Report of the Task Force on "Sustainable Strategy for Enhancing Existing Diversity (SEED) in MCE"

September 1, 2020

SEED Committee Members:

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1. Introduction and Charge

The SEED in MCE Task force was established on July 2nd, 2020 by Prof. José Andrade, with the charge reported in Appendix IV. The focus of the committee's charge was to suggest an actionable plan, to be rolled out in the next 5-10 years, starting in Fall 2020, to expand our student body diversity and inclusion, focusing on the graduate students cohort.

The committee has met 6 times since charged. Initially, the committee focused on identifying areas of needs in the department and sought input from all members of the department. We were guided in part by recommendations from the Black Scientists and Engineers of Caltech in their institute-level call to action. A survey was sent out to students, post docs, faculty and staff to collect input (Appendix V). Responders utilized an online anonymized platform and/or sent suggestions via email.

The committee also organized a dedicated meeting with Hanna Song and Monique Thomas, from the Center for Inclusion and Diversity, to learn about existing programs and initiatives on campus and to discuss possible ideas to implement in MCE to improve its diversity, focusing specifically on the graduate student cohort.

2. Motivation: Discrimination in Academia and beyond

The death of George Floyd and the ensuing social movement have inspired global efforts toward reducing racism. While we have progressed substantially from times of slavery and racial segregation, racism remains pervasive throughout society, both explicitly and implicitly. Unfortunately, many forms of racism are challenging to identify, but nevertheless have harmful effects on Black, indigenous and other people of color. Discrimination and bias are not limited to race, and are experienced by women and other underrepresented groups as well.

> "Recent social cognition research has provided stunning evidence of implicit bias against various social categories. In particular, it reveals that most of us have implicit biases against racial minorities notwithstanding sincere self-reports to the contrary." (Kang, 2008)

There is overwhelming evidence that unconscious bias and racism remain pervasive in our daily lives and across various systems. There are racial disparities in federal criminal sentences (Rehavi and Starr, 2014). Black and Hispanic drivers are about two times more likely to be searched in a traffic stop, although white drivers are slightly more likely to be found with contraband (Pierson et al., 2020). People of color receive lower quality health care and have lower health outcomes compared to white patients (Feagin and Bennefield, 2014). Discrimination effects hiring, pay and promotion across all industries. Bertrand and Mullainathan (2004) reported that identical resumes from white-sounding names received 50 percent more interviews than those with Black-sounding names. Similar results have been found for Arab/Muslim sounding names (Rooth, 2007) and women (Tyler and McCullough, 2009).

Academia is not immune to these biases. While academia, and particularly STEM academia, are often touted as being objective and merit-based, bias and discrimination manifest in the systems that we create and are socialized into. Stereotype threat, the pressure associated with inadvertently confirming stereotypes, has been repeatedly shown to have an impact on test performance of women (Spencer et al., 1999), African Americans (Steele and Aronson, 1995), Asian-American women (Shih et al, 1999) and other stigmatized groups (Spencer et al., 2016). Gender bias prevails in academic hiring, as differences in career development cannot be explained in terms of performance indicators alone (Besselaar and Sandström, 2016). Milkman et al. (2015) studied faculty response rates by sending identical emails from prospective students applying to doctoral programs, changing only names to signal race and gender. Professors from all groups were significantly more likely to respond to Caucasian males compared to women, Black, Hispanic, Indian and Chinese students. Representation of women and racial minorities in the institution did not reduce this disparity. Studies on machine learning in facial recognition accuracy, resume screening, criminal justice processes and loan approvals have demonstrated significant racial and gender bias (Mehrabi et al. 2019; Coded Bias Documentary; Hao, 2019). Almost any system that deals with people will require an understanding of the different identities of those whom the system serves and involves. If we do not train ourselves to recognize and account for these biases, these systems will continue to perpetuate barriers to opportunities for minoritized groups.

At the same time, diversity and inclusion offer many benefits to everyone in the system. Research demonstrates that inclusive teaching practices "are helpful for all students' learning but especially beneficial to students who are members of groups underrepresented in their fields or traditionally underserved by institutions of higher education" (Center for Research on Learning & Teaching at the University of Michigan). Inclusive leadership and bias mitigation enable diversity of thinking, which in

turn leads to greater creativity and innovation (Phillips, 2014; Bourke, 2016; Bourke and Dillon, 2018). As academia and industry begin to recognize the importance of diversity and representation, MCE has a moral and academic responsibility to value diversity and equip students to be culturally sensitive as they engage in the world beyond Caltech.

The Black Scientists and Engineers of Caltech (BSEC) demonstrated in their call to action that Caltech is not exempt from these issues, and that we may in fact perform worse than many of our peer institutions in regards to diversity and inclusion. At Caltech, while undergraduate women enter with greater merit-based performance and continue to outperform undergraduate men through to graduation, their sense of belonging and perception of their own performance are significantly lower those of undergraduate men (Hanna Song, Decoding Diversity Workshop).

Fortunately, we have an incredible agency to enact positive change in MCE and in Caltech, in part thanks to Caltech's relatively decentralized and non-bureaucratic nature. This year, MCE has eliminated the use of GRE scores in its admissions process, understanding that the GRE, as with many standardized tests, predicts for socioeconomic status, sex and race better than for academic ability and student success (Miller and Stassun, 2014). While we can avoid the bureaucratic rules that can slow down change, we should still take advantage of collective efforts across the institution to determine best practices in admissions, mentorship and inclusivity where our initiatives are similar. We should seek out the advice of experts, many of which are housed within the Caltech community. The Center for Inclusion and Diversity hosts a wealth of events that raise awareness of various identities and the different experiences that result. The Center for Teaching, Learning and Outreach (CTLO) disseminates evidence-based and inclusive teaching practices. We should take full advantage of these resources.

We recognize the great efforts that MCE has already made in this realm, and we also stress that the journey is ongoing. As members of the MCE SEED Task Force, we are grateful for the opportunity to compile and present these suggestions of initiatives to pursue. And as members of the larger MCE community, we are excited for the change we are seeing towards a more diverse, equitable and inclusive community.

3. MCE Demographic Data

As part of our initial examination of the main areas of need in MCE, the committee has collected data on diversity within the department. Although it was not possible to collect complete information on gender and ethnicity of the entire MCE population, the following information was retrieved:

Faculty (excluding Emeriti):
 Gender: Female 25%, Male 75%
 Ethnicity: Asian 12.5%, White 79%, URM 8.5%

Staff (including Technical and Administrative):
 Gender: Female 78%, Male 22%
 Ethnicity: Asian 17%, Black 11%, White 61%, Hispanic 11%, Other 0%

Post-Doctoral Scholar:
 Gender: Female 0%, Male 100%
 Ethnicity: Asian 52%, Black 0%, Hispanic 13%, White 35%, Other 0%

Graduate Students (including MCE and Students outside of MCE advised by MCE Faculty):
 Gender: Female 28%, Male 72%
 Ethnicity: Asian 47%, Black 0.9%, Hispanic 8%, White 27%, Other 0.9%, N/A 16.2%

Graduate Students (Students admitted in MCE only):
 Gender: Female 30.59%, Male 69.41%
 Ethnicity: Asian 52.94%, Black 0%, Hispanic 10.59%, White 29.41%, Other 1.18%, N/A 5.88%

The MCE student body, inclusive of MCE students and Caltech students advised by MCE faculty has a total of 113 students. The admitted cohort of students that joins graduate programs offered in MCE every year is about 15. Although in recent years MCE has improved the gender diversity of its graduate student class, the department could use significant improvements with respect to URMs. Because of the small incoming class, even changes in the order of 1-3 incoming students every year would reflect significantly in the overall diversity.

 MCE should set clear goals on diversity. To achieve them, the department should collect data, examine change over time and compare the progress with other organizations. By collecting and analyzing data on diversity over time, comparing those numbers to the numbers at other organizations, and sharing them with key stakeholders, it is possible to increase accountability and transparency around diversity issues. A common input received from survey respondents regarding data was to publish transparent public-facing demographic data on the MCE website, disaggregating "Underrepresented Minority" enrollment statistics (most people found that current data available to the public appears incomplete and opaque). However, publication of such data needs to be carefully considered in view of the small size of the MCE department and in consideration of the fact that demographic and ethnicity data is protected information. It is important to note that demographic information with cell sizes smaller than 5 are confidential and cannot be published.

4. Topics considered by the Task Force

The task force identified four major areas where actionable items could be implemented to improve diversity in the graduate student cohort. Although the list of suggestions and items discussed in each area was extensive, the committee focused on identifying one or two implementable tasks that should be given priority to.

1. **Outreach/Inreach**
2. **Admissions and Recruitment**
3. **Retention and Climate**
4. **Transparency and Continuity**

5. Details on Suggested Action Items

1. **Outreach/Inreach**

One of the most direct ways to increase the diversity of our graduate student population is to expand and diversify the pool of applicants seeking admission to the MCE graduate programs. Caltech is not widely known to many underrepresented students, and it is of paramount importance to raise awareness and promote our programs to local high schools and undergraduate programs and to nation-wide minority serving institutions (MSIs).

This can be achieved in two ways: (i) By hosting underrepresented students on campus (*inreach*); or (ii) by building relationships with other URM programs (*outreach*). For both inreach and outreach efforts, MCE should participate in EAS Division-wide initiatives (e.g., by having MCE faculty, staff and students participate in events such as "Caltech FUTURE" and "Grad Preview"). However, our committee has identified some MCE specific tasks that could be implemented independently:

a) MCE should appoint a **Diversity Liaison**, who could help with administrative tasks relevant for engaging, supporting and recruiting diversity. The liaison could also help oversee the suggested tasks' execution and provide accountability. The liaison should be selected from members of the professorial or administrative staff and should work closely with SOPS, the EAS Division, the Center for Inclusion and Diversity and the Equity and Title IX office.

b) MCE should create a **Diversity Directory**, which should be used for tracking and consolidating contacts and connections created by individual faculty members throughout the years with colleagues and collaborators in minority serving institutions, alumni and friends of the department. The Directory should also include connections with local high schools and minority serving institutions. The Diversity Directory will allow us to broadly communicate initiatives taken by the department (e.g., linked to recruiting efforts). The Directory will also help in cultivating advocates for MCE, who can help us identify prospective students and recruit them to Caltech. The management and curation of the Diversity Directory should be one of the responsibilities of the diversity liaison.

c) MCE should **support undergraduate students** planning to apply to grad schools. This can be achieved by offering seminars/webinars for interested applicants, to explain how to navigate the application process and describing the available MCE programs. A possible format for the

seminars/webinars is a discussion panel, consisting of graduate students and a representative from the faculty, discussing criteria for admissions. Also, it would be beneficial to offer office hours for students working on the application material. SOPS is already running similar initiatives for Caltech undergraduate students interested in graduate school. MCE should extend access to these initiatives to minority serving institutions (MSIs), historically black colleges and universities (HBCUs), and local colleges. This can be done reaching out to the members of the Diversity Directory. Another format could be the creation of a series of videos to be posted on YouTube and/or the MCE website. The committee recommends that SOPS should be responsible for this task. Some additional details are available in Appendix II, section 1.c.a.

d) The MCE Department should financially **support additional fellowships for expanding participation in the WAVE program**. Such dedicated funds could also be made available to faculty intending to offer paid research opportunities during the year for undergrads (especially for people who work part time jobs).

2. Admissions and Recruitment

MCE's commitment to diversifying our graduate student population should translate into efforts to ensure transparency of processes, consistency of criteria, but also understanding and accommodation of the challenges associated with the various facets of the diverse population we are targeting to attract. With these goals in mind, our committee has identified the following MCE specific tasks:

a) MCE should coordinate the **graduate student visitation day** with other departments within the EAS division, such as GALCIT and CDS; and/or divisions across campus, such as GPS or Medical Engineering. Involvement of a critical mass of students in diversity-centric events during visitation day(s) will help recruitment efforts, which are currently hindered by the campus climate perception of minority visiting students facing the very population homogeneity we seek to rectify. Coordinating visitation days across campus will also bring together a larger fraction of diverse faculty with whom the visiting students can identify, further supporting our recruitment efforts.

b) MCE should establish a committee tasked to establish a **standardized set of admission criteria** and a scoring rubric to evaluate and rank applicants after interviews. These criteria should be evaluated vis-à-vis our diversity goals; and revised regularly (e.g. every three-five years) on the basis of feedback from faculty, graduate students, and in consultation with the Center for Diversity and Inclusion at Caltech. An initial set should be put in place for the 2020-2021 admissions cycle. Particular emphasis should be placed on understanding and including modifiers that account for challenges/hardships of URMs or first-generation students, for example, and can support our goal of establishing a near-bias-free admissions process.

c) MCE should **include graduate students in the admissions process,** in an advisory role at the beginning of the admissions season. Graduate student involvement in admissions is recommended to help the faculty improve the interview process and post-interview scoring. Graduate student input will also help MCE to establish, evaluate and revise our admissions criteria and rubrics.

d) MCE should publicly disclose information for **waiving the application fee**. Published research suggests that for certain members of our target graduate population (Black, Hispanic, Native American and Asian students, among others) application fees pose an insurmountable barrier that significantly limits the number of schools that applicants consider. Publicizing programs like

waivers of graduate school application fees and financial aid if admitted, offered either by the Institute, the Division or by MCE, will affirm our commitment to increase diversity of admitted graduate students. At the same time, however, MCE needs to affirm its commitment to support minority students through completion of their graduate studies. Recommendations on programs providing financial help and mentoring intended to demystify the advanced degree application process by assigning faculty mentors and exposing students to laboratories, research seminars and discussions, and mock graduate-school interviews, are outlined in sections 1, 3 and 4 of this document.

3. **Retention and Climate**

Improving the pipeline will not solve issues with diversity unless MCE is able to retain the students that are admitted. It has not been proven what factors influence retention in MCE, but it is expected that MCE climate has a direct influence on retention rates. In general, a sense of belonging is correlated with improved retention and greater student outcomes. Thus to improve retention rates, we suggest action items that are grouped into four main goals.

a) The first goal is focused on **valuing diversity in academia**. Simple actions towards this effort include (a) inviting URM speakers (3.a.a), (b) creating awards such as "extraordinary dedication to furthering diversity, equity and inclusion" (3.a.b), (c) funding a bookshelf in the Housner lounge with books on racism (3.b.c), and (d) advertising CCID events. These initiatives showcase the work of minoritized individuals and bring in ideas from different perspectives. These actions not only make students from diverse backgrounds feel valued, but they also give the message to the entire MCE community that diversity in academia is important and is valued.

b) The second goal is improvements for a **more inclusive work environment.** Action items that exemplify such improvements include (a) proper signage for the location of the gender neutral bathrooms in Gates-Thomas (3.b.a), (b) changes to the sub-basement "nap" room so that it can also serve as a lactation room (3.b.b), and (c) encouraging MCE community members to obtain Safe Zone training.

c) The third goal is changes towards **fairness and equity of opportunity**. An example action item includes the creation of a "bootcamp" for incoming G1 students that is aimed at bringing incoming students up to speed on basic topics used in first year courses (3.c.a). Such a boot camp would be co-organized with GALCIT and entirely run by students. Another example action item is to distribute resources from the CTLO on inclusive teaching resources (3.c.b). Another example action item is unconscious bias training for faculty members giving qualifying exams (3.c.c). These serve to eliminate barriers that make it disproportionately challenging for minoritized students to succeed.

d) The last goal is centered around **addressing issues of climate**. One example action item is encouraging faculty members to have regular check-ins with their lab members regarding lab climate and lab policies (3.d.a). Another example action item is financially supporting existing cohort building programs such as the SOPS big sib little sib program. A final suggested action item is appointing a designated member of the MCE community as the person students should talk with to report instances of racism, discrimination, bias, or harassment. This person could be the Ombudsperson or the diversity liaison. Regardless of who the designated person is, their role

and responsibilities should be widely advertised and listed on the MCE website. The roles and responsibilities of the Ombudsperson could also be advertised in the same manner.

4. Transparency and Continuity

Transparency and continuity should include three main topics: data collection, accountability and fostering connections. Collecting data provides a good starting point to make informative choices, and it is key to track changes. Publishing data minimizes false impressions about MCE and gives a clear picture of the department, identifying our challenges, showing necessary improvements over time, and promoting accountability. By doing so, it also has the potential to trickle into retention of our student population and lead into fostering connections.

a) The SEED committee has collected current data on ethnicity and gender of our staff, postdocs, faculty and students. The department should **keep track of this data and keep it up to date**. We should compare this data against equivalent information from all other EAS departments, peer institutions and, most importantly, against the demographics of the US and Los Angeles.

b) As a part of accountability, **MCE should add a tab to the department website** and list the diversity principles and initiatives that MCE is currently involved in, along with past and future plans that the department has in diversity efforts. The tab should also have the code of conduct listed, whether this be the Caltech Code of Conduct or one that MCE creates. Items added to this tab on the MCE website should be clear when it comes to explaining what the diversity efforts are and include timelines and expectations for these items. The website should be ongoing and updated as needed. A helpful resource will be the DEI Database that some MCE students (Marcus Lee and Victoria Lee) have created which serves as a hub for all of Caltech diversity initiatives but could easily filter MCE specific ones to this tab. Lastly, by including the names of individuals involved in these efforts allows others to send support and helpful resources directly to them.

c) Another aspect of accountability is more frequently having the **faculty seek students input** on past diversity initiatives, which can help the department reflect on the outcomes of them and gauge how they succeeded or how they should be improved the next time around. Having ongoing meetings will ensure that both students and faculty are informed regularly and could possibly catch department diversity issues before they become larger scale.

6. Summary of Suggested Action Items

1. Outreach/Inreach
   a. Appoint a diversity liaison
   b. Create a Diversity Directory (listing contacts and programs)
   c. Support undergraduate students planning to apply to grad schools (1.c.a)
   d. Financially support additional fellowships for expanding participation in the WAVE program
2. Admissions and Recruitment
   a. Visitation Day
   b. Documented criteria/guidelines for graduate admissions, to be revised in consultation with CDI
   c. Student representation in graduate admissions through graduate student interviews and feedback forms
   d. Publicly disclose information for waiving the application fee
3. Retention and Climate
   a. Valuing diversity in academia (diversity speaker series 3.a.a, diversity awards 3.a.b, diversity bookshelf 3.a.c, advertise CCID events)
   b. Changes for a more inclusive work environment (gender neutral bathrooms 3.b.a, lactation room 3.b.b, Safe Zone training)
   c. Fairness and Equity of Opportunity (G1 bootcamp 3.c.a, inclusive teaching practices 3.c.b, inclusivity in the quals process 3.c.b)
   d. Addressing issues of climate (Lab climate and policy check-ins 3.d.a, cohort building programs, Ombudsperson)
4. Transparency and Continuity
   a. Track demographic data and evaluate it over time (both with respect to local demographics and in regards to retention)
   b. Add a page to MCE website outlining diversity efforts and code of conduct
   c. Establish recurring meetings between faculty, staff and students to discuss progress

7. Conclusion

In our recommendations above, we have targeted the breadth of the graduate admissions pipeline, from preparing and encouraging students to apply, to evaluating the admissions process, and finally to retention of enrolled students. We have selected items that we felt were most valuable for the effort involved. Some of them are larger scale undertakings whereas others may be low hanging fruit, with a smaller impact but also a simpler implementation. There is room to stagger the undertaking of different initiatives, which will depend on the number that are enacted and the bandwidth of different parties. We encourage scaling each initiative as appropriate, and we also have a list of initiatives that we have not described here but could be implemented in the future as we finish establishing the items in this report (see Appendix I).

While we expect each initiative to be a collaborative effort within the MCE community, we recommend that each initiative have a clearly designated individual who is responsible for following through. They could be a staff member, faculty member or student. We also highlight the importance for these responsible individuals to seek input from people in MCE and Caltech, particularly from experts in the Caltech Center for Diversity and other relevant offices. To ensure that our initiatives are as effective as possible, it is vital to gather feedback from participants in the initiatives we plan. This feedback should be used to refine and improve the initiatives. In Appendix III, we have included a more thorough set of ideas that can help guide responsible parties as they develop their initiatives.

We would like to stress again the importance of transparency and continuity, regardless of who is responsible for a given item. We recognize that these initiatives are nontrivial undertakings that will be largely performed on a voluntary basis. To provide some accountability and means to check-in regularly, we highly recommend that transparent communication channels are established between staff, students, and faculty, dedicated to monitoring progress on these initiatives. Faculty, staff and the SOPS committee should all be aware of what initiatives are being implemented and by whom. As we described in Section 5, regular meetings would ensure that the entire MCE community can support one another as these items develop.

In addition, we recommend that in looking at the various items holistically, there is an appropriate distribution of labor so that the same people are not always the ones responsible for diversity related initiatives, which can contribute to achievement gaps. If certain individuals do end up taking most of the responsibility for enacting these items, we encourage an organized effort to have others contribute their time to the initiatives under the direction of the responsible parties.

While the scope of our task force was limited to MCE initiatives for graduate students, we recognize that there is a lot of room to expand to initiatives for the undergraduate, postdoc and faculty levels. At the time of this report, MCE has zero female postdocs. This means that for the next few years, MCE will not contribute any women faculty members to other institutions from the MCE postdoc ranks. In addition, several ideas that came up during discussions were beyond the department level. However, many require collaboration between MCE and other departments (e.g. coordinated Visit Days) or EAS division action (e.g. survey of shared facilities like CAST). To ensure a diverse and inclusive community for all, we highly recommend that there is a dedicated effort for these items as well.

Appendix I: Action Items Table

In the attached [Action Items Table](#), we provide a more complete list of items which we discussed together. These include the items discussed in this report as well as additional items that could be implemented in later years or that may be beyond the scope of the task force but should be followed up on and supported.

- Key:
    - Dark green - main item for items with many sub-items
    - Green - prioritized items
    - Yellow - non-prioritized items
    - Red - items difficult to enact
    - Blue - push to appropriate channel (e.g. EAS)
    - Grey - already enacted, follow up as necessary

Appendix II: Detailed Examples of Action Items

While we leave the details of individual recommendations to the respective responsible parties, we document here some additional ideas and details for recommendations that may benefit from additional guidance. We draw on the ideas provided in the Guidance for Recommendations section. We hope these examples will provide an example for all responsible parties to think through their initiatives to ensure they are successfully implemented.

1.c.a Support undergraduates applying to grad school

Target Group: Junior/senior undergraduate students applying to graduate school, within and beyond Caltech, particularly URMs, women, other underrepresented groups and students at MSIs/HBCUs

Responsible Party: SOPS Committee

Deliverables:

1. **Panel on applying to grad school and fellowships:** SOPS currently conducts a yearly panel for MCE and related undergraduate students who are applying to grad school and/or fellowships. They can ask questions to MCE graduate students and faculty. We recommend that these panels continue and be extended to include undergraduate students from other institutions. The panels can also be recorded to be made available online. Consider additional advertising efforts to underrepresented groups and having additional exclusive panels for these groups.
2. **Office hours:** In the past, SOPS held office hours for individual help on graduate applications, including general questions and statements. These were discontinued in 2018. We would like to see these revamped, with a focus on reaching students beyond Caltech. Consider additional advertising efforts to underrepresented groups.
3. **Online guides and recordings:** These should be hosted on the MCE or SOPS website. If hosted on the SOPS website, include a link on the MCE Admissions Website. Guides should include admissions criteria. For example, recommendation letters are ideally from research faculty members, personal statements should include...

Examples:

1. Past SOPS panels and office hours for Caltech undergraduate students. Panels for 2018 and 2019 are documented.
2. PMA has an unofficial guide to Applying to Caltech Physics.

3.a.a Host a more diverse range of speakers

Target Group: MCE community

Responsible Party: MCE Seminar TAs + SOPS Seminar Master (Taeho Kim)

Deliverables:

1. **Diversity of MCE Seminar speakers:** It is important to feature a diverse set of speakers to allow all students to see their identities represented in these speakers. As we invite faculty speakers from other institutions to talk at MCE Seminars, we can be conscious of this representation. This can also be used as a way to build ties with other institutions and attract diverse applicants. These speakers can also coincide national and international days of celebration including International Women's Day, Black Awareness Month and Caltech's Gaypril month to highlight these days and show support.
2. **Diversity of SOPS Seminar speakers:** SOPS Seminars traditionally feature MCE faculty and graduate student speakers. However, the current virtual environment due to the pandemic presents an opportunity to invite speakers from other institutions. We suggest that the SOPS committee consider inviting graduate student speakers from other institutions if there are slots available to do so.

3.a.b. Recognition of work in furthering diversity, equity and inclusion

Target Group: All graduate students

Responsible Party: MCE faculty/Executive Officer

Deliverables:

1. **Formalize and empower diversity and inclusion work:** Minority groups are often disproportionately responsible for important work in diversity and inclusion related community service. This work is largely unpaid and unrecognized, furthering achievement gaps since privileged groups may not devote any time to these efforts. Formal positions and awards provide incentive for students to engage in diversity and inclusion work and reward/recognize them concretely for their efforts, bolstering their credentials. This communicates to current and incoming students that MCE finds this work valuable and supports improvement. MCE should continue to create formal positions that institutionalize efforts to promote continuity, formally recognize these efforts and grants power and agency to individuals who want to make a difference. The MCE Climate Survey Committee, this MCE SEED Task Force and the MCE Community Seminar Organizer are great examples of recognition and empowerment. This addresses BSEC Item 2.3. Further examples include:
   a. Caltech's Diversity and Inclusion Ambassador
   b. Harvard University's Diversity Fellows (compensated position to support continued engagement.
   c. Princeton University's Diversity Fellows program: similar to above
   d. MIT's Graduate Diversity Ambassadors: similar to above
2. **MCE Diversity and Inclusion Award:** MCE currently has awards for academic achievement, best thesis and more. Establish an award for an "undergraduate student showing extraordinary dedication to furthering diversity, equity and inclusion". We can also do the same for graduate

students, postdocs, staff and faculty. An example is the [Chen Institute Diversity and Inclusion Awards 2020](#) ($500 award). This addresses [BSEC Item 2.3](#). Funding estimate: $1000 per year.

3. **MCE Community Service Award:** Consider also the same as above but for community service. This addresses [BSEC Item 2.3](#).

4. **Advertising:** Students should be made aware that these diversity and inclusion related awards exist so that they understand that this work is valued. This should be publicized on the MCE Website alongside existing awards.

3.a.c. Diversity Bookshelf

Target Group: MCE Community

Responsible Party: SOPS Outreach Chair (Maegan Tucker)

Reports to: Option Manager (Holly Golcher)

Deliverables:

1. **Diversity Bookshelf:** We want to provide more means for our community to read from a diverse range of authors and develop their openness to perspectives that may differ from their own. This also replaces a need to provide individual resources that could be shared. We recommend setting up a shared bookshelf in a common area (e.g. Housner Lounge) with books promoting diversity, equity and inclusion. Examples include anti-racism books like *How to be an Antiracist* by Ibram X. Kendi, *Me and White Supremacy* by Layla F. Saad, and *So You Want to Talk About Race* by Ijeoma Oluo. General books by [authors of color](#) are suitable as well. Some authors are Toni Morrison, James Baldwin, Maya Angelou, Earnest Gaines and Michelle Obama. Our aim is not to replace the bookshelf that the CCID already has, but to bring resources in greater proximity to the MCE community. Ideally, the books should be purchased from black-owned bookstores where possible. Students could also donate books they have already finished. Funding estimate**:** $900 for bookshelf and 40 initial books + $200 per year for new books.

2. **Advertise online resources:** Virtual eBooks and resources can also be made available, especially during the pandemic. We can also point to online sources through the Pasadena/LA Public Library and others.

3. **Ideas for expansion:** Book clubs, book discussions.

3.b.a Gender-Neutral Bathroom Signage

Target Group: Occupants of Gates-Thomas

Responsible Party: Lynn Seymour

Deliverables: Ideally, Gates-Thomas would have a gender neutral bathroom on every floor. However, since this would require significant remodeling/construction, our recommendation is to have better signage for where the gender neutral bathroom is located (on the sub-basement floor). This would consist of a plack added underneath every restroom sign that reads something to the effect of "Gender-neutral bathroom located on the sub-basement level".

3.b.b Lactation Room

Target Group: Occupants of Gates-Thomas

Responsible Party: Lynn Seymour

Deliverables: Lactation room requirements are as follows: a door that locks; an electrical outlet for plugging in a breast pump; good lighting and ventilation; a comfortable chair; a countertop or table; an "occupied" sign for the door; a wastebasket and cleaner; a nearby sink; a nearby fridge; an assigned coordinator. MIT lists these requirements on their website here.

3.c.a Boot camp for incoming G1 students

Target Group: All incoming G1 students

Responsible Party: SOPS Committee

Deliverables:

1. **Boot camps and office hours:** Students enter Caltech with varying levels of exposure to different topics such as Mathematica, MATLAB, Einstein notation, tensor calculus, linear algebra and others. While not all of these are formal prerequisites for G1 classes, many are particularly relevant and helpful (e.g. Mathematica and Einstein notation). We create a steep learning curve for students who are expected to simultaneously master these concurrently with subject-specific material. In July 2020, GGSC proposed the idea of a yearly boot camp for incoming G1 students. Since then, the SOPS Committee has committed to joining this initiative. There is considerable overlap in G1 classes taken by students in MCE and GALCIT. The boot camps and office hours will be student-run and take place during orientation week. The boot camps will provide a basic introduction for non-subject-specific material that is most useful and least familiar to incoming students, including Mathematica and Einstein notation. A combination of guides and office hours will address topics where more appropriate, including linear algebra and tensor calculus. This could expand to more related departments in EAS. Note we are simply describing the deliverables that the SOPS Committee and GGSC have already initiated and developed independently of the SEED Task Force. We do so to encourage a more guided process for reporting and feedback and to inform other parties who can support this initiative. There is no funding requirement for virtual events. In person boot camps may require providing lunch for participants and instructors. Estimated total: $15 x (15 G1s + 5 instructors) = $300.
2. **Online guides and recordings:** Recordings of material from the boot camps will be made available online for reference throughout the year. Guides for each topic should be created and made available online. These should include links to helpful online resources and provide a basic introduction that focuses on literacy to help students navigate further resources. These also include generally helpful topics like setting up the Caltech VPN and obtaining software through Caltech. Again, this deliverable comes directly from the SOPS Committee and GGSC.
3. **Advertising:** G1s should be directed to and reminded of the online resources before and during the year. SOPS should also remind faculty to direct students to the specific topics that are relevant in their classes, perhaps in their syllabi and by word of mouth.

3.c.b Inclusive Teaching Practices

Target Group: Undergraduate and graduate students in MCE classes

Responsible Party: MCE Faculty

Deliverables:

1. **Advertise inclusive teaching resources by CTLO (Center for Teaching, Learning & Outreach):** Inclusive teaching practices are evidence-based teaching that aim to teach to all students in a classroom, regardless of their background. Research shows that inclusive teaching practices "are helpful for all students' learning but especially beneficial to students who are members of groups underrepresented in their fields or traditionally underserved by institutions of higher education" (Center for Research on Learning & Teaching at the University of Michigan). Caltech's own CTLO has an abundance of resources dedicated to effective teaching practices, including resources for Teaching for Inclusion & Diversity. The CTLO also offers several events and courses targeting graduate students, postdocs and faculty. Some are targeted to online teaching as well. We recommend that professors, lecturers and TAs be pointed to these resources and regularly encouraged to attend the many classes, workshops and seminars that the CTLO organizes. This will help professors and TAs be more mindful of how their teaching practices may disproportionately advantage or disadvantage various groups in their classes. Expansion idea: Bring in the CTLO for workshops on teaching.
2. **Provide a syllabus template and inclusive teaching checklist:** To help disseminate best practices, we recommend that a summary checklist is provided to help professors and TAs quickly reflect on their teaching practices. A checklist might look like a summarized version of the CTLO's Teaching for Inclusion & Diversity and could include things like being aware of pronouns, how to address microaggressions and examining assumptions. A syllabus template could remind faculty members to include a clear section on learning outcomes, recommended background knowledge, homework policies, reporting issues, commitment to inclusive teaching, etc. We recommend seeking extensive input from the CTLO and from students.

3.c.c Inclusivity in the Quals process

Target Group: MCE G1 and G2 students

Responsible Party: MCE Option Representative: Nadia Lapusta

Deliverables:

1. **Be transparent about criteria and expectations in quals:** As with any forms of examination, criteria that are unclear will often disproportionately affect underrepresented groups. Faculty should be clear and transparent about what the quals aim to measure and all factors in the pass/fail consideration. This ensures that students understand what is being valued and can develop themselves appropriately. It also helps to eliminate unconscious bias since it urges faculty to themselves reflect and confirm concretely what factors are valued.
2. **Eliminating unconscious bias in quals:** Unconscious bias can often appear unwittingly, especially in subjective processes where standardization is challenging. While MCE has put in a great effort to ensuring the process is fair, there is no harm in examining the process further with

the help of experts in unconscious bias. We recommend that MCE faculty consult with experts from the CCID and/or the CTLO to further improve the process.

3.c.d Advertise general and diversity fellowships

Target Group: MCE undergraduate students, graduate students and postdocs

Responsible Party: Marcus Lee and Victoria (Tori) Lee

Deliverables:

1. **Advertise general and diversity fellowships:** Underrepresented minorities often face additional financial burden and may not choose to attend graduate school for financial concerns. There are students who are not aware that PhD programs are often fully funded with an additional stipend (Hanna Song, personal interview). We should advertise MCE's generous financial support for first year students and the expectation that students will be funded throughout their program. Currently the graduate program website for Mechanical Engineering indicates funding while the Civil Engineering, Applied Mechanics, and general websites do not. General fellowships, external fellowships for underrepresented groups and women, and general financial support also exist. These include the Mellon Mays Undergraduate Fellowship and AGEP for postdocsThose that are applicable to the MCE community should be compiled and advertised on the MCE website. Documenting fellowships in the Caltech DEI Resource Database may help in this endeavor.

3.d.a MCE and research group policies on community service

Target Group: MCE Community

Responsible Party: MCE Faculty

Deliverables:

1. **Eliminate barriers to participating in diversity, equity and inclusion initiatives:** Individuals who want to engage in activities may not feel free to do so depending on the perceived or real attitude of their advisors or employees to community service. Faculty and MCE overall should clearly communicate their policies on this front. We encourage MCE faculty to give students, postdocs, faculty, and staff who want to participate in events and activities that enhance diversity, equity, and inclusion time to do so. Expansion idea: Funding could include dedicated department funding that is separate from research funding for any looking to engage in such events, to support workshop and conference expenses.
2. **Regularly and openly discuss lab climate and issues:** To reduce the burden on students to bring up any issues, we encourage faculty to hold spaces to discuss issues as well. Even small efforts are effective. Many MCE faculty hosted Title IX training for their lab groups. We encourage faculty to continue regular training and make it as easy as possible for their students to bring up any issues they may have. Some things that individual faculty have already implemented include holding office hours exclusively for non-research topics and expressing support and awareness of issues.

Appendix III: Guidance for Recommendations

We provide this detailed guidance to help individuals implement initiatives that they are responsible for. These are simply ideas of things to think about that can help ensure that the initiatives are as effective as possible. It is by no means an exhaustive list nor a strict set of rules to follow. We encourage you to take a look and decide which parts are most relevant to your initiative.

1. Target Group: Specify the target demographic that the item will help. Be as specific as possible and then do your best to reach these groups. This may take effort, especially if the target group are not at traditional feeder schools. For example:

- high school, undergrad, grad students, postdocs
- URM, women
- within Caltech, beyond Caltech, HBCUs

2. Responsible Party: This should be a specific person ideally. While we expect initiatives to be a collaborative effort of the entire MCE community and other offices/experts, one person (or group) should take primary responsibility for ensuring that the item is implemented.

3. Deliverables: Refer back to each of the deliverables from the recommendations in the report and any you may have added. Report your progress clearly on each so none slip through the cracks.

4. Input: Think about what people and resources exist that will be able to help. One fallback of Caltech's decentralized nature is that we easily forget that Caltech has many great offices and resources that we can reach out to. Remember that offices like the CCID and the CTLO exist and are eagerly awaiting opportunities to help. This could also include others in the MCE community, related departments who have already implemented what we are starting or who we can work with at the same time.

5. Indicators of success: "If you can't measure it, you can't improve it." - Peter Drucker. Think about what data will demonstrate the success of this individual initiative, and be as specific as possible. While our overall goal is to increase the numbers of URMs and women graduate students in MCE, there are more granular indicators and data that will show how individual initiatives are impacting the entire pipeline. Some examples of indicators are:

- the participation rate of minoritized groups in the initiative
- where the participants are from and who is not being reached
- the proportion of program participants who apply, get accepted and enroll compared to the general applicant pool
- an increase in the percentage of applicants who are URMs, women, etc.
- results of feedback surveys

Identify indicators and then use them to adjust the programs where they are not having the intended impact. This step is particularly important for the annual review by MCE Faculty as they will have access to more granular data throughout the graduate admissions pipeline.

6. Feedback: We encourage groups to explicitly plan how they will get feedback. This is an important step to ensure that the initiative is as effective as possible and is actually grounded in the needs or the target group. Who will the responsible party ask for feedback? Feedback may come from the target group

(e.g. participants), those involved in planning and/or experts. What is the method of feedback? This could be a survey to participants, focus groups and/or open forums.

7. Synergistic recommendations: Remember that there are other recommendations being implemented as well that you may want to be in contact with. Some that we point everyone to are the Diversity Liaison, the Diversity Directory of related contacts, advertising on the MCE website, and listing resources in the institute-wide Diversity, Equity and Inclusion Resource Database.

8. Examples: These are not the first time many of these recommendations have been implemented somewhere, either in other Caltech departments or at other institutions. Look for similar initiatives from other departments and institutions and use these to guide your efforts. You might even reach out to other organizers to learn more.

9. Funding: Items to fund and the amount of funding. Is it possible to get funding from other offices or share funding responsibilities with related departments.

10. Timeframe: Have a goal in mind of when you will complete the deliverables and any major checkpoints. While it is okay for timeframes to change, this can help keep us on track or help us evaluate why something is taking longer than initially planned. Think about how the opportunity might grow in the future as well.

11. Transparency: We recommend that responsible parties communicate openly about progress for their initiatives. This could take the form of brief reports or of update meetings with others in the department. This provides a mechanism for different groups in MCE to follow up and hold one another accountable in a productive way. It could help to address each of the items listed in this guidance and share it. You should also consider updating other related groups and experts as an opportunity to get some feedback and ideas.

12. Continuity: Designating a responsible party is meant to help with continuity, but as roles change and people cycle in and out of MCE, we urge you to actively plan for how each initiative will continue. For example, the SOPS committee should keep track of all the initiatives that students lead to ensure that they are passed on smoothly through the years. Something similar can be established for faculty and staff.

13. Documentation: We highly recommend that each initiative is well documented. This will help when it comes time to change responsible parties. Where possible and appropriate, responsible parties should upload resources and updates to the MCE website. Initiatives should be documented in Caltech's Diversity, Equity and Inclusion Resource Database.

Appendix IV: SEED in MCE Task Force Charge

The committee was charged on July 2nd, 2020, with the following email:

"Dear Chiara, Domniki, Maegan, Holly and Marcus,

Thank you for your willingness to serve on the Sustainable Strategy for Enhancing Existing Diversity (SEED) in MCE Task Force. Chiara Daraio will serve as Chair.

The Task Force will work during the summer to prepare an actionable plan that MCE can discuss and implement in the Fall. I would like to have your report to present to the faculty by Aug. 31.

I have chosen the name of the Task Force purposefully. Our objective is to come up with an actionable plan that is sustainable, strategic, recognizes our existing diversity in MCE, and our desire to expand our diversity and inclusion.

What we need is a concrete plan that we can implement, not once, but over a number of years in order to improve our graduate student cohort. As you can see, MCE almost has gender parity (but not quite) and could use significant improvements with respect to URMs. If we could change our yield of female students by 2-3, URMs by 1-2 in the next 5-10 years, MCE would be a lot more diverse and inclusive. Our current cohort of graduate students is around 15 per year. Changes in 1-3 students are relatively significant.

Your task force should recommend a plan that will help the department deploy resources (people, funding) for the next 5-10 years that will result in an increasingly more diverse MCE over the next decade. By year 5 we should begin to measure some of its effects.

This is an important Task Force and I am grateful for your willingness to serve. I encourage you to reach out to our colleagues in the department and solicit their input. I will also ask Chiara to let the MCE faculty know about this initiative. We should also make sure that SOPS is aware of it.

I am always available to you for anything you might need or to discuss any items.

Thank you for your service and your commitment to a more diverse and inclusive MCE.

Best,
Jose"

Appendix V: Survey email sent to the department

The email invitation for the survey was sent out on July 14, 2020 and read:

"Dear All,

The recently appointed Task Force for enhancing diversity is looking for your suggestions for an actionable long-term plan to create a more diverse and inclusive environment in MCE. So far, we have identified three main areas in which MCE can improve processes and implement new initiatives:

1) OUTREACH and INREACH: We want to expose our programs to historically underserved and minority students and facilitate such students getting to know our programs from the inside, e.g., by reaching out to historically black colleges and minority serving institutions, participating in dedicated conferences, and by inviting URM students to internships and visits on campus.

2) ADMISSIONS: We want to improve the selection and recruitment processes, to further diversify our graduate student body.

3) RETENTION: We want to improve the experience of current graduate students in MCE and provide a welcoming home to students of all backgrounds.

We are looking for your input in proposing ideas and suggesting solutions for MCE. We would appreciate your initial input by July 20th, if possible. Please let us know your ideas by responding to this email or contacting any of the Task Force members (signed below). You can also submit a response anonymously using this google form.

Best regards,

Chiara, Domniki, Holly, Maegan and Marcus"