clex@unsw.edu.au
The ARC Centre of Excellence for Climate

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Science Strategy and Priorities Taskforce
Department of Industry, Science and Resources
DiversityinSTEM@industry.gov.au

Submission to: Diversity in STEM Review: draft recommendations

The **ARC Centre of Excellence for Climate Extremes** (the Centre) welcomes the opportunity to comment on the Diversity in STEM Review: draft recommendations. We are one of Australia's leading climate science centres, bringing together over 150 scientists, from many diverse backgrounds, across five Australian universities. Our research utilises a range of disciplines including mathematics, physics, earth sciences and data science to understand the underlying processes causing climate extremes that impact Australia. As a scientific research centre, we would like to share our perspectives on increasing diversity in STEM.

We have drawn on the experience of the Centre's Culture and Diversity committee who have provided insights from their own experience.

We focus our comments on recommendations 3a, 4c, 5a and 8a which relate to our experience and expertise.

We thank the Department of Industry, Science and Resources for the opportunity to make a submission on this important topic. We are happy to provide further information on any matters arising from this submission.

Yours sincerely,

Professor Julie Arblaster
Deputy Director
ARC Centre of Excellence for Climate Extremes

The ARC Centre of Excellence for Climate Extremes provides comment below on selected draft recommendations. We have provided a single response on multiple recommendations where appropriate.

'Recommendation 3a Government grant funding, investment and procurement for STEM-related programs should align with best practice guidelines for inclusion and diversity.'

'Recommendation 8a Governments and Australian universities should work together towards equity in access, participation and attainment of STEM higher education'.

The Centre strongly supports the implementation of best practice guidelines for inclusion and diversity in grant funding decisions for higher education. In this section we address recommendations 3a and 8a by sharing our experience in three areas that impact diversity:

1. best practice in grant funding,
2. how the PhD stipend limits access for diverse groups and
3. how visa and insurance costs impact international students and professionals.

1. Best practice for inclusion and diversity in grant funding

The prevalence of bias in society can limit the careers of people in STEM. This applies at every stage, from having applications accepted and obtaining grants, to getting papers published. Applying best practice guidelines for inclusion and diversity is therefore important for researchers in STEM to facilitate an equitable environment where they can compete on a level footing with their peers.

The Centre suggests that best practice guidelines of inclusion and diversity be clearly defined by the Department of Industry, Science and Resources and that these guidelines align with recommendations from key STEM agencies, such as the Australian Academy of Science.

We define best practice guidelines as those which ensure:

- The STEM fields include people from *diverse* demographic backgrounds and the innumerable intersections between them (age, cultural background, Indigeneity, disability, sexuality, gender, neurodiversity, socioeconomic status).
- People in STEM from all demographic backgrounds experience a sense of *inclusion* in their study and work.

The Centre advocates for the implementation of mandatory unconscious bias training as a best practice guideline. Unconscious biases can negatively affect workplace practices and decision-making thwarting funding applications and therefore the progress of STEM students and researchers. Grants awarded through government funding agencies are highly dependent on evaluations by reviewers from the Australian scientific community. As many people are unaware of their bias, we believe that mandating unconscious bias training for all employees can alert us to our own fallibility.

We propose two further recommendations that could help limit unconscious bias:

1. Remove assessment criteria for “investigators'' in non-fellowship grants. This contributes up to 30% of the grant ranking and encourages simply measuring prior output of the investigator’s team. This likely contributes to the difficulty of early career researchers obtaining grants. Instead, the team’s suitability could be assessed through the “Feasibility” criterion, with explicit instructions to only note experience and skills necessary for the proposed project.
2. Provide better guidance for interpreting non-traditional career pathways (careers with breaks) through the Research Opportunity and Performance Evidence (ROPE) framework. This framework provides an excellent vehicle to embed inclusion and diversity principles in grant assessment, but further guidance and education for reviewers could improve ways in which it is applied.

2. PhD stipend limits access for diverse groups

The Centre urges that best practice guidelines incorporate wages and more specifically, pay a living wage to PhD students. At present, the PhD stipend in Australia pays well below minimum wage, and often below the poverty line. This has profound impacts on diversity, deterring candidates who may not have access to additional financial support that enables them to spend three years on this wage. Further, PhD students do not earn superannuation, or pay down any HELP debt, leaving them with a financial burden that continues beyond graduation. For students from diverse backgrounds, who undertake a PhD, this financial stress is compounded by stresses due to their minority status such as navigating bias and stereotyping, the lack of role models and mentors, and other cultural challenges. These compounding factors conspire against academic performance, education, retention in STEM, and general wellbeing.

A recent survey from over 50 higher degree research students at the Centre found that:

Over two-thirds agreed or strongly agreed that their financial situation while studying impacted their mental health.

- Over two-thirds agreed or strongly agreed that they needed a part-time job to supplement their income in order to afford necessities.
- Nearly one-third agreed or strongly agreed that they had considered quitting their higher degree research studies due to financial pressures.
- Just under 60% indicated that they had actively refrained from using health care as a result of their financial situation.
- Students commented that their financial situation curbed or halted family planning, made them more inclined to work from home to reduce public transport costs, caused them to reduce heating and cooking to save on power bills and made it more difficult to focus on research.

3. Visa and insurance costs for international students and professionals

Visa requirements and associated costs for international students and professionals can be a significant barrier to diversity. At the Centre we have many talented researchers who have moved from other countries to study or work with us. These colleagues have frequently commented on the difficult, time-consuming, and stressful process of obtaining their visas, particularly where they are not sponsored visas such as students. In particular, the uncertainty of processing times can be highly stressful, especially those on a tight schedule. This application process is not covered by most scholarships, making the financial barrier very significant: for some students from countries with lower earnings, the cost can amount to two months of salary. Health insurance poses an additional cost that can be prohibitive and make it more challenging for researchers to bring their families abroad due to the costs of insuring them.

Investment that reduces the costs of visas and health insurance, or policies that institute more flexible payment options will reduce some of these financial barriers. Additional assistance with the visa application process would reduce the stress and workload of applicants, clearing the path for a more diverse and competitive research sector.

'Recommendation 4c All STEM-related sectors should actively include diverse knowledges and representations of diversity in research, publications, education materials and scientific approaches.'

The Centre agrees with this recommendation. Here we highlight the need for knowledge exchange with indigenous communities and climate science.

Meaningful knowledge exchange between climate scientists and First Nations communities is crucial to our collective effort to address climate change. This exchange can provide First Nations communities with knowledge to protect Country in our changing climate, while also informing modern scientists about the challenges encountered on Country, and how traditional and cultural knowledge can contribute to climate solutions.

More support for these partnerships is essential. Our Centre is currently working alongside Deadly Science to provide climate science resources for remote schools. STEM organisations and First Nations communities would benefit from more guidance, support and opportunities for creating meaningful partnerships, knowledge exchange and co-designed projects. This may involve increasing the number of linkage roles that integrate modern science with traditional and cultural knowledge, or further support for organisations including the NESP (National Environmental Science Program) Climate Systems Hub, the National Indigenous Science Education Program and Deadly Science. We advocate for more support for these initiatives to facilitate knowledge exchange and integration.

'Recommendation 5a Implementing the 2022 National Teacher Workforce Action Plan should incorporate a strong focus on teaching STEM thinking and skills pathways into STEM.'

The Centre strongly supports actions to improve STEM thinking and pathways into STEM in school. Attitudes towards STEM that are developed in school are important determinants of whether a student will continue to study STEM. It is imperative that students from diverse range of demographics have access to STEM skills to contribute towards climate solutions over the coming decades. If particular groups are deterred from STEM in school, this compounds throughout undergraduate and postgraduate degrees, leading to a lack of diversity in the workplace. For example, at the Centre, First Nations peoples are significantly underrepresented and despite efforts to address this, we have had minimal success recruiting Indigenous scientists. This is because key barriers occur before tertiary education. We have two key recommendations for encouraging students to study STEM in school:

2. Context based learning

Incorporating context-based learning shows students how STEM skills can be applied in the real world, adding meaningful relevance. Climate science relies on maths, physics and data science, and so incorporating climate science into the STEM curriculum demonstrates how these subjects can address real world problems. For Indigenous school students, adding context to STEM subjects may involve teaching how STEM skills can complement cultural knowledge to increase their relevance (a key endeavour of the Deadly Science initiative).

To build climate science into the high school curriculum and encourage students to study STEM, the Centre developed our Climate Classrooms initiative in partnership with the Monash Climate Change Communication Research Hub. Since 2020 we have run 4 workshops which support and empower high school teachers to incorporate climate information into the curriculum. Examples of co-designed lesson plans from these workshops include:

- A data analysis unit for year 7 which looks at seasons and climate variability.
- A maths lesson for years 10 to 12 which uses sea level data from global measuring stations to investigate how sea level has been changing.
- A physics lesson for years 11 and 12 that looks at the power, energy and dynamics of wind turbines.

From our experience with Climate Classrooms, key barriers for teaching climate science in school include limitations in the teacher's confidence to teach climate science, limited resources available that are tailored to the school curriculum, large teaching loads and limited ability to take time off for professional development. Additionally, there is limited funding for research institutions to undertake outreach programs dedicated to climate science in school. To overcome these barriers, we suggest allocating further funding towards teacher training and investing in outreach programs between climate scientists and teachers.

2. Communicating job opportunities in STEM

If we are able to engage students in school, the next challenge is to encourage students to follow STEM into tertiary and/or vocational education. It is important to communicate the many and varied opportunities for students in STEM fields. A key barrier we perceive is the ambiguity around what being 'a scientist' or 'a mathematician' looks like. Compared to other career paths such as 'doctor', 'plumber', 'lawyer', 'nurse', 'teacher', it is hard to understand what a career as a 'scientist' involves. The skills of climate scientists are sought after, for example, at the Bureau of Meteorology, all levels of government, consulting, and insurance. However, these opportunities only become clear to most students later in higher education.

There has been some impressive work in this space (e.g., the Australian Mathematical Sciences Institute's 'Choose Maths' campaign) however it is important to resource more of these programs, especially when considering climate science. Our Centre members have had positive experiences igniting the passion for STEM in school students through outreach for the UNSW gateway program which aims to support students who do not typically access university. One session was enough to spark intense dialogue amongst the attending students and affirm the passion many already held for topics such as reducing greenhouse gas emissions. The materials used knowledge that many secondary science teachers could easily grasp to engage students in STEM. By continuing to support institutions to raise the profile and value of STEM, we can encourage greater participation in STEM courses and careers.