

Lemelson-MIT Program

Goals, Objectives, Priorities, and Accomplishments

In 2018–2019, the [Lemelson-MIT Program \(LMIT\)](#) continued its mission of celebrating outstanding inventors and inspiring youth through its awards, invention education, and communication activities. Among other initiatives, LMIT maintained its national awards program and the EurekaFest event.

Noteworthy highlights during 2018–2019 include:

- The \$500,000 Lemelson-MIT Prize was awarded to Luis von Ahn, inventor of reCAPTCHA, co-inventor of CAPTCHA, and creator of the free language learning platform DuoLingo.
- We continued our partnership with *MIT Technology Review* to celebrate the Lemelson-MIT Prize winner.
- Seven winners in the national student prize competition for graduate and undergraduate students were announced.
- Webinars for educators were held and the first fee-based summer professional development offerings were initiated.
- We continued direct mail marketing efforts to promote InvenTeam grant opportunities and professional development offerings.
- New invention education articles were published in *Technology & Innovation*.
- InvenTeams continued to receive recognition from elected officials through community engagement efforts.
- We hosted two coding webinars in partnership with CSforALL.
- Public testimony at the US Patent and Trademark Office (USPTO) SUCCESS (Federal Study of Underrepresented Classes Chasing Engineering and Science) Act hearing on June 3 informed policies that could create more diversity among inventors.
- Eleven articles written by LMIT staff and InvenTeam members were published in Cricket Media's special "invention" issues in *Click, Ask, Dig, Cobblestone, and Muse*.

Further details on LMIT's goals and accomplishments are described below.

Recognizing Outstanding Inventors

LMIT's activities to recognize outstanding inventors and inspire youth to lead creative lives through invention include two annual awards: the \$500,000 Lemelson-MIT Prize and the \$10,000/\$15,000 Lemelson-MIT Student Prize Competition.

Lemelson-MIT Prize

LMIT strives to increase the number and diversity of high-quality nominations for the Lemelson-MIT Prize each year. This year's goals included having 20 new nominations

and two women nominees. The nomination pool resulted in a total of 45 nominations, with 20 states represented. Twenty of the 45 nominations involved new nominees, seven of whom were women. Two female nominees were among the top 11 nominations, and one female nominee advanced to the final round reviewed by the jury.

The screening committee—composed of MIT alumni and faculty and members of the no-longer-presented Lemelson-MIT Award for Global Innovation committee (to provide a global perspective)—reviewed the 45 nominations received and identified four finalists. LMIT’s national awards jury of influence makers from the scientific, entrepreneurial/venture capital, and media industries met and selected the winner of the 2018 Lemelson-MIT Prize in mid-May. The winner, Luis von Ahn, inventor of reCAPTCHA, co-inventor of CAPTCHA, and creator of Duolingo, was announced in mid-September at EmTech 2018. His press announcement exceeded 303 million impressions, including 184 million impressions attributed solely to traditional media (online, print, broadcast).

Lemelson-MIT Student Prize Competition

The national Lemelson-MIT Student Prize Competition is open to graduate students and teams of undergraduate students selected on the basis of their inventive work and its significance to the US economy. Non-monetary student prize incentives include prestige; communication and media training; networking opportunities with other inventive students and with judges, past winners, and the Lemelson network overall; and a push for significant media coverage to bolster the winner’s trajectory. The prize categories were “Cure It!” (health care), “Use It!” (consumer devices), “Eat It!” (food/water and agriculture), and “Move It!” (transportation and mobility; renamed from “Drive It!”)

Recruitment efforts for the prize resulted in 116 applications, a decrease from last year’s 190 due to limited staff support (the goal is 200 applications per year). The “Eat It!” undergraduate subcategory saw an increase in applications, while the “Cure It!” undergraduate subcategory and the “Move It!” graduate category saw decreases. Representation of underrepresented minority groups as a percentage of the total pool of applicants decreased slightly among both undergraduate (from 15% to 11%) and graduate (from 14% to 11%) applicants. Although there was a slight increase in representation of female graduate students (from 17% to 20%), there was a marginal decrease among female undergraduates (from 37% to 34%).

Screening committees were formed to select graduate student and undergraduate student team finalists in the competition’s four categories. These committees included experienced Lemelson-MIT Prize screeners and experts in health technology, consumer products, transportation, and food and agriculture. Finalists submitted videos of their inventive work along with letters of support. The same national jury that selected the winner of the Lemelson-MIT Prize then reviewed and selected the winners of the \$15,000 graduate prizes and \$10,000 undergraduate team prizes. Seven prizes were awarded in April 2019, with awards going to four graduate students and three undergraduate student teams. No prizes were awarded this year in the “Use It!” undergraduate team subcategory, as the jury felt the finalists in that subcategory were not quite at the level of Lemelson-MIT Student Prize winner standards and the standards of past winners. One of the winners selected by the jury was from MIT. The seven 2019 Lemelson-MIT Student Prize winners are as follows:

- Mercy Asiedu, the “Cure It!” graduate winner from Duke University, developed a low-cost imaging tool for speculum-free cervical cancer screening; the tool can be connected to a mobile phone, tablet, or computer and is intended for low-resource settings. It has an introducer that obviates the need for a speculum and can be used either by a health provider with a patient or by women themselves for self-cervical cancer screening.
- The Ithemba “Cure It!” undergraduate team (Sophia Triantis, Laura Hinson, Madeline Lee, and Valerie Zawicki) from Johns Hopkins University developed a reusable, affordable, ergonomic, and contamination-free core needle breast biopsy device designed to support earlier diagnosis in low-resource settings. Durable and reusable firing mechanisms partnered with novel contamination-trapping disposable needles ensure that the device is safe for large-scale use and is easy to clean. The disposable needles also lower the cost per procedure, making biopsies a safe and affordable option in situations in which they were not previously.
- Julie Bliss Mullen, the “Eat It!” graduate winner from the University of Massachusetts at Amherst, created a scalable water purification technology (marketed initially for residential use) that employs low levels of electricity to precipitate metals, destroy organic contaminants, and disinfect all types of pathogens: bacteria, viruses, and protozoa. It requires little or no maintenance and no filter replacement and involves low operating costs relative to commercialized technologies. Mullen is offering the technology through her startup, Aclarity LLC.
- The BioEnergy Project “Eat It!” undergraduate team (Enid Partika and William Tanaka) from the University of California, San Diego, developed a compact and scalable food-waste-to-food-and-fuel system that converts food waste from dining halls and restaurants into electricity generated from biogas and nutrient-rich organic fertilizer that can be used to grow more food. This allows for a cyclical system that can address food insecurity, the need for renewable energy sources, and climate change by capturing and utilizing a methane source that would otherwise be released into the atmosphere in landfills.
- Federico Scurti, the “Move It!” graduate winner from North Carolina State University, invented an internal monitoring system for high-temperature superconductors (HTSs) used in electrical machines and trains. The sensing system is based on optical fibers embedded into superconducting wires. This invention prevents failure of the superconducting winding, which is the primary factor hindering the application of HTS materials to build high-power-density, high-efficiency motors and MagLev trains.
- The Portal Entryways “Move It!” undergraduate team (Josh Horne and Morgen Glessing) from Brigham Young University invented a wireless device that opens handicap-accessible doors when a user approaches with the Portal smartphone app. The Portal app runs in the background on the user’s phone and uses proximity to instruct the door to open as the user approaches. The app sends door usage data and provides a reporting platform for facilities to maintain accessibility.

- Arnav Kapur, the “Use It!” graduate winner from MIT, invented a non-invasive and non-intrusive wearable system that transcribes a user’s internally articulated speech and gives sensory and audio feedback through bone conduction. This creates a subjective human-computer interaction experience completely internal to the user and allows the user to communicate with computers and people in natural language, without voice or discernible movements or actions. The system has applications in directly augmenting human cognition; interfacing with artificial intelligence, telecommunications, and the Internet of Things; and rehabilitating amyotrophic lateral sclerosis, stroke, and Alzheimer’s patients.

Winners were announced through a national press release and in coordination with their respective schools on April 23, 2019. The Lemelson-MIT Student Prize continued to serve as a highlight of LMIT’s recognition activities, with more than 85 million media impressions. LMIT celebrated the winners at EurekaFest in June.

Inspiring Youth

LMIT’s activities to inspire youth to lead creative lives through invention include invention education, InvenTeams, Junior Varsity (JV) InvenTeams, community engagement, and EurekaFest.

Invention Education

LMIT’s invention education activity consists of collaborations with partners such as national youth organizations to promote inventive thinking and doing. This is also the arena in which LMIT pursues new research and opportunities and engages with the MIT K–12 science, technology, engineering, and mathematics (STEM) community. New partnerships and opportunities for invention education are described below.

InvenTeams

InvenTeams, LMIT’s premier hands-on invention experience for teams of high school students, educators, and mentors, continued as a national program. LMIT announced the selection of 15 AY2019 InvenTeams, representing 13 US states, on October 24, 2018. Projects were underway in November, with InvenTeams completing research and outreach to beneficiaries or customers. Prototypes were built and iterated in December through late April, when teams began to think about EurekaFest.

Recruitment for 2018–2019 InvenTeams resulted in 44% female student representation, and 73% of participating schools had free or reduced-price lunch programs.

Examples of continuing LMIT programmatic InvenTeams activities included:

- Conducting 15 InvenTeams site visits prior to the end of 2018. Site visits early in the grant cycle offer guidance to teams for successful initiation of the invention process.
- Conducting an informational webinar for the public during the recruiting season to raise educators’ awareness of InvenTeam grant opportunities and answer any questions.
- Holding communications/public relations and finance training sessions using Adobe Connect, along with engaging in video conferencing with teams.

- Supporting InvenTeam master teachers in conducting mid-grant technical reviews for teams.
- Requiring teams to hold mid-grant technical progress reviews open to their respective communities.
- Selecting 2019 Excite Award recipients.

Junior Varsity InvenTeams

The JV InvenTeam initiative has traditionally run from January through June each year since 2014, with students served primarily in 21st Century Community Learning Center sites in Massachusetts, Texas (Houston), Oregon, and California (Los Angeles). However, the initiative was in a state of transition during the first half of 2019 since it had ceased to offer grants and had had a reduction in staff. Plans and funding were in place, however, for some grantees as of December 31, 2018. LMIT provided the JV InvenTeam experience to 182 students in 13 middle schools. Six schools were in one district in southern California, and seven were Citizen School sites in metropolitan Boston.

Three winter camps for middle school students were held in the first half of 2019 using the JV InvenTeam activity guides. One camp was in Cambridge (with additional funding support from MIT's Pathway to Invention); the second was in Waltham, MA (with additional support from Boston College and Waltham Public Schools); and the third was in Tampa, FL (with additional support from the University of South Florida). There were 59 middle school camp attendees. The JV InvenTeam U Control curriculum was used at the Waltham camp. Lessons learned from this camp were used to refresh the educator and student guides, which were then used for a region-wide summer camp program in northwestern Wisconsin funded by Ashley Furniture. The University of South Florida camp was a pilot test of an electronic textile project that was modified in partnership with Sylvan Learning for its summer camps and made available to 577 Sylvan Learning Centers. LMIT provided webinars for educators associated with the Ashley Furniture-sponsored camps and the Sylvan Learning Centers to help them understand invention education as well as hands-on projects.

There was significant reach with JV InvenTeams outside of the grants and camps through the continuation of Chill Out! This partnership with Boston College and the Waltham Public Schools involves a multi-week in-school initiative supporting our ongoing research. Approximately 250 seventh-grade students in two schools spent up to four weeks inventing and learning STEM in their physical science classes. Five teachers employed by the Waltham Public Schools taught the curriculum.

The Lemelson-MIT Program supported Beyond Benign in the development and testing of a new JV InvenTeam curriculum guide on "green chemistry" in the spring semester. Three of the pilot sites were former JV InvenTeam grantees at the high school level: the Oregon City Service Learning Academy (Oregon City, OR), KIPP Sunnyside (Houston, TX), and the Energy Institute (Houston, TX). Thirty students affiliated with LMIT piloted the new curriculum. In addition, 97 students piloted JV InvenTeams Green Chemistry at sites affiliated with Beyond Benign.

Community Engagement

LMIT started a community engagement campaign in 2011 with the goal of creating awareness among political and community leaders about InvenTeam projects happening in their community and the community support needed to sustain the projects throughout the school year and beyond. The success of this campaign is dependent on consistent outreach on an ongoing basis. LMIT sends a letter to political leaders at the start of the InvenTeam grant period. Participating schools receive a certificate of appreciation citation from political leaders in response to LMIT's letters. This recognition helps excite and encourage InvenTeams. A list of local officials and supporting mentors and local organizations is included in the final InvenTeam grant application.

Community engagement efforts during the past year focused on letter and email campaigns for InvenTeams. The first campaign was executed in late January in anticipation of letters arriving on the desks of elected officials in time for National Inventors Day in February. Elected and school officials in each InvenTeam community received a letter from LMIT encouraging recognition of the InvenTeam. Emails were sent to school administrators and additional supporting local companies listed in the InvenTeam grantee's application. A second letter and email campaign was executed in mid-May to invite special community members, partners, and elected officials to EurekaFest. These members of the community either participated at the school events or gave recognition/donations to the teams. InvenTeam community engagement highlights during 2018–2019 are as follows:

- The 2018 Garey High School InvenTeam from Pomona, CA (Heart & Sole device) and the 2018 Northeast High School InvenTeam (Mosquito Agitator) were selected to work with Microsoft in the company's #MakeWhatsNext Patent Program, which offers female inventors patent support and mentorship.
- The 2014 SOAR High School InvenTeam from Lancaster, CA (which created a personal safety device), received a patent for its invention in 2016 and implemented an in-school invention education capstone class in 2019.
- Seven students participating in the 2018 Frederick County Career and Technology Center's InvenTeam project (which involves a device designed to provide safe drinking water) received financial support in June from their local Rotary Club in Frederick, MD, to travel to Melka Oba, a school in Ethiopia, to put their device to use. Melka Oba became the InvenTeam members' inspiration when they discovered the school's source of unsanitary drinking water coming out of a nearby well.

EurekaFest 2019

LMIT held its 13th annual EurekaFest from June 19 to 21. The event celebrated InvenTeams and the Lemelson-MIT Student Prize winners.

EurekaFest was designed to establish a tradition of invention through activities that inspire youth, honor role models, and encourage creativity and problem solving. It comprises two major components: a series of events held at MIT over two days that serve as a capstone for InvenTeam students and as training for prospective InvenTeam educators and a celebration of the Lemelson-MIT Student Prize winners. As a new

addition to the event, LMIT held a series of workshops for student prize winners (e.g., financing an invention or business). The two days included presentations by InvenTeam students and a public showcase of inventions from InvenTeams and Lemelson-MIT Student Prize winners. LMIT's faculty director, Professor Michael Cima, presided over the awards ceremony on June 19. Rob Schneider, Lemelson Foundation senior director of strategy, attended EurekaFest and spoke on behalf of the foundation.

LMIT discontinued its partnership with the Boston Museum of Science on "Duck 'n Hover," a daylong design challenge held each year at the museum on the Saturday after EurekaFest. Instead, InvenTeams participated in a mini-make-a-thon challenge on the MIT campus on June 21.

Lemelson-MIT Student Prize winners were featured in a short video that included two-minute descriptions of their winning inventions. The winners also watched and asked questions during InvenTeams' presentations. Excite Award recipients (who were finalists for 2019–2020 InvenTeams grants) participated in active learning workshops and learned about the InvenTeams experience from teachers and students. Surveys were conducted at the end of the event to collect information on InvenTeam students' and educators' experiences.

New this year, an invention education open house was hosted at EurekaFest with 33 attendees working in the philanthropy, business, education, and nonprofit sectors. The goals of the open house were to create awareness of LMIT's invention pathway and to establish dialogues and potential partnerships.

LMIT marketed EurekaFest in local events calendars, letters to local businesses, on-campus promotions intended to reach the broader MIT community, and bus shelter advertisements on Massachusetts Avenue near MIT.

Partnerships and New Activities

MIT EmTech

LMIT established a partnership with *MIT Technology Review* in 2013 to celebrate the Lemelson-MIT Prize winner at a peer-level event. Luis von Ahn was lauded on the first night of EmTech 2018, which included a presentation and fireside chat with *Technology Review's* editor; remarks from Carol Dahl, executive director of the Lemelson Foundation; and a celebratory reception. The partnership and event were deemed successful, with more than 800 people in attendance. Some 61% of MIT's C-level staff, directors, and vice presidents attended.

The 2019 winner, who was selected in early June, will be announced on September 18 and celebrated later that evening at EmTech 2019. The celebration will again include a brief presentation, a fireside chat with the editor, the presentation of the prize, and a reception.

Dewey Square Group

LMIT reengaged with the Dewey Square Group public relations firm on January 1, 2019, for a national media awareness campaign for the Lemelson-MIT Prize winner and the Lemelson-MIT Student Prize winners.

Invention Education New Activities and Opportunities

Staff spent time outlining a partnership opportunity called Partners in Invention Education as a new effort to actively engage all InvenTeam educators and K–12 administrators in a professional learning community. Community components include invention education consulting, professional development, and access to new and existing invention education resources. An annual membership fee of \$10,000 is required for access to the community. The opportunity was introduced to our list of 577 prior InvenTeam educators, administrators, and 2018 Excite Award recipients in April. It was also presented during the new invention education open house hosted at EurekaFest. The new membership effort will move through a pilot phase during 2019–2020 and kick off in 2020–2021.

The Lemelson-MIT Program continued its fee-based professional development offerings on the west coast in July 2018 (Pomona, CA) and the east coast in August 2018 (MIT campus). A new invention education webinar series was held in March and May 2019 featuring the topic of coding with JV activity guides. The purpose of these webinars was to inform educators and recipients in the Kids Code grant program in California how coding can be combined with activity guides. The first webinar was hosted by LMIT, CSforALL, and the California Department of Education, and the second, follow-up webinar was hosted by LMIT, CSforALL, and InvenTeam educator George Kirkman of Rolling Robotics, who discussed how his students used coding with JV InvenTeam activity guides.

LMIT published invention-related articles with Cricket Media in five children’s periodicals. The February issues of *Click*, *Ask*, *Muse*, *Dig*, and *Cobblestone* magazines included articles about LMIT Student Prize winners, InvenTeam projects, and InvenTeam students. LMIT personnel curated the compilation of articles in each magazine and authored three of the articles in *Dig*. LMIT also published an article in February’s issue of *Science Teacher* titled “Let’s Invent,” which detailed how invention activities can integrate into engineering design in science classrooms and included examples from previous InvenTeam projects.

As required by the SUCCESS Act, the US Patent and Trademark Office is gathering information for a report to Congress that is due in October. LMIT presented public testimony at the USPTO SUCCESS Act hearing on June 3 to inform policies that could create more diversity among inventors. In addition, written testimony (authored by Faculty Director Michael Cima and Executive Director Stephanie Couch) in response to questions was submitted to USPTO.

Continued analysis of the experiences of K–12 students who participated in the InvenTeams initiative resulted in manuscripts submitted for publication to *Technology & Innovation*. Multiple journal articles authored by LMIT staff, Executive Director Couch, Leigh Estabrooks, and others in the field were published in the journal’s special issue on invention education and in the February issue on the invention gender gap. The study findings were taken from the national InvenTeam initiative and its 15-year history of helping young people from diverse backgrounds to develop working prototypes of their inventions.

Administration

The four-year grant period with the Lemelson Foundation started January 1, 2018.

Finances and Funding

LMIT adjusted its fiscal year in 2018 to run from January 1 to December 31. The funding level from the Lemelson Foundation for this calendar year is \$3 million.

Personnel Changes

Adam Santone left his role as JV InvenTeams coordinator in May. Carolyn Blais joined as communications coordinator in January; she replaced Connie Wang, who left her role for a residential move to Seattle.

Future Plans

The Lemelson-MIT Program plans to:

- Continue to carry out program initiatives in accordance with the four-year Lemelson Foundation grant proposal
- Increase diversity in recruitment efforts for the prize program
- Cultivate additional sources of funding and partnerships that support expansion of the program
- Launch a new website redesign
- Offer ongoing professional development webinars and workshops for invention education
- Work with the city of Cambridge, schools, and other organizations to develop a “pathway to invention” for young people in Cambridge and other cities where InvenTeams and JV InvenTeams are supported in the school culture
- Continue national media campaigns to promote awareness of inventors and Lemelson-MIT Prize winners in partnership with the Dewey Square Group
- Present the award for the 2019 Lemelson-MIT Prize
- Complete recruitment efforts for 2020 student prize applicants and conduct the first round of reviews
- Select the 2019–2020 InvenTeams
- Launch JV InvenTeams Green Chemistry
- Conduct research and write new papers for publication

Stephanie Couch
Executive Director