MIT Office of Engineering Outreach Programs

The MIT Office of Engineering Outreach Programs (OEOP) continues to pursue our longstanding goal to diversify the science and engineering communities by empowering students from underrepresented and underserved groups to develop the skills and confidence needed to pursue careers in technical fields. In addition, the OEOP is currently pursuing several additional goals. For instance, we aim to:

- Attract students from across the country to OEOP

- Increase the number of students we serve annually

- Continue to assess the effectiveness of our programmatic activities

Programmatic Accomplishments

Student Demographic Data

During FY2020, we served 365 students between Minority Introduction to Engineering and Science (MITES), MIT Online Science Technology and Engineering Community (MOSTEC), and Saturday Engineering Enrichment and Discovery (SEED) Academy (including three SEED Academy students who also attended MITES or MOSTEC). Of these students, 51% are women, 78% are from underrepresented minority groups, 71% are from low-income families, 51% are the first in their families to attend college, and they represented 34 states. OEOP places a unique emphasis on a positive educational environment that cultivates strong ties between teachers and students, and a community of supportive peers. This model creates a sense of belonging among students, while building self-confidence in their STEM abilities, both of which are critical to our students' success.

Impact on MIT

OEOP alumni have a large impact on MIT's undergraduate population. Evaluation of the efficacy of our programs suggests that students who participate in our national programs (i.e., MITES and MOSTEC) are more likely to apply to MIT and other selective colleges, be admitted, and go on to pursue a degree in a STEM field.

Since 2008, 61% of our alumni have attended MIT or another competitive school as classified by Barron's Profiles of American Colleges. Our alumni have a six-year graduation rate of 89%, compared to the national average of 59%. Moreover, 79% of OEOP alumni earn undergraduate STEM degrees and enter careers as scientists or engineers. In fall 2019, approximately 225 OEOP alumni entered college. Currently, 90% of our alumni are actively matriculated in some of the most competitive schools across the nation, including California Institute of Technology, Carnegie Mellon, Harvard University, and Cornell University.

OEOP alumni account for 5% of MIT's undergraduate student population. Furthermore, OEOP alumni account for 9% of all Black, Hispanic/Latinx, and Native American undergraduate students at MIT, significantly impacting MIT's undergraduate landscape.

Minority Introduction to Engineering and Science: June 22, 2019 – August 2, 2019

We served 80 students in the 2019 MITES program. Each student completed a course in calculus, physics, life sciences, and humanities, as well as one hands-on engineering elective in either architecture, machine learning, electronics, engineering design, or genomics. During this six-week residential experience, two MIT undergraduate or recently graduated students and three MIT graduate students—many of whom are MITES alumni—supported the students throughout the program and beyond as peer role models, mentors, and coaches. At the end of the program, students completed and presented final projects to the MIT community during the MITES Final Symposium, held on July 26, 2019. Finally, students received support around the college admissions and financial aid processes with help from the MIT Admissions Office.

MIT Online Science Technology and Engineering Community: June 26, 2019 – December 18, 2019

We served 137 students in the 2019 MOSTEC program. MOSTEC begins with a four-week, rigorous academic component where students participated in an online science writing course and completed one project course in either astrophysics, community-based design thinking, computational biology genomics, electrical engineering and computer science, mobile app development, neuroscience and connectomics, data visualization, or machine learning. Classes are taught by teaching instructors via Google Classrooms and WebEx (a ratio of 1 to about 15 to 20). Weekly webinars and cluster meetings are run by the program administrator and cluster leaders, respectively via WebEx (a ratio of 1 to 14). During week five, students participate in a one-week conference where they stay on campus and interact with staff and instructors daily. Students also toured labs, met with MIT staff and faculty, and completed two of the following workshops on architecture, computer science and data analytics, electronics, understanding traumatic brain injury, neuroscience, biophysics, web development, neuroengineering, and underwater robotics. Following the conference, participants met virtually on a weekly basis with current undergraduates in small groups where they received additional support on their college applications.

Saturday Engineering Enrichment and Discovery Academy: September 7, 2019 – May 9, 2020

During 2019, SEED Academy provided 135 students with rigorous, hands-on project courses taught by MIT graduate students, postdoctoral fellows, and research scientists. Our fall session launched on September 7, 2019, with 90 students, and our fall final symposium was held on November 16, 2019, and was attended by 221 people, including students, teachers, and family and community members.

We accepted 45 of the 148 spring SEED applicants, and launched our spring SEED semester on February 22, 2020, with 135 students. We were midsemester when MIT halted all in-person K-12 programming effective March 5, 2020, due to the COVID-19 pandemic. In adherence to MIT's new guidelines, our staff worked relentlessly to reformat and reschedule the remaining SEED Saturday classes to develop an online SEED program format. We launched our virtual SEED Saturday sessions with an orientation on March 28, 2020, followed by three biweekly sessions, wrapping up on

May 9, 2020. At the start of the virtual sessions, instructors received a SEED virtual learning guidebook to prepare them for the new format. Staff sent SEED students an e-survey to ensure that all students had the technological equipment required to participate, and prepared to assist those students who needed computer equipment with obtaining it. In addition to the Academic Mentoring Seminar course, each student completed one of the following project courses:

SEED Academy fall 2019 curricula

Grade	Graduating class	Course title
8th	2024	Materials Science
9th	2023	Civil Engineering
10th	2022	Computer Science
11th	2021	Electronics
12th	2020	Biological Engineering

SEED Academy spring 2020 courses

Grade	Graduating class	Course title
7th	2025	Engineering Design
8th	2024	Environmental Engineering
9th	2023	Mechanical Engineering
10th	2022	Robotics
11th	2021	Biological Engineering
12th	2020	Engineering Design/Architecture

Outside of the classroom, we provided SEED Academy students with the following:

- Free academic tutoring in all subjects

- Access to a virtual OEOP college fair, where 34 colleges had exhibits

- Guidance on applying to and getting into college and pursuing science and engineering majors

- Free online webinars for students and parents on topics such as financial aid and choosing the right college fit

- Contact with STEM professionals from underrepresented and underserved minority groups, who spoke to students about their career trajectory and personal experience

We are currently offering fall SEED Academy online, which launched with a virtual orientation session on September 12, 2019, followed by seven Saturday virtual sessions that culminated with an online symposium on November 21, 2019.

Evaluation

OEOP utilizes both quantitative and qualitative metrics to assess program success and help instructors prepare curriculum tailored to meet our students' needs. OEOP also

examines other measures of success, including graduating students' college enrollment, choice of major, and the time it takes them to obtain a degree. Students complete pre- and postprogram surveys to measure their interest level in STEM and college, self-efficacy, and resilience. Postsurveys also track students' semester-to-semester growth and provide timely feedback on our curriculum and class content. OEOP also administers surveys to our alumni that help us track their postcollege careers choices.

Based on students' assessments and feedback OEOP students achieved the following:

- Expanded understanding of and interest level in STEM curriculum

- Increased interest in pursuing STEM careers

- Raised expectations for and understanding of the college application process

- Enhanced interest in majoring in technical fields

Perhaps just as telling of OEOP's success is our students' feedback, including the following comments from SEED students:

> "This was one of the best experiences I've ever had, despite having to do part of it virtually. I got to meet people who have the same interests as me and everything we did at SEED contributed to a sense of community."

> "Seed academy gave me the opportunity to learn and be a part of a community that is full of bright and inspirational students and staff."

The following quotes are responses to a question asking whether the MITES Program increased participants' confidence:

> "My MITES experience increased my confidence by giving me a sense of belonging in such a brilliant and talented group of students. Talking with my peers and chats with my teaching assistants made the topic of competitive colleges seem more inviting and attainable."

> "At MITES, I was able to find a group of students who were as excited about education as I was and who weren't afraid to embrace the 'quirks' and traits that made them unique, even if they were viewed as weird back at home. . . . Knowing that I have a network of people who love and support me as I continue to battle my personal problems and the stress of the college application process has helped me gain confidence in myself and embrace who I am, regardless of what other people think."

> "The rigor of the work at MITES made me realize that I can accomplish any task if I work hard enough at it. Also hearing the stories of our instructors and teaching assistants increased my confidence, as I realized that in some ways they are just like me and are attending prestigious universities."

Recruitment

In addition to changing the SEED Academy application deadline, the OEOP successfully expanded our multifaceted recruitment strategy to serve additional students in Lawrence and the greater Boston area by taking the following steps:

- Called, emailed, and mailed informational packets to Greater Boston school officials, including teachers and guidance counselors

- Visited 12 Greater Boston middle schools and high schools—including schools in Lawrence—to recruit students in person and spread the word among staff members

- Emailed and mailed informational packets to Institute partners and Greater Boston-based organizations, including Boston After School and Beyond

- Engaged current SEED Academy students in recruitment opportunities by encouraging them to share information with school peers

In an effort to increase our national programs' geographic diversity, and improve OEOP's national visibility, OEOP increased recruitment and outreach efforts beyond Boston. In November 2019, OEOP's executive director, Eboney Hearn, traveled to Detroit, Michigan, where we have some major donors. Hearn met with local teachers, education-focused community groups, and school leadership members to promote OEOP's mission and programming. Following this trip, we received 15 MITES and MOSTEC applications from Detroit students. Closer to home, OEOP staff members made similar efforts to donors, community members, and educators in Worcester, Massachusetts, and our Worcester MITES and MOSTEC applicants increased from 16 to 24.

Partnerships

In FY2020, we expanded the local and national dialogue and engagement surrounding best practices in STEM education. We shared our experiences and met with colleagues to increase our knowledge of best practices through multiple outreach and speaking engagements, which are outlined below:

Eboney Hearn co-authored an abstract for a panel discussion with faculty and staff from Carnegie Mellon, University of California at Berkeley, and the University of Washington. The abstract, which describes the SEED model, appeared in the Special Interest Group in Computer Science Education's 2020 publication, *SIGCSE '20: Proceedings of the 51st ACM Technical Symposium on Computer Science Education*. She participated in this panel discussion so we could share the knowledge and outcomes gained by the SEED model, which expands STEM education to middle and high school students. This academic publication is widely shared at the Association for Computing Machinery annual conference. The article, "Institutions Share Successes, Failures, and Advice in Moving the Diversity Needle" (co-authored with Dan Garcia and Jonathan Reynolds), outlined the initiatives and results of five Hopper-Dean Foundation grant recipients (including OEOP) who received an award to develop interventions that advance diversity in computer science.

OEOP and Bridge to Enter Advanced Mathematics Joint Mathematics Meetings Panel

In January, Hearn and OEOP program manager Reimi Hicks were invited by the New York City-based Bridge to Enter Advanced Mathematics (BEAM) to sit on their international Joint Mathematics Meetings' panel titled "Outreach Strategies for Reaching Underrepresented Students at the Pre-College Level" in Denver, Colorado. The BEAM's mission is to create pathways for underserved students to become scientists,

mathematicians, engineers, and computer scientists. Hicks presented on the OEOP's efforts to diversify participation in STEM programming by recruiting and supporting students from underrepresented minority groups through precollege STEM-focused programs, highlighting the work we do in SEED Academy.

OEOP and the Lemelson Foundation

In November 2019, Eboney Hearn attended the Lemelson Foundation's 25th Anniversary Convening. In addition to offering a chance to collaborate to craft an invention education framework, the event provided an opportunity to connect with local and national leaders in the invention education community and discuss the challenges they face with gender, socioeconomic, and racial disparities in their field.

OEOP and the National Partnership for Educational Access

The OEOP works with youth-focused nonprofits as well as teachers and guidance counselors from schools across the country to recruit and recommend students to our programs. As an active member of the National Partnership for Educational Access the OEOP regularly participates in their conferences and professional development workshops.

OEOP and the Research, Educator, and Business Leaders

Eboney Hearn sits on the steering committee of the University of Massachusetts's Institute of Diversity Sciences' (IDS); Research, Educator, and Business Leaders' (REBL) network; and facilitates a smaller working group of state-wide educators focused on access to computer science education for K-12 students in Massachusetts. Also known as REBL, this working group was established when the IDS received a $500,000 grant from the National Science Foundation to lead a STEM diversification network that will bring leaders from all sectors together from across Massachusetts to break down racial barriers to STEM careers, and build a multi-institutional partnership.

OEOP and the Hopper Dean Foundation Convening

The OEOP was awarded a two-year grant from the Hopper-Dean Foundation in September 2019 to support computer science education in all OEOP. As a result, Eboney Hearn participates in a monthly convening of all award recipients, including leaders from University of California at Berkeley, University of Washington, Howard University, Georgia Tech, Cornell University, and Carnegie Mellon. This group will create a guidebook of best practices in broadening participation in computer science from K-12 all the way through the professoriate.

Reimagining a Virtual MIT

In the face of the pandemic, all of MIT's in-person K-12 programming was either cancelled or required to pivot to an online format. Given that the OEOP has 11 years' experience running our successful online MOSTEC program, OEOP staff was invited to participate in multiple virtual Reimagining a Virtual MIT presentations. During a 75-minute webinar, OEOP executive director Eboney Hearn, Manager of Programs Reimi Hicks, and MOSTEC program administrator Annie Grant shared the evolution and learnings of the MOSTEC program.

Collaboration with Office of Multicultural Programs

Over the past year, the OEOP collaborated with MIT's Office of Multicultural Programs and MIT's Social Justice Programming and Cross-Cultural Engagement Intercultural Center (a.k.a., the SPXCE Program) to review the OEOP's staff and student training with an eye toward building our capacity to best support a diverse student population. In an effort to meet this goal, several OEOP staff members attended Learning Equity and Diversity, an online workshop series for MIT employees who work directly with students. OEOP staff members participated in five workshops. Topics included identity development, microaggressions, implicit bias, gender identity and sexual orientation, racial identity development, and best practices for working with diverse populations. Going forward, OEOP managers and educators will facilitate workshops on creating inclusive classrooms as part of their onboarding process.

Finances and Funding

The OEOP is able to provide free programming because we secure over 80% of our budget from outside sources. We work with MIT's central development office and staff within the School of Engineering to solicit funds from individuals, foundations, and corporations. Specific sustainability measures include the following:

- Scheduling regular meetings with funders to discuss their funding goals and the OEOP's accomplishments and needs

- Participating in MIT's annual 2020 24-Hour Challenge on March 14 (Pi Day), where 160 donors gave, and we raised a total of $79,107; this amount was smaller than recent years because where Pi Day took place in the midst of MIT's initial response to the pandemic, we didn't promote it as much, so MIT staff and students could focus on a COVID-19 transition plan

- Hearn delivered presentations about our programs to groups at MIT, including junior faculty and department heads at MIT's School of Engineering, with the goal of sharing our work, and attracting instructors and mentors to our programs

- Hosting corporate networking events, attended by OEOP corporate sponsors and recent OEOP alumni

- Increased OEOP alumni activity; the OEOP staff continued efforts to identify, cultivate, and solicit donations from OEOP alumni, including a networking gathering we held in Washington, DC in November, 2019

The OEOP received additional grant funding from the following foundations and corporations:

- 3M
- 484 Phi Alpha Foundation
- Amelia Peabody Foundation
- Apple Matching Gifts Program
- Ayco Charitable Foundation
- Bank of America Charitable Gift Fund
- Benevity Community Impact Fund
- Boeing
- The Boston Foundation
- Charles Hayden Foundation
- Corning
- D. E. Shaw

- D. E. Shaw Research
- Dorothy Lemelson Trust
- Exxon Mobile Foundation
- Fidelity Charitable Gift Fund
- Fidelity Foundation
- Google Foundation
- Hopper Dean Foundation
- Johnson Family Foundation
- Linde Family Foundation
- Lloyd G. Balfour Foundation
- Lockheed Martin
- Merck
- Microsoft Corporation
- Moses Kimball Fund
- Novartis Institutes for Biomedical Research
- P&C Fund for Charitable Giving
- San Francisco Foundation
- Schwab Fund for Charitable Giving
- Shell
- Texas Instruments Fund

Personnel Appointments and Departures

Appointments

Gabby Ballard, program assistant, MITES and MOSTEC

Gabby Ballard joined the OEOP in July 2019. Ballard assists with the daily tasks required to implement the MITES and MOSTEC programs. She believes that all students should have access to high-quality education in a variety of fields, including STEM and the humanities, and she is excited to provide support in the implementation of educational programs that expand this access. In 2019, Ballard obtained her bachelor of science in engineering and humanities from MIT, where she concentrated her studies in anthropology, computer science, and education. She also trained as a healthy relationship and relationship empowerment educator and worked in the Admissions Office and the Women's and Gender Studies Program.

Stacy Lambert, administrative assistant II

Stacy Lambert joined the OEOP in January 2020 and departed March 2020. Originally from New York City and Connecticut Lambert previously worked as an administrative assistant at other academic and health care institutions. Lambert holds a degree in dance performance from Hartford Conservatory. She performed complex, diverse administrative duties in support of the executive director and for the overall OEOP office.

Departures

- Stacy Lambert, administrative assistant II (departed March 2020)
- Prossy Najjuma, administrative assistant II (departed August 2019)

Eboney Hearn
Executive Director