

MIT FUTUREMAKERS



2023 IMPACT REPORT

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RAISE Initiative
Responsible AI for Social
Empowerment and Education

in collaboration with  **SureStart**

From project-driven learning to impact-driven learning & computational action



MIT FUTUREMAKERS



Artificial intelligence (AI) is shaping our personal and professional lives. It is transforming industries as AI-powered applications, tools, and solutions enter the marketplace. It has already contributed to impressive economic growth, and organizations continue to harness it to help address society's most urgent challenges and realize exciting opportunities. However, if not designed and deployed responsibly, it can exacerbate inequity and cause considerable harm, particularly to historically marginalized groups.

[MIT RAISE \(raise.mit.edu\)](https://raise.mit.edu) created the FutureMakers program to nurture early talent pipelines toward a more diverse, creative, and ethical AI workforce for the future. The goal of the [FutureMakers](#) program is to help to prepare the next generation of diverse AI-powered change makers who aspire to make a better world for all. To prepare students to be successful in an increasingly AI-powered world, the next-generation technical workforce needs to be trained to develop innovative solutions with AI responsibly. Others need to be trained to work with increasingly intelligent tools and technologies to become AI-enabled problem solvers and human-centered solution designers, bolstering their domain-essential skills and knowledge. In addition to understanding how AI works, they will need leadership skills, teamwork skills, creative problem-solving, critical thinking skills, and an entrepreneurial mindset.

Through this comprehensive program, FutureMakers systematically develops students' hands-on technical skills while also developing human-centered skills such as teamwork, leadership, entrepreneurial mindset, critical awareness, and responsible design methods of AI-powered solutions. It cultivates the formation of young people's computational identity and their confidence in digital empowerment. Computational identity encourages students to become leaders, learn how to design compelling solutions, and convincingly communicate their ideas for solving real-world problems that benefit others. Participants leave the program with a certificate of completion, practical

technical skills, a compelling project (some with GitHub code), an enhanced resume, and improved interview skills that will help them secure their next summer internship, apply to college, or even make progress toward their own startup idea.

FutureMakers Student Learning Objectives

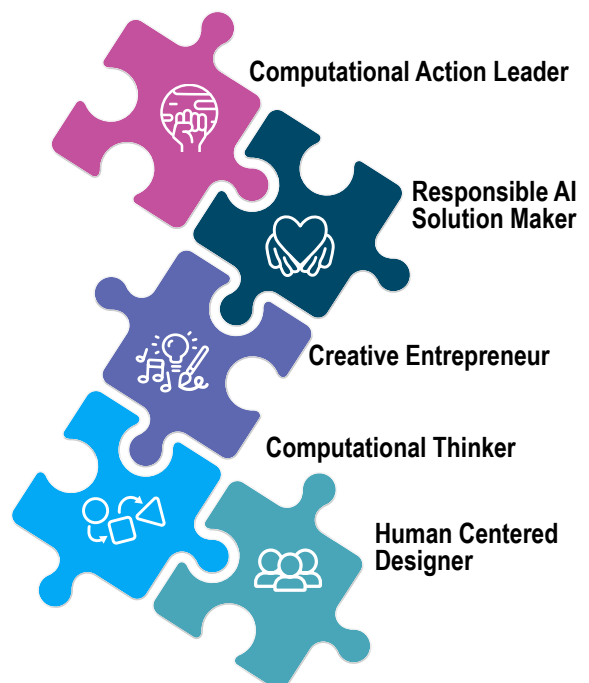


Figure 1: Components of the MIT RAISE FutureMakers Program.



Figure 2: Some of the students and mentors from our 2023 cohort.

PROGRAM DESIGN



FutureMakers is a no-cost six-week program designed to inspire and train diverse middle school, high school, and undergraduate students in AI technologies for positive impact. The program is run in collaboration with [SureStart](https://mysurestart.com) (mysurestart.com) and is virtual by design to be able to eliminate barriers in geography and financial means to travel.

Students learn and work in a supportive online community of cross-grade peers, university student mentors, and FutureMaker staff. The cross-grade band teams encourage participants to be near-grade role models for each other.

In addition to the mentorship provided by the MIT RAISE and SureStart staff, FutureMakers also recruits and trains a diverse roster of university student mentors with expertise in AI and a passion for mentorship. These graduate or undergraduate students, or even FutureMaker alumni, also serve as aspirational role models for participants.

The two-phase program is designed to prepare students holistically with technical, responsible design and human-centered skills to empower them to become positive change-makers in their communities. To support this, MIT RAISE has developed a novel pedagogical framework (Figure 3) and curriculum built on the principle of [*computational action*](#), an impact-driven learning approach that empowers and encourages students to solve personally meaningful and authentic problems relevant to groups with whom they feel invested. This serves to further enhance students' own belief of self-efficacy and their confidence in tackling real-world problems that are personally meaningful. Finally, Futuremakers offers an extensive series of webinars featuring diverse industry experts to help students learn leadership and communication skills, how to interview and prepare a resume, oral and multimedia communication skills, and a wide variety of exciting career opportunities in the AI field.

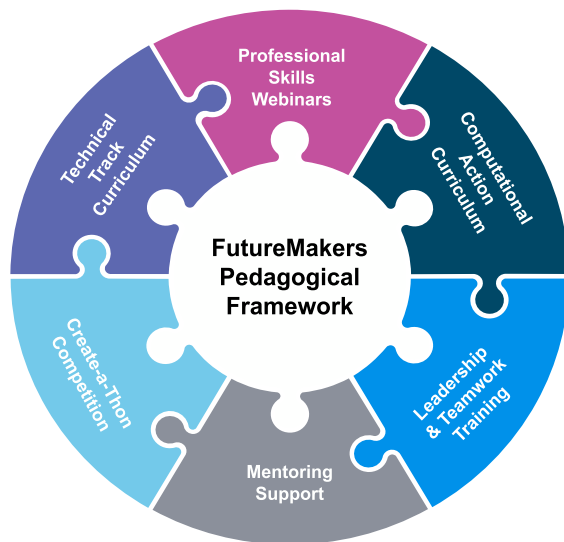


Figure 3. The FutureMakers Pedagogical Framework.

THE COMPUTATIONAL ACTION PROCESS

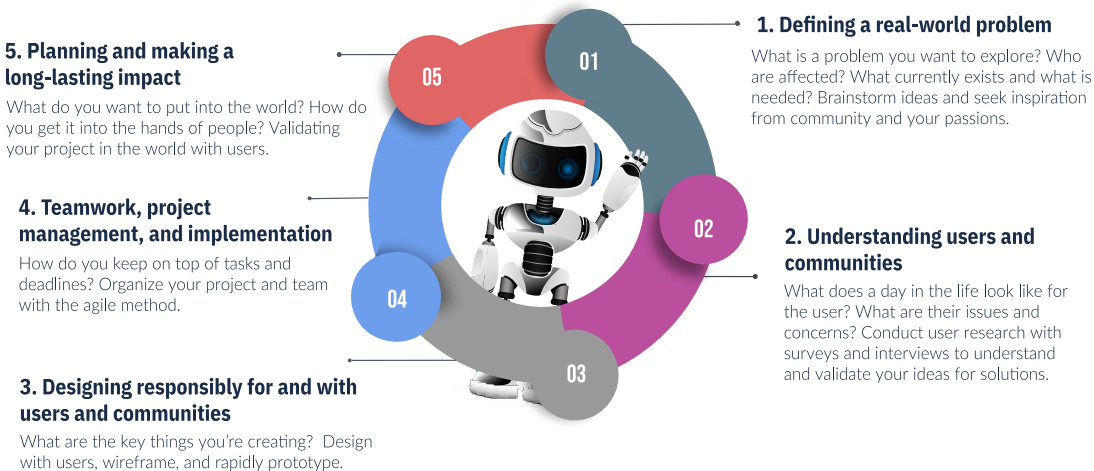


Figure 4. FutureMaker’s computational action curriculum (computationalaction.org) teaches participants practical skills such as brainstorming, problem identification, project management, market and stakeholder research, teamwork, human-centered design, user interface design, and responsible deployment and impact.

Technical AI & Design Tracks. In the first four weeks, participants learn technical skills and concepts in AI (such as deep learning, computer vision, or natural language processing) through small-group instruction, hands-on exercises, and active mentorship. Currently, we offer three technical tracks:

- **MOBILE APP DEVELOPMENT WITH INTRO TO AI TRACK** for middle-school students using MIT App Inventor. To support novice coders in this track, MIT RAISE has developed student-friendly, block-based coding tools with AI extensions to lower the barrier in making AI-powered mobile applications for Android and iOS. In this MIT RAISE-developed curriculum, students learn how to code and debug their own mobile apps, as well as how manage projects with their team. They learn about machine learning, computer vision, and Internet of Things (IoT) through engaging, hands-on interactive tutorial examples. They are also introduced to free web-based UX design tools for designing the user interface of their app. Importantly, they also learn about highly consequential technologies, such as deepfakes, and understanding why the responsible design of AI applications is so important for society.
- **MOBILE APP DEVELOPMENT WITH CONVERSATIONAL AI TRACK** for high-school students and undergraduates with no prior coding experience. Similar to the Intro to AI Track, MIT RAISE has developed student-friendly, block-based coding tools for MIT App Inventor with AI extensions. In this curriculum, students delve into the fundamentals of coding, debugging, and project management within a team setting. Through interactive sessions with a mentor, they explore machine learning, computer vision, and conversational AI, gaining practical experience and skills. Additionally, students receive guidance on designing the user interface of their apps using free web-

based UX design tools. Beyond technical skills, participants also learn about the societal implications of AI, including topics like deepfakes. Emphasis is placed on the responsible design of AI applications, highlighting their impact on society.

- **APPLIED DEEP LEARNING** for high-school and undergraduate students using the Python programming language. In this curriculum developed by SureStart, participants learn machine learning (ML) principles, responsible design to mitigate potential ML bias, and hands-on examples of ML applied to affective computing, computer vision, natural language processing (NLP). They also learn about data analytics, visualization, UI, and responsive web design. They learn to use industry tools, libraries, and techniques including Python,

Numpy, Keras, Github, Jupyter Notebooks, and Google Colab. They use ML frameworks such as TensorFlow and explore Kaggle challenges using publicly available datasets that we provide.

DESIGN JAMS. To help to reinforce students developing teamwork and computational action skills, we developed a series of short format mentor-facilitated design jams. In each, student teams are presented with a scenario based on real-life stories of youth around the world who have used MIT App Inventor to address a community problem (adapted from case studies published in *Become an App Inventor*, MITteen Press, 2022). Participants have 30 minutes to deliberate among themselves and, guided by their mentors, to come up with a “back-of-the-envelope” solution to the problem that they share out. Through design jams, students experience the pressure of a design effort in real life, where the time constraint forces them to rethink priorities together.

CREATE-A-THON COMPETITION. In the final two-weeks, students form cross-grade band solver teams with a dedicated mentor and enter into the Create-a-Thon phase of the program. The Create-a-

Figure 5. Example of a design jam scenario in the 2023 Mobile Apps & AI track.

“Chinmayi’s mom suffers from severe asthma and the air pollution in her city caused by wildfires in Canada often makes it hard for her mom to be able to leave the house. The city government publishes the air quality everyday on Twitter, but her mom doesn’t know how to use Twitter. Think of a ‘just-in-time’ app on a mobile phone that could alert air quality sensitive people whether or not it was safe to go out of the house.”



Figure 6. Past FutureMakers winners at the ASU-GSV Summit.

Thon tasks teams to identify a problem in their community, design and prototype a human-centered solution with AI, and then present their solution in an entrepreneurial-style pitch competition to an expert panel of judges. Our unique computational action curriculum teaches students how to bring their idea from a concept to a well-conceived prototype solution with supporting tools and methods. Winners for each track are awarded a grand prize: an all-expense paid opportunity to present their work (youtu.be/m_BAY3iUIDI) in a special session just for them at the ASU-GSV Summit (asugsvsummit.com) that “connects leading minds focused on transforming society and business around learning and work. Our north star is that ALL people have equal access to the future.” Students are also registered to attend the entire conference as a key enrichment opportunity to learn about the education technology field — from startups to academia — with exciting keynote presenters.

PARTICIPATION



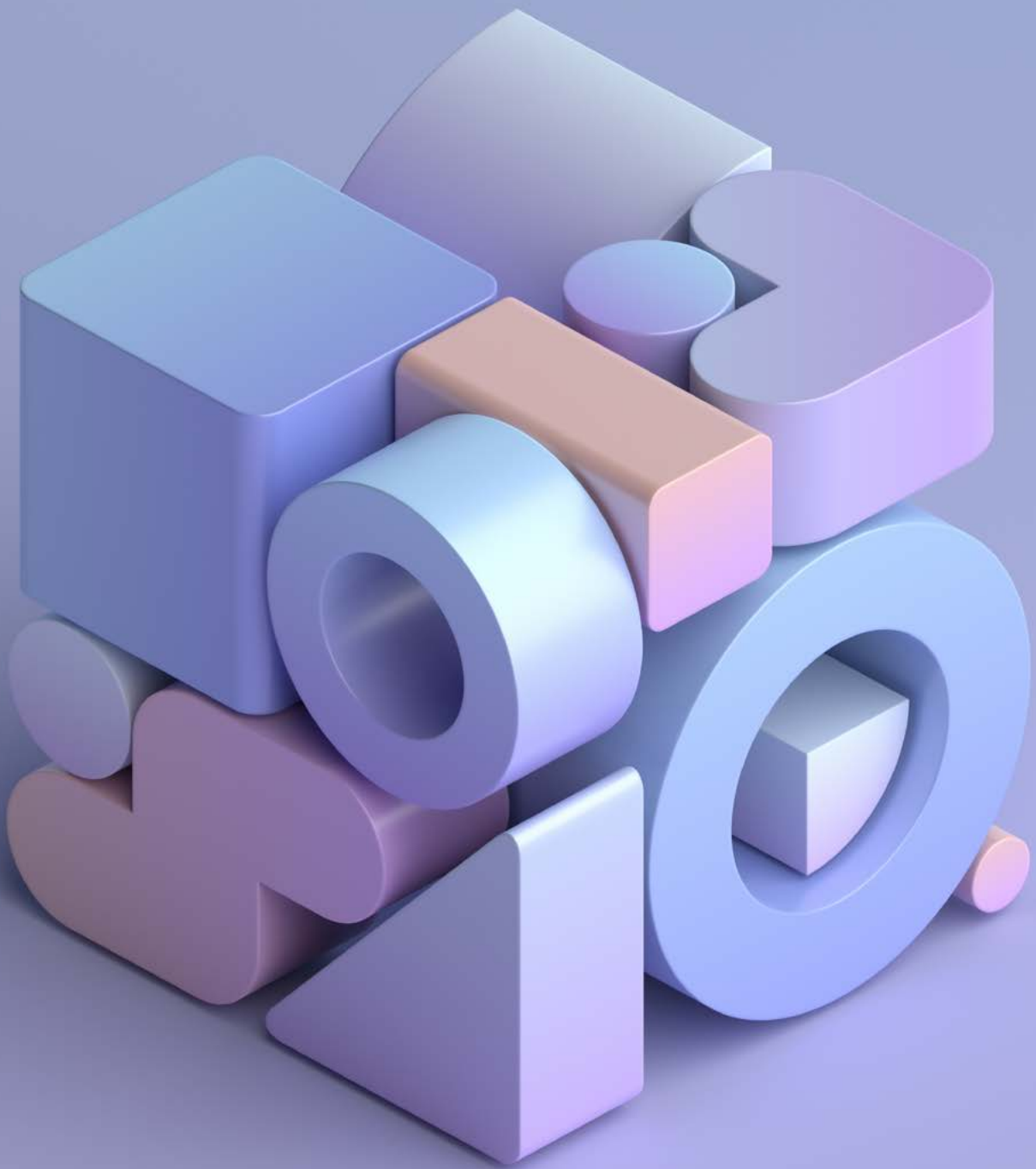
Interested students apply through our online application. To make sure we are reaching underserved students, we advertise our program through our growing email list of STEM non-profits and schools throughout the US. This year's recruitment outreach added MIT's pre-college program MITES, teachers who participated in RAISE's Day of AI, and youth who participated in a Data Activism course to previous outreach targets like the OKThunder Fellows, Girls Who Code, Liliuokalani Trust, KIPP Academy, Computer Clubhouse Network, the Opportunity Network, and many more.

FutureMakers accommodated 114 participants in the summer of 2023. Our selection criteria balanced a number of factors, including program grade level, school district, whether the applicant attends a Title I school, and their answers to a series of short questions. We gave priority to students who would otherwise age out of the program next year. Qualified applicants who did not secure a spot this year may be prioritized next year. The distribution of the admitted students this year is as follows: 15% attend middle school, 57% attend high school, and 28% attend a college/university. Students hailed from 23 states and one US territory (Puerto Rico). The two AI tracks included 20 middle school participants and 33 high school participants. Any student without any prior coding experience and all middle school students (grades 6-8) were assigned to Intro to AI. A total of 54 participants were enrolled in the Deep Learning track, all having at least one full year of programming experience.

Essential to the success of FutureMakers is the high quality and dedication of our mentors, who work with participants throughout the program. We recruited 23 mentors, mostly from undergraduate and graduate computer science programs in US colleges and universities (e.g., UC Berkeley, Cornell Tech, UC Davis, and University of Washington, to name a few).

We also included a few CS teachers from K-12 school districts with whom we have worked in the past. All mentors received SureStart's "Mentoring Across Differences" training module to learn how to guide

their mentees inclusively by providing constructive feedback, balancing accountability and encouragement, and supporting mentees who experience "imposter syndrome". Deep Learning Track mentors were provided SureStart's asynchronous training materials on industry-focused machine learning. Our Mobile Apps & AI Track mentors received an intensive, two-week-long virtual workshop by MIT RAISE staff on MIT App Inventor fundamentals and its AI extensions (i.e., image classification, face segmentation, IoT, and conversational AI using Alexa). Over the 6-week program, our mentors delivered 18 hour-long head mentor presentations, 18 hour-long office hour sessions, and 540 team mentoring sessions.



MIT FutureMakers was made possible in part through the generous support of:

DP World
MIT Open Learning pK-12 Fund



I have seen mentees bring new perspectives and smart solutions to the issues which affect them on a personal level. It's such a proud feeling to have been a conduit for these self-driven mentees who are interested in social good through artificial intelligence.

While discussing the technicalities and ethical impacts of AI with my mentees, I make sure to create a space where they can ask questions without any fear and receive answers without any judgment. I am very amazed and thrilled with the progress my mentees have made in just 6 weeks, and I hope that they continue their journey in AI which has started through this program.

Kunjal Panchal

Track Mentor and Ph.D. student at University of Massachusetts Amherst



IMPACT STORIES



The Create-a-Thon competition motivated students to apply technical knowledge and the computational action process to successfully prototype their proposed solutions with AI technologies to address a variety of social challenges across different applications. In total, 21 teams competed in the Create-a-thon and entrepreneurial pitch competition. Each team was assigned a mentor. Student solver teams were provided with open data sets and challenge prompts. Table 1 summarizes the themes that the student teams selected and used their new technical, human-centered design, computational action, and entrepreneurial mindset skills to tackle.

The solutions and prototypes that teams presented were truly inspiring. In the Intro to AI track, teams developed and demoed working app prototypes. For instance, Team Tomorrow Makers presented a mobile app, *Safer Steps*, aimed at helping peers stay safe by reporting unsafe situations and requesting help. The winning team from the Mobile App & Conversational AI

track, Team Sonic J.E.T.S., created the language app CultureConnect after recognizing that immigrant children often experience feelings of exclusion and low self-esteem in environments where their native language is not shared. The app focused on eradicating the gap between students with its cooperative style, fun games, and AI tools. And Team DataDrillers won the Applied Deep Learning with Python track FrackOnTrack to make people aware about the good and the bad caused by fracking, while providing a predictive and analytics tool to governmental bodies and oil companies to bring accountability.

Table 1: Themes tackled by the number of student solver teams.

	INTRO TO AI (MIDDLE SCHOOL)	MOBILE APP & CONVERSATIONAL AI (HIGH SCHOOL)	APPLIED DEEP LEARNING WITH PYTHON
PHYSICAL HEALTH AND MENTAL WELL-BEING MANAGEMENT	1	5	2
NEW INCLUSIVE APPROACHES TO LEARNING AND WORK	0	1	1
TECHNOLOGY ENHANCED SMART CITIES	1	0	0
CLIMATE CHANGE AND ENVIRONMENTAL RISK MITIGATION	1	1	3
EQUITABLE RESOURCE ALLOCATION	0	1	0
ADVANCING SOCIAL AND RACIAL JUSTICE	0	2	0
ROLE & RELIABILITY OF SOCIAL MEDIA IN INFO SHARING	1	0	1



Figure 7. Team Awesome Achievers created Safe Sources to provide an app for students, teachers and computer-users to help find reliable sources when researching online.

Choosing winning projects was a challenge given how impressive the finalists were. For the Intro to AI track, Team Awesome Achievers and their Safe Sources app took on the problem of helping students and teachers find reliable sources when researching on line. Team Olympiads, in the Mobile App Development with Conversational AI track, developed Cozee, an AI journaling app that offers some of the benefits of social connection without mindless scrolling; they wanted to address issues around school stress, social media addiction, and busy schedules, which they said can cause a severe lack of sleep in teens, which can be harmful to teens’ mental well-being. In the same track they were joined by fellow finalists Team R.A.W.S., who created Shift2Serve to connect charities to people looking to volunteer, gamify the tradeoff of screen time and volunteer time by allowing users to share their volunteer time with friends, and allow for thoughtful reflection of each volunteer experience. And lastly in the Deep Learning with Python, Team DataDrillers developed “FrackOnTrack” to make people aware of the good and the bad caused by fracking, while providing a predictive and analytics tool to governmental bodies and oil companies to bring accountability.

The competition judges were effusive in their praise. As one said to the participants, “I am no stranger to judging and it was amazing to see what I saw today. It compares to a lot more experienced teams and considering time that you were able to put into it, it’s a big achievement...reflect on what you have learned. Maybe it’s not just the information about how to use certain technologies. I’m sure there have been a lot of things that you have been able to achieve by understanding how to work with each other, how to communicate in challenging situations, resolve conflicts, and look at things creatively.”



Figure 8. Team R.A.W.S. developed Shift2Serve as part of the theme of physical health and mental well-being management.



ALUMNI HIGHLIGHTS



- **Over 40% (of 90 respondents) have gone on to top 25 universities, including 37% of the 47 high school participants now in college. (Figure 11)**
- **More than 100 organizations have hired past participants for internships. (Figure 12)**
- **An all-female 2021 Deep Learning track team (Team Code Blue with their project Machine Vision-based Facial Asymmetry Stroke Test) filed their first patent and are in the process of building a healthcare startup focused on early stroke detection.**
- **A participant was awarded a US Congressional Medal for Youth in 2023 based on a project he started during the 2021 FutureMakers program. The app, Udiet, created by him and his teammates, focused on helping individuals jumpstart their health journey by aligning app recommendations with their age and budget.**

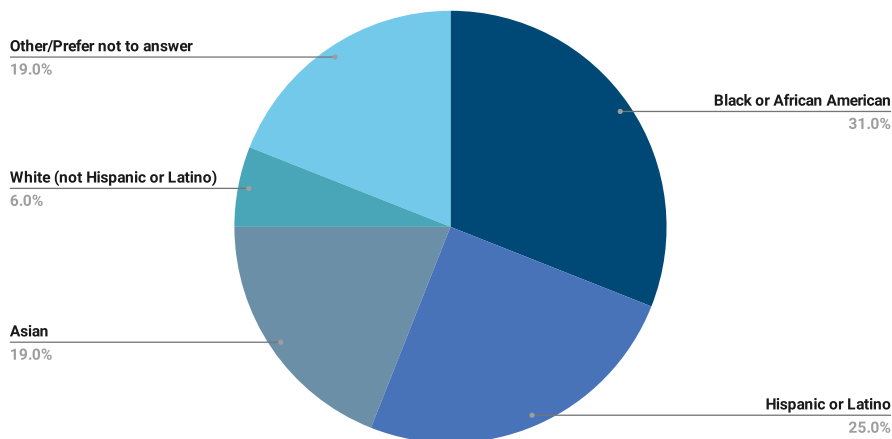


Figure 9. Demographic distribution of the summer 2023 student cohort.

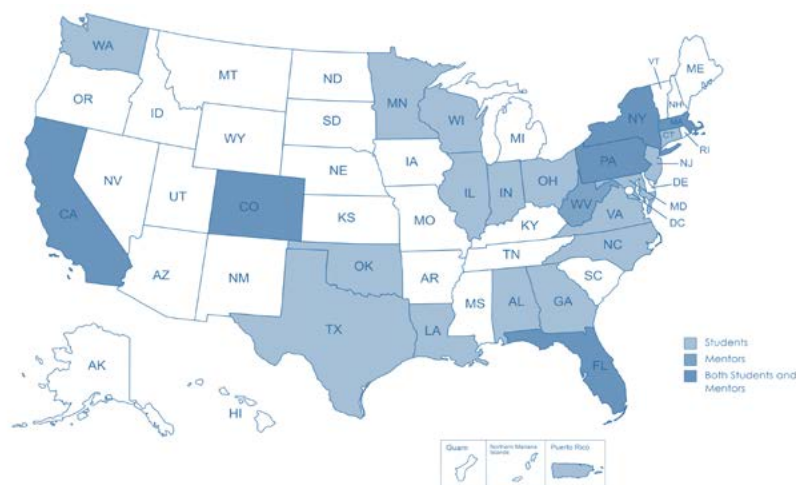


Figure 10. The 2023 cohort's geographic distribution across the U.S.



Thank you motivating the kids! Smyan thoroughly enjoyed the program and it as amazing to see all the kids and their presentations. You clearly are building a platform to nurture the next generation. Love all that you do. I had tears seeing all the kids present and thinking about AI and how to use that ethically for the community.

Thushara Shastri, Parent

Major Fields

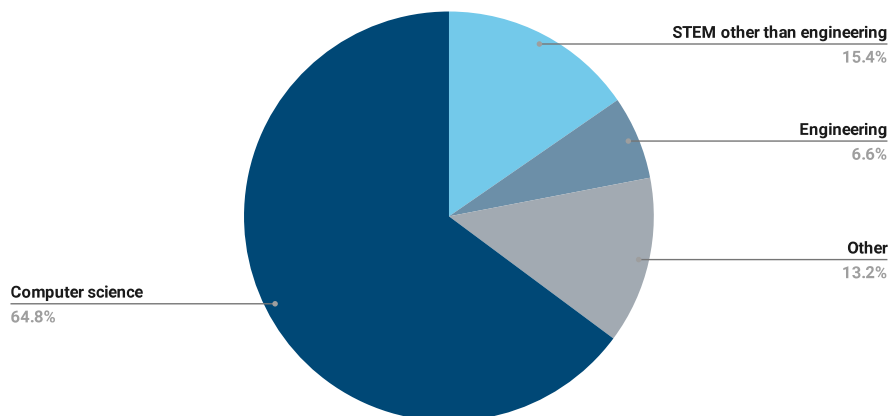


Figure 11. College major field distribution of past FutureMakers participants.

U.S. News & World Report Ranking

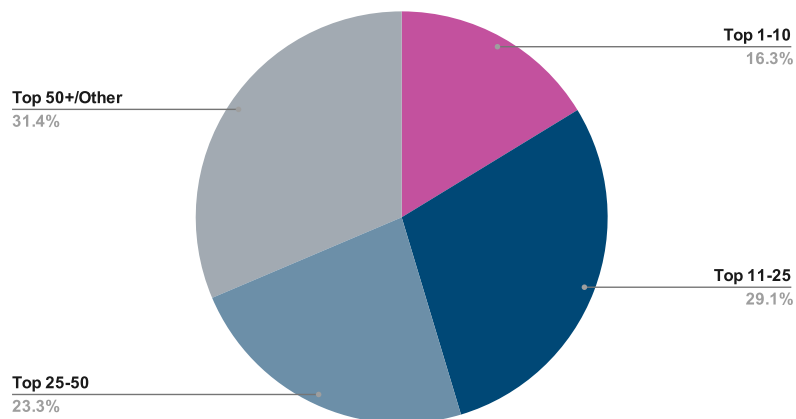


Figure 12. University matriculation of FutureMakers participants by U.S. News & World Report ranking (usnews.com/best-colleges). Students have entered MIT, Stanford, Columbia, Yale, Carnegie Mellon, and other top schools. Data is from 90 respondents of 114 participants.

Internships by Industry

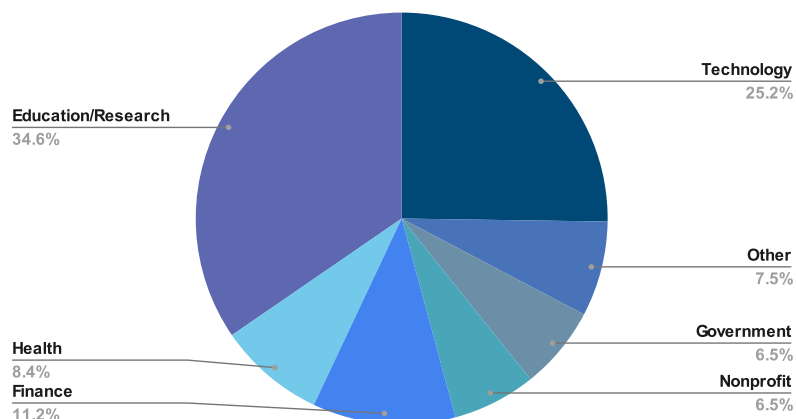


Figure 13. Industries where participants have secured internships. Organizations include Google, Amazon, Disney, NASA, the Society of Women Engineers, Vanguard, CVS Health and two dozen universities.



SPONSORSHIP & HOW YOU CAN HELP

A generous grant by DP World supports our summer FutureMakers program. The inaugural FutureMakers program was launched in the summer of 2021 with 71 students and 21 mentors. By 2023, the third summer program accepted 114 students and 22 mentors.

MIT FutureMakers is seeking support to scale our program beyond the summer session to accommodate more participants (students and mentors) across the U.S. and in other countries. If you are interested in becoming a sponsor, please contact us at futuremakers-info@mit.edu.

PUBLICATIONS

- Du, X., Blumofe N., Mishra, T., & Breazeal, C. (2023). [MIT FutureMakers: A Computational Action Approach for Youth to Learn About Deep Learning for Social Good](#). Artificial Intelligence in Education Technologies: New Development and Innovative Practices
- Breazeal, C., Du, X., Abelson, H., Klopfer E., & Park, H. (2023). [Day of AI: Innovating Pedagogical Practices to Bring AI Literacy to Classrooms at Scale](#). International Conference on Artificial Intelligence in Education Technology.
- Blumofe, N., Mishra T., & Du, X. (in review) Developing an Inclusive Deep Learning and Computational Action Program for Youth: Impact on Attitudinal and Conceptual Change on Artificial Intelligence Literacy. Submitted to 2023 Thirteenth AAAI Symposium on Educational Advances in Artificial Intelligence.
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- Kim Patch | MIT Media Lab. (2022). [MIT's FutureMakers programs help kids get their minds around - and hands on - AI](#). MIT News | Massachusetts Institute of Technology. Retrieved October 3, 2022.
- Pang, N (2021). Computational Action with MIT. [computationalaction.org](#)
- Tissenbaum, M., Sheldon, J., & Abelson, H. (2019). [From computational thinking to computational action](#). Communications of the ACM, 62(3), 34-36.
- Developing a Student-Centered APP Inventor Curriculum: Impact on Student's Computational Action Initiatives. Submitting to CSTA 2023 [Under preparation].
- Innovating Computational Action Pedagogical Approach: Developing Students' Knowledge and Attitudes in Artificial Intelligence Literacy Development. Submitting to International Journal of Artificial Intelligence in Education [Under preparation].

ABOUT MIT RAISE

MIT RAISE ([Responsible AI for Social Empowerment and Education, raise.mit.edu](https://raise.mit.edu)) is an MIT initiative to innovate learning and education in the era of AI. As computers continue to automate more routine tasks, AI education is a key enabler to future opportunities where success depends increasingly on intellect, creativity, empathy, and having the right skills and knowledge. In the face of this accelerating, AI-powered change to people's personal and professional lives, the RAISE research, outreach, and impact mission are to advance equity in learning, education, and computational action to rethink and innovate how to holistically and equitably prepare diverse K-12 students, an inclusive workforce, and lifelong learners to be successful, responsible, and engaged in an increasingly AI-powered society.

Headquartered in the MIT Media Lab, RAISE is a collaboration with the MIT Schwarzman College of Computing and MIT Open Learning. As part of the RAISE research effort, faculty, staff, and students from across MIT explore

new pedagogical approaches, and develop a constructionist curriculum where students learn-by-making, creative innovative tools, advance the science of learning, as well as how AI can advance human learning. These advances are applied to RAISE outreach programs designed to promote an AI literate society by engaging teachers and students in impact-driven learning from K-12 to the workforce. The educational goals are to demystify AI and to enrich AI literacy for everyone by empowering learners of all ages to embrace AI technology creatively and to use it responsibly, equitably, and ethically. By doing so, we aspire for people to know how to use AI responsibly, have an informed voice to shape how AI is used in society, and prepare a diverse and inclusive workforce that can design and apply AI responsibly to make a better world.

ABOUT SURESTART

SureStart (mysurestart.com) is a startup that provides flexible, accessible and industry-skills focused Data, AI and Machine Learning related skill-building programs for emerging technologists. Recognizing that the future of AI depends on inclusion and diversity — of ideas, skills, experiences, and perspectives — and its severe lack in the current AI landscape, SureStart is on a mission to increase diversity in the AI workforce through creating success pathways for career-aspirants from populations underrepresented in the tech and AI workforce. Our skill-development programs interweave learning of AI/ML and Data-related technical skills with the development of power skills critical for workplace success, situated in a mentoring-centered learning environment.

Founded in late 2020, SureStart has provided virtual industry-focused tech and AI/ML skill building “intensives” to 300+ students from diverse backgrounds, geographic locations and demographics, through collaborations

with education and industry partners – 160 students supported in collaboration with our champion collaborator, MIT RAISE. Within months of completing our AI intensives, many of our trainees secured tech internships at companies like Amazon, Snap, Google, Microsoft, Accenture, Facebook, JPMC, Gap, Goldman Sachs, Consumer Reports, among others. Looking forward, working together with current and new partners, we aim to scaffold the career pathways for not hundreds, but thousands of emerging technologists, to begin closing the AI diversity gap and make the industry more inclusive, and hence, more innovative and effective.

