participate and succeed (including through dedicated infrastructure and in-class assistance) following the return to campus.

The Higher Education Disability Support Program offers Australian Government support for these students; however changes in the Program's design made by the previous Government have meant that students with lower cost claims no longer receive support. This represents a barrier to participation for some students with a disability.

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[8] NCSEHE, *Facilitating Student Equity in Australian Higher Education*, 2016, p. 16, https://www.ncsehe.edu.au/wp-content/uploads/2016/08/Facilitating-Student-Equity-in-Australian-Higher-Education.pdf
[9] ibid. p. 19
[10] Universities Australia, *2017 Universities Australia Student Finances Survey,* 2018, https://www.universitiesaustralia.edu.au/wp-content/uploads/2019/06/180713-2017-UA-Student-Finance-Survey-Report.pdf, (accessed 19 April 2023).

Similarly, the Australian Government provides funding to universities to support Indigenous students, and students from low SES, regional and remote backgrounds through the Indigenous, Regional and Low-SES Attainment Fund (IRLSAF). However, programs such as these may leave out some underrepresented groups, including those who are first in family and those from non-English speaking backgrounds. It is crucial that universities receive adequate funding to provide ongoing wrap-around supports for underrepresented students to increase enrolments, educational attainment and employment outcomes.

Recommendations

- *Address gaps in the Higher Education Disability Support Program and Indigenous, Regional and Low-SES Attainment Fund to ensure that underrepresented groups are adequately supported in higher education.*

Staff recruitment

We lose underrepresented groups from the STEMM pipeline at key transition points, including the transition from study to work. It is important that staff recruitment initiatives, including within STEMM faculties, seek to address this directly.

An important initiative that has achieved positive results in the University's experience is women-only recruitment. This was implemented in 2016 in the University's Mathematics department and has since been repeated in Physics, Chemistry and Engineering to drive women's representation in those fields, particularly between Level B and D.

While women-only recruitment is not intended to be a long-term solution, it has proven to have impact lasting beyond the single round of recruitment. Even one round of women-only recruitment in those departments led to a greater proportion of women applications in further rounds of recruitment open to all genders. Feedback from applicants suggested that the women-only recruitment round sent a signal to applicants that the University supported gender equity and encouraged women to apply to open roles advertised thereafter. Additionally, the quality of applicants to later rounds rose after a women-only round.[11]

There may be a role for this type of recruitment across other forms of diversity, to encourage greater representation within STEMM staff bodies. However, the University notes that this measure alone is not sufficient, particularly where there is intense competition to recruit from a small pool of qualified candidates. These measures need to be complemented by those that address the entire pipeline and ensure that staff employed through targeted recruitment can feel welcome, included and able to fully participate and succeed in their new roles.

Other measures to improve recruitment of diverse staff into STEMM could include offering unconscious bias training to those undertaking recruitment to address systemic discrimination against underrepresented groups. For example, this has been trialled in MDHS to improve promotions processes.

Recommendations

- *Encourage STEMM employers to consider alternative approaches to staff recruitment, including targeted recruitment (e.g. women-only), and review recruitment and promotions processes to remove barriers for underrepresented groups, including unconscious bias.*

Retention and promotion of staff

For many underrepresented groups in STEMM, there exists a "leaky pipeline", where the percentage of these groups represented declines at each level. This is generally due to issues with retention and promotion of staff. The barriers to retention and promotion vary significantly across underrepresented groups and individual fields of education and there is no silver bullet. However, some actions are suggested below that may boost retention and promotions for diverse groups across the board.

Mentoring

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[11] Further details can be found here: https://www.nature.com/articles/d41586-022-02829-y

Individuals from underrepresented groups are generally more likely to have negative perceptions of their own career success, less likely to obtain research funding and have lower likelihood of gaining promotions.[12] However, research suggests that mentors can play a powerful role in supporting staff in STEMM fields to overcome some of these barriers.[13] [14]

Supporting Women in MDHS (SWiM) was launched to promote gender equity and support academic promotion of women and non-binary academics in the Medical, Dental and Health Sciences (MDHS) Faculty. The SWiM Mentoring for Promotion Program is a tailored program of support for female and non-binary staff who are eligible for academic promotion. Since 2021, over 100 women have participated in the program, which has been highly successful in promoting women and creating a sense of collegiality and community across the Faculty.

The program doubled from 37 in 2021 to 67 in 2022 and included Levels B, C and D. Those seeking promotion to Level C via the SWiM program had an 83% success rate of promotion. There was an 81% success rate for promotion to Level D in 2022 (in 2021, MDHS's representation of women Associate Professors increased to 52%, exceeding men for the first time). There was a 100% success rate for SWiM mentees applying to Professor Level E – this significantly increased the representation of women at Level E from 30% in 2018. Participants reported 100% satisfaction with the program, noting the mentoring often continues after the SWiM program ends.

The Mentoring@FEIT program was launched late 2017, signalling the Faculty of Engineering and IT's commitment to developing its academic staff and seeding organisational change towards an embedded culture of mentoring/sponsorship. While the pilot program was focused on female academics at levels A, B and C, it is now open to all academics and is run on an ongoing basis. The Faculty of Science also has a career development program for levels A, B and C with a similar focus.

In 2022, the University launched the institution-wide Athena Swan STEP (Supporting Talent and Enabling Progression) Mentoring Program. This is modelled on SWiM, providing support to women and non-binary staff applying for promotion to senior academic level D, where they are underrepresented in most faculties. Additionally, the University runs the Academic Women in Leadership Program (AWIL), aimed at addressing women's underrepresentation in higher level academic appointments and on key policy, decision-making and governance bodies.

Through these types of mentoring programs, universities and other STEMM workplaces may improve retention and promotion.

Promotions

Promotion applications require extensive peer review and numerous national or international referees. This requires individuals to maintain skill sets and professional networks through project or research collaboration, travel to conferences and attend networking events. However, this can be extremely difficult to maintain during significant career interruptions (e.g. due to caring responsibilities, disability or community obligations) or during periods of part-time work. The fast pace of scientific fields can make it difficult to keep up throughout the challenge of transitioning back to part-time work. This means that career interruptions can have significant impacts on career progression, posing a significant barrier for many underrepresented groups.[15]

Additionally, academic conferences are not always fully accessible, particularly those that are held in-person. This can present significant challenges for academics with disability, who may face additional costs associated with travel arrangements and/or travel insurance, or may be unable to attend due to health risks. Similarly, standardised performance metrics may exacerbate inequalities, noting that some people from underrepresented groups may not be able to produce the same level of metrics in the same amount of time. For example, academics with disability who compete for metrics at the same pace as their colleagues without disability report working additional hours and

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[12] K Wanelik et al., *Breaking barriers? Ethnicity and socioeconomic background impact on early career progression in the fields of ecology and evolution*, 2020, https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.6423#ece36423-bib-0010

[13] ibid

[14] R Markle et al., *Supporting Historically Underrepresented Groups in STEM Higher Education: The Promise of Structured Mentoring Networks*, 2022, https://www.frontiersin.org/articles/10.3389/feduc.2022.674669/full

[15] DISR, *Advancing Women in STEM Strategy*, https://www.industry.gov.au/publications/advancing-women-stem-strategy/snapshot-disparity-stem, (accessed 19 April 2023).

compromising their physical and mental health and work-life balance.[16]

Career recognition and progression processes in all STEMM fields and industries should feature evaluation frameworks that recognise these barriers. In the academic sector, Performance Relative to Opportunity (PRO) is an evaluation measure that seeks to supplement, but not replace, traditional metrics of achievement (quantity, rate or breadth of outputs, such as publications).

PRO calculates achievements in context of the available time in which they were achieved by the applicant, bringing nuance and context that goes some way towards equalising the playing field for applicants who have had time away from work. In doing so, PRO does not displace merit or disciplinary standards, but gives context to the qualities of achievement pertinent to promotion eligibility within institutions or disciplines, such as the University of Melbourne's core performance dimensions of activity, engagement, and quality and impact.

Research funding schemes such as the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC) also consider PRO in grant applications. Importantly, these sections can capture the impact of interruptions due to a range of reasons – not just caring and parental responsibilities. For example, the ARC lists disability and community obligations, including Aboriginal or Torres Strait Islander cultural practices and protocols, as reasons for career interruptions.[17] However, these sections of grant applications have evolved over time and become significantly more complex than originally intended. The Government should therefore consider how PRO could be simplified, as recommended in the recent ARC Review.[18]

Scholarships and fellowships specifically targeted at those who have experienced career interruptions or other barriers to career progression could also play a key role in leveling the playing field. For example, MDHS Momentum Fellowships support the research momentum, career progression and retention of Level B and C researchers and academic staff with extraordinary and compounding personal circumstances. This includes staff whose disability, chronic health conditions and/or disproportionate caring responsibilities have significantly impacted their capacity to progress their academic career. Two fellowships are available and include a maximum award of up to $100,000 per year for salary and research-related expenses over a maximum two-year term. Seven fellowships have been awarded in the last two years.

Additionally, the Melbourne Research Fellowships (Career Interruptions) Program enables eligible researchers to enhance or re-establish their academic careers where they have been significantly interrupted, delayed or otherwise constrained by chronic illness, child rearing or other caring duties. This program offers recipients $60,000 plus $20,000 for travel or research support.

There may be an opportunity for the Australian Government to provide a similar national fellowship program to support those who have faced extraordinary and compounding personal circumstances that have limited their STEMM career progression.

> *Recommendations*
>
> - *Consider simplifying Performance Relative to Opportunity sections in ARC and NHMRC grant applications.*
> - *Develop a national fellowship program to support those who have faced extraordinary and compounding personal circumstances that have limited their STEMM progression, similar to the University's Momentum Fellowships.*

Fostering an inclusive and safe workplace

The University acknowledges that there are other disincentives and barriers to STEMM retention including cultural issues such as systemic and structural biases, sexism, racism and ableism, and harassment. Individuals from underrepresented groups are far less likely to remain in STEMM careers if they do not feel welcome and safe in their

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[16] J Olsen et al., *Reporting from the Margins: Disabled Academics Reflections on Higher Education*, 2020, p. 268 https://sjdr.se/articles/10.16993/sjdr.670.

[17] ARC, *Research Opportunity and Performance Evidence (ROPE) Statement,* https://www.arc.gov.au/sites/default/files/2022-06/ROPE%20Statement.pdf, (accessed 19 April 2023).

[18] M Sheil et al., *Trusting Australia's Ability: Review of the Australian Research Council Act 2001*, 2023, p. 19-20, https://www.education.gov.au/higher-education-reviews-and-consultations/resources/trusting-australias-ability-review-australian-research-council-act-2001.

workplace. One survey of women of colour in Australian scientific and technical organisations found that racial microaggressions were commonplace, which one respondent described as "death by a thousand cuts."[19] It is therefore incumbent upon employers to cultivate an inclusive, professional and safe workplace to aid retention.

Employers must adopt a zero-tolerance approach to hostile work environments and ensure that perpetrators of bullying, harassment and discrimination face consequences. Workplaces also need to ensure that victim-survivors and whistle-blowers do not experience additional harm from reporting harassment, bullying and discrimination. For example, last year the University of Melbourne launched the Speak Safely portal to allow staff and students to safely report sexual assault, harassment and other forms of inappropriate behaviour. Those who report have the choice to remain anonymous. The University is also rolling out compulsory Respect training to staff and students as part of the University-wide Respect Action Plan. Training for all staff (including disability and LGBTIQA+ awareness training) and clear policies are essential in ensuring that workplaces are safe and inclusive.

Additionally, those looking to establish inclusive and safe workplaces must be cognisant of the additional workload that can be placed on underrepresented groups within STEMM and academia more broadly. For example, Indigenous academics often experience the "cultural taxation of taking an uneven load of Indigenous work" – work that is often invisible or not readily recognised.[20] This cultural load on Indigenous staff (and students) within STEMM organisations, such as universities, requires urgent attention in terms of workforce planning, remuneration and addressing behavioural racism. People with disability often experience additional time burdens and workloads too, in seeking adjustments, self-advocating, and navigating an environment that is not always accessible.

Supporting international engagement

It is acknowledged that there are a number of advantages to internationally oriented academic careers.[21] One way of enhancing Indigenous representation in STEMM could be to develop new schemes that support international experiences for Indigenous researchers. There may be opportunities for the Australian Government to co-invest in these types of programs with external funding bodies like Fulbright. For example, Fulbright currently partners with Ngā Pae o te Māramatanga (NPM), the Māori Centre of Research Excellence in New Zealand, to offer awards for Māori researchers. A similar program, focused on STEMM disciplines, could be established for Indigenous researchers in Australia. This could improve retention of Indigenous academics in the disciplines while promoting Indigenous research discoveries and impart to broader audiences. The Australian Government might also consider offering international fellowships aimed specifically at academics with disability, noting the immense barriers people with disability face when traveling for work.

> *Recommendations*
>
> - *Provide Universities with additional funding and resources for initiatives that foster safe and inclusive workplaces.*
> - *Co-invest in programs that support international experiences for underrepresented groups, including Indigenous researchers in STEMM.*

Government measures to address diversity in STEMM

Many of the existing Australian Government programs have been helpful at addressing the underlying barriers to greater diversity in STEMM, particularly those faced by women. The University would encourage the Australian Government to continue these programs (explored below), while establishing new programs that can support broader forms of diversity within STEMM.

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[19] M Nash and R Moore, *'Death by a thousand cuts': women of colour in science face a subtly hostile work environment,* 2020, https://theconversation.com/death-by-a-thousand-cuts-women-of-colour-in-science-face-a-subtly-hostile-work-environment-130204 , (accessed 19 April 2023).

[20] M Locke et al., *Australian Indigenous early career researchers: unicorns, cash cows and performing monkeys,* 2023, p.13, https://www.tandfonline.com/doi/epdf/10.1080/13613324.2022.2114445?needAccess=true&role=button

[21] A Calikoglu et al., *Faculty International Engagement: Examining Rationales, Strategies and Barriers in Institutional Settings*, 2022, https://doi.org/10.1177/1028315320963508.

SAGE Athena Swan

The SAGE Athena Swan program provides a clear framework for STEMM institutions to improve and promote gender equity and diversity. The University has been part of Athena Swan since 2015 and is currently working towards applying for Athena Swan Silver accreditation in 2027. The University is committed at the highest level to continuing participation in this program and achievement of its aims. We encourage the Government to continue supporting the program.

STEM Equity Monitor

The STEM Equity Monitor plays an important role, providing a national data resource on girls and women in STEMM from primary education through to the workforce. This provides crucial insights into the factors that influence women's participation in those disciplines. This work should continue. However, going forward, the remit of the STEM Equity Monitor could be expanded to include other underrepresented groups, including people with disability, given the dearth of national data on other forms of diversity in STEMM.

ARC and NHMRC initiatives

Last year, the NHMRC announced that from 2023 it will award an equal number of Leadership grants to men and women (or non-binary researchers) under its Investigator Grants scheme.[22] While the ARC does not set quotas for its grants programs, it does offer women-only science and technology fellowships through the Georgina Sweet Australian Laureate Fellowships, who act as ambassadors and mentors to women in research.[23] These Government policies and programs can set important precedents, signalling the prioritisation of diversity within STEMM.

The University notes that the recent ARC Review recommended introducing two named Fellowships for Indigenous researchers in the ARC Australian Laureate Fellow Scheme to improve representation of Indigenous academics.[24] The Government might also wish to consider establishing Fellowships for other underrepresented groups, including people with disability, to improve opportunities and visibility for these academics.

Additionally, the ARC could review its grant guidelines to expand the forms of financial research support available to researchers with disability. This could clarify expectations of practical workplace supports and adjustments that should be made available to the researcher by the research institution, without impacting the quantum of funding for the actual research.

CSIRO initiatives

From 2014 to 2021, the BHP Foundation funded CSIRO to deliver the Indigenous STEM Education Project, aimed at increasing interest and achievement among Indigenous students in STEM subjects and professions. This comprised six programs and reached just under 24,000 Aboriginal and/or Torres Strait Islander students, 2768 teachers and assistant teachers, and 603 schools.

The final evaluation report found that it had "left a lasting impact on participating educators, students, and schools" and that the six programs were effective in meeting their desired outcomes, with transformative impacts.[25] This project has now ended but there may be opportunities to apply learnings from the evaluation and fund similar programs in the future.

Other Government initiatives

The Australian Government funds a range of other programs to support women in STEMM, including the Superstars of STEM program and Elevate: Boosting Women in STEM program. Positively, these programs take a holistic approach, offering women in STEMM mentoring, access to events and networking, and training. However, the administrative

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[22] NHMRC, *Working towards gender equity in Investigator Grants*, https://www.nhmrc.gov.au/about-us/news-centre/working-towards-gender-equity-investigator-grants, (accessed 21 April 2023).

[23] ARC, *Kathleen Fitzpatrick and Georgina Sweet Australian Laureate Fellows*, https://www.arc.gov.au/funding-research/funding-schemes/discovery-program/australian-laureate-fellowships/kathleen-fitzpatrick-and-georgina-sweet-australian-laureate-fellows, (accessed 21 April 2023).

[24] Sheil et al., p. 21.

[25] CSIRO, *Indigenous STEM Education Project: Final Evaluation Report,* 2021, https://www.csiro.au/en/education/Programs/Indigenous-STEM-Education-Project/Monitoring-and-evaluation/Final-evaluation-report

burden involved in applications can deter some women from applying, particularly for those balancing academia with caring responsibilities. The University would therefore encourage streamlined application processes for all diversity in STEMM programs, where possible.

Recommendations

- *Continue supporting women in STEMM programs, while ensuring that application processes are streamlined to reduce administrative burden.*
- *Establish new programs to support broader forms of diversity in STEMM. This could include the establishment of new Fellowships within the ARC Australian Laureate Fellow Scheme to support Indigenous researchers, as recommended by the ARC Review, or researchers with disability.*

Attachment 1

Diversity data at the University of Melbourne

Gender

In 2021, just over half (51%) of the University's STEMM enrolments identified as women or non-binary. At the postgraduate level, this percentage is even higher (53%). However, representation varies significantly across the STEMM fields of education. For example, women and non-binary students make up the majority of enrolments in health (68%) and agriculture, environmental and related studies (57%), but the minority in information technology (40%) and engineering and related technologies (29%). They make up almost half of the enrolments in natural and physical sciences (49%).[26]

Across the University, women comprise 58% of staff. Our latest figures show that the number of women in University leadership roles, both academic and professional, has grown from 35 per cent in 2019 to 43 per cent at the end of 2022.

The number of academic women at the highest level in the University has increased from 39 per cent in 2020 to 44 per cent at the end of 2022 for Associate Professors, and from 32 per cent in 2020 to 35 per cent at the end of 2022 for Professors. In the last two years, more women than men have been promoted to full Professor (Level E) and Associate Professor (Level D). The University's Council has reached parity with women making up 50 per cent of its membership in 2023 and the University Executive is made up of 38 per cent women.
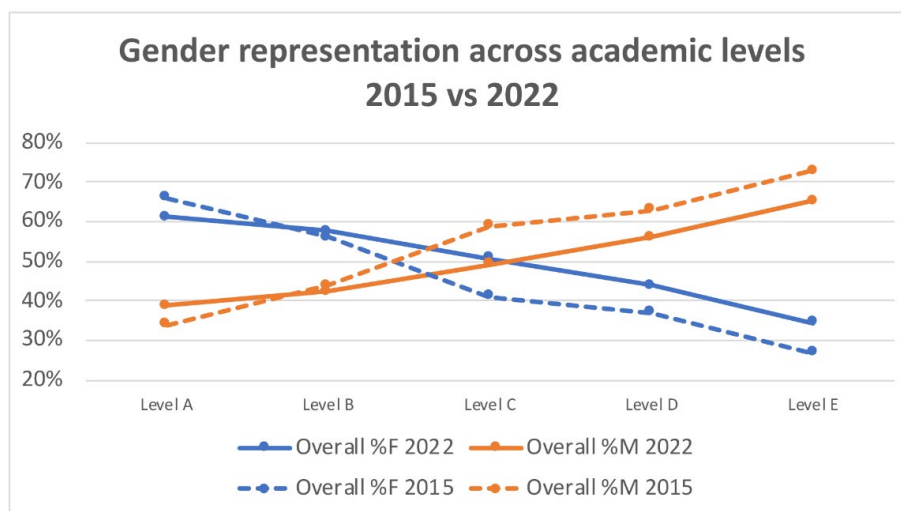

Fig 1. Although there is considerable work yet to do, progress has been made towards increasing the representation of academic women at a senior level and closing the scissor gap.

Looking specifically at STEMM faculties, women's senior representation is lower – the percentage of women holding professoriate positions is 31% in STEMM fields. In faculties where there is a minority female workforce, such as the Faculty of Engineering and IT and the Faculty of Science, the percentage of top professorial positions held by women is lower again (14% and 22% respectively). However, in the Faculty of Medicine, Dentistry and Health Sciences, which has a majority female workforce, the percentage of women in the top academic roles is significantly higher (41%). This data reinforces the need for determined institutional efforts to improve gender equity concurrently, which could be enhanced through the coordinated program and funding support of government and other stakeholders.

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[26] Department of Education, *Student Enrolments Pivot Table 2021*, https://www.education.gov.au/higher-education-statistics/resources/student-enrolments-pivot-table-2021, (accessed 19 April 2023).

Gender representation across academic levels by STEMM faculty

Legend:
- FEIT Male %
- FEIT Female %
- MDHS Male %
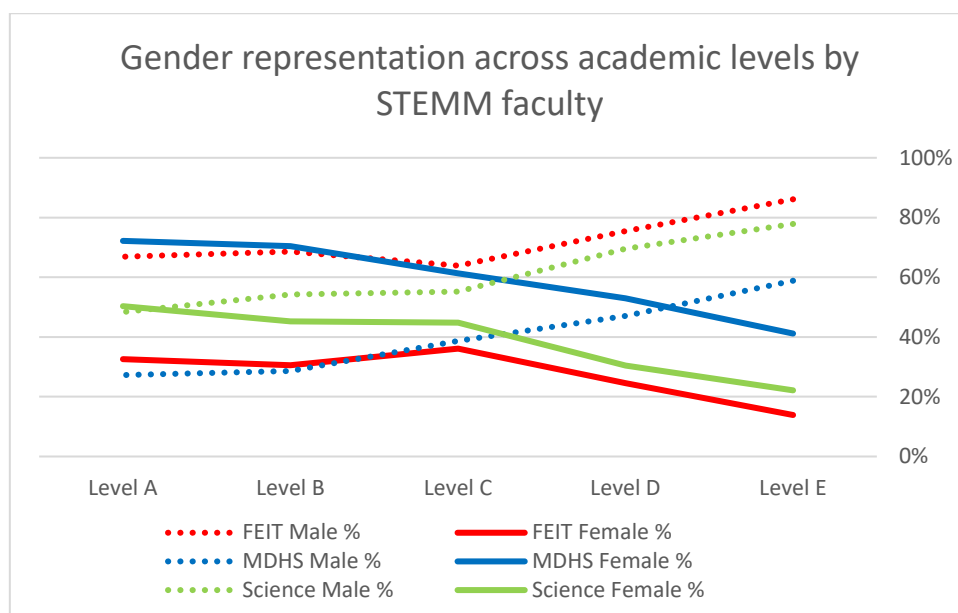- MDHS Female %
- Science Male %
- Science Female %

Fig 2. The percentage of women in top academic roles is significantly higher in the female-dominated Faculty of Medicine, Dentistry and Health Sciences (MHDS) than the Faculty of Science and Faculty of Engineering and IT (FEIT).

Indigenous

In 2022, 500 students enrolled at the University identified as Aboriginal and/or Torres Strait Islander (1.16% of domestic students). Of these, 235 were enrolled in undergraduate degrees, 149 in higher degree coursework, 60 in graduate research degrees and 65 in other postgraduate degrees.[27] The proportion of Indigenous students in the University's STEMM faculties are slightly lower than across the University overall. Just under 1% of STEMM enrolments in 2022 identified as Indigenous. In the same year, 1.3% of commencing enrolments in STEMM faculties identified as Indigenous.

In terms of STEMM staff, 1.4% identified as Aboriginal and/or Torres Strait Islander. However, this statistic is based on self-reporting in the University's HR platform, which may understate the size of the cohort.

Culturally and Linguistically Diverse (CALD)

In 2019, more than 5% of domestic students enrolled at the University were from a non-English speaking background (NESB), the second highest in Victoria.[28] Based on 2023 accepted offers, STEMM courses generally had a slightly higher percentage of NESB students. The University also enrols a large number of students from CALD backgrounds through its international student cohort, who may face similar barriers to their domestic NESB counterparts.

Data on CALD staff is not as readily available. However, a diversity and inclusion survey undertaken by the Faculty of Science in 2021 provides some insights. It found that cultural diversity decreased with seniority for both academic and professional staff. For Level D/E staff, 15% spoke a language other than English at home, 26% at Level B/C and 39% at Level A.

Disability

In 2023, just over 10% of those who accepted offers for an undergraduate place at the University declared that they had a disability. Across STEMM courses the share was slightly lower (9%), however, there was significant variance within STEMM. For example, just under 16% of those who accepted offers for the Bachelor of Agriculture disclosed that they had a disability, whereas only 7.6% of those who accepted offers for the Bachelor of Biomedicine disclosed a disability.

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[27] Enrolments have been gradually increasing over recent years. In 2021, the University had the third highest commencing enrolment share of Indigenous students in Victoria (1.3%). This represented a significant increase from 2011, when Indigenous students made up only 0.5% of commencing enrolments. The University's Indigenous student retention rates are the highest in Victoria (85% in 2020); its Indigenous student success rates are the second highest (82%).

[28] NCSEHE, *Institutional Data,* https://www.ncsehe.edu.au/data/institutional-data/, (accessed 19 April 2023).

It is difficult to ascertain the number of staff with disability. Statistics are based on self-reporting in the University's HR platform and voluntary participation in staff surveys, which is likely to understate the size of the cohort. However, a fifth of respondents to a Faculty of Science survey in 2021 reported they had a disability. That same survey found that 16% of those holding Level D (Associate Professor) or E (Professor) positions in the Faculty had a disability (compared to 19.5% overall).

Low SES and First in Family

In 2023, 8.1% of undergraduate applicants who had accepted offers were low SES. Over 16% of students identified as First in Family (FiF). The share of low SES students was slightly higher in STEMM courses (9.5%), while the percentage of FiF was the same (16%).

Regional and rural

In 2023, 11.8% of undergraduate STEMM applicants who had accepted offers to the University were from regional, rural or remote areas. This was slightly higher than the percentage in HASS disciplines. The percentage was significantly higher in the Bachelor of Agriculture (26.8%), while it was slightly lower in the Bachelor of Science (11%).

LGBTIQA+

The University does not have reliable institution-wide data on the percentage of its students or staff that identify as LGBTIQA+. However, a diversity and inclusion staff survey from 2019 found that 10% of staff identified as LGBTIQA+ and 1% identified as non-binary. Figures from 2021 indicated that 0.3% of staff identified as gender diverse.

The Faculty of Science survey found that 29% of students who responded identified as LGBQA+. More than 4% of students indicated they were non-binary, gender diverse or trans. The same survey found that 14.5% of staff in the Faculty identified as LGBQA+, and 2.5% indicated that they were non-binary, gender diverse or trans. Many of the respondents identifying as LGBQA+ had intersecting identities – 62% were women, and 27% spoke a language other than English at home.

Attachment 2

Additional University of Melbourne Diversity in STEMM Programs

Victorian Indigenous Engineering Winter School (VIEWS)

VIEWS seeks to boost representation of Indigenous Australians in engineering and information technology. Since 2016, the annual, week-long VIEWS program has fired the ambitions of over 100 Year 10-12 students from around Australia, introducing them to university life, STEM mentors and career possibilities, while also connecting these pathways to their culture. The University of Melbourne, Monash, RMIT and Swinburne Universities work together to provide the program, with support from Indigenous community Elders, industry partners and the community.

Professional Certificate in Indigenous Research and Graduate Certificate in Indigenous Research and Leadership

The Professional Certificate in Indigenous Research and the Graduate Certificate in Indigenous Research and Leadership support the success of Indigenous HDR students and early career researchers to address the disparity in higher degree completions between Indigenous and non-Indigenous students. In so doing, they contribute to the expansion of the Indigenous academic workforce and build Indigenous research and leadership capacity within the University and across Australia. These interdisciplinary graduate coursework programs are the only ones of their kind in Australia that explore research, and develop research and leadership skills, from an Indigenous perspective.

Girl Power in Engineering and IT

The Faculty of Engineering and IT supports the Girl Power in Engineering and IT program, designed to advance gender parity in engineering and IT disciplines. The program delivers interactive workshops, work experience programs, residential camps, and mentoring to female high school students from Years 9 to 12.

Since its inception, Girl Power has attracted over 1400 applications. It has welcomed 220 students from 119 schools across Melbourne, rural areas, and interstate. Additionally, 22 students have become students at the University.

Girls Programming Network

The Girls' Programming Network (GPN) is a program developed and run by girls and for girls. Managed by a group of female information technology (IT) students (both from the University of Melbourne and elsewhere), the program is for high school girls interested in IT, particularly those interested in learning to program or improving their software development skills.

Faculty of Engineering and IT (FEIT) International Research Fellowship

The FEIT International Research Fellowship provides a dedicated opportunity for young women to work in universities and research centres abroad. The fellowship, which is valued at up to $11,000, aims to provide opportunities for women in FEIT to strengthen and develop their academic networks, knowledge, skills, and contacts.

Diploma in General Studies

The University's Diploma in General Studies (DiGS) is a one-year program based at the Dookie Campus designed to provide domestic students with a pathway into one of the University's bachelor programs, or to provide direct entry into employment. The program allows students to explore a range of subjects and experience university-level study.

It provides a guaranteed pathway to one of the University's five bachelor programs for students who achieve the required average score in their DiGS subjects. The regional location enables students to remain close to home at the early stage of their post-secondary studies, addressing a major barrier to participation – the cost of relocation.

Access Melbourne

Access Melbourne is the University's access entry scheme for eligible domestic students seeking a place in one of our undergraduate degrees. Melbourne Access Scholarships are a key component of the scheme: the scholarships provide $7,500 per year for three years for students from disadvantaged backgrounds and regional or remote areas. The University also offers STEMM specific scholarships, such as the Science Access Scholarship. In 2023, 16% of STEMM Access Melbourne students declared a disability, 26% were FiF, 21% were from regional or remote locations, 19% were from low SES backgrounds, 0.5% were Indigenous and 3.4% were from a NESB.