I-STEM EDUCATION INITIATIVE

Science, Technology, Engineering, and Mathematics Education | University of Illinois at Urbana-Champaign

I-STEM EDUCATION INITIATIVE ANNUAL REPORT

January–December, 2020

ILLINOIS

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Lara Hebert, the CISTEME365 Program Coordinator, shares during the December 2nd, 2020 PD session held via Zoom.

At I-MRSEC's Remote Presentation Workshop, Jean-luc Doumont demonstrates how to use body language to direct viewers' attention to the next slide in one's presentation.

From the Desk of the I-STEM Director:

I-STEM Director Maria-Luisa Rosu

In 2020, the participation of I-STEM in the development of multiple STEM programs, units, and research efforts at Illinois continued to be essential for their success. I-STEM has also played a critical role in the achievement of STEM-related activities across Illinois, including grant applications that require an independent evaluation of STEM-related research and education programs.

The 2020 annual report highlights I-STEM involvement in the following activities:

- **Fostering and participating in dialogue among key campus and external stakeholders;**
- **Working with campus units to plan, develop, and submit external funding proposals for STEM education;**
- **Helping to improve campus STEM education programs by performing summative and formative evaluations;**
- **Enabling networking among STEM educators about effective pedagogy and program components;**
- **Disseminating information about campus STEM education programs and funding opportunities;**
- **Promoting university K–12 outreach activities.**

I-STEM aims to play a more central role in multiple aspects of STEM education at Illinois and to be better known across campus and serve as a locus of activity and as a clearinghouse in the following years for all STEM education research and evaluation, as well as a valuable source of information regarding STEM Education outreach activities both on campus and in the community. In particular, for a larger impact, I-STEM is also reconfiguring many of the existent collaborations in a stronger partnership among the involved stakeholders in STEM education: local schools and communities; the Chancellor's Office; the Colleges of ACES (Agricultural, Consumer, and Environmental Sciences), Engineering, Education, LAS (Liberal Arts and Sciences), and Veterinary Medicine; and industry partners, corporations and foundations.

We hope you will recognize the benefits of the STEM initiatives in this report and of the increased collaboration and entrepreneurship in STEM education on our campus. We are hopeful that the energy and impact of these STEM initiatives will continue to grow in 2021!

Luisa-Maria Rosu
I-STEM Director

Front cover: During a February 2020 field trip to the Materials Research Lab by Franklin Steam Academy students, I-MRSEC's Kising Kang introduces a student to Virtual Reality.
Back cover: During the December 2020 Cena y Ciencias's Cristales Escondidos en tu Cocina (Hidden Crystals in your Kitchen), post doc researcher Gonzalo Campillo-Alvarado does a hands-on activity, "Crystallization of Flavored Milk."

Kathleen Oolman displays her entry for I-MRSEC's Bake-Your-Research Contest. (Image courtesy of Kathleen Oolman.)

Contents

I-STEM COLLABORATORS

COLLEGES AND SCHOOLS

- College of Agricultural, Consumer, & Environmental Sciences
- College of Applied Health Sciences
- College of Education
- College of Fine and Applied Arts
- Division of General Studies
- Gies College of Business
- Graduate College
- Grainger College of Engineering
- School of Labor and Employment Relations
- College of Law
- College of Liberal Arts and Sciences
- Graduate School of Library and Information Sciences
- College of Media
- Carle Illinois College of Medicine
- School of Social Work
- College of Veterinary Medicine

CAMPUS UNITS

- Beckman Institute for Advanced Science & Technology
- Carl R. Woese Institute for Genomic Biology
- Center for Education in Small Urban Communities
- Center for Innovation in Teaching & Learning (CITL)
- Division of Biomedical Sciences
- National Center for Super-Computing Applications (NCSA)
- Office for Mathematics, Science, & Technology Ed. (MSTE)
- Osher Lifelong Learning Institute (OLLI)
- University of Illinois Extension–4H

EXTERNAL COLLABORATORS

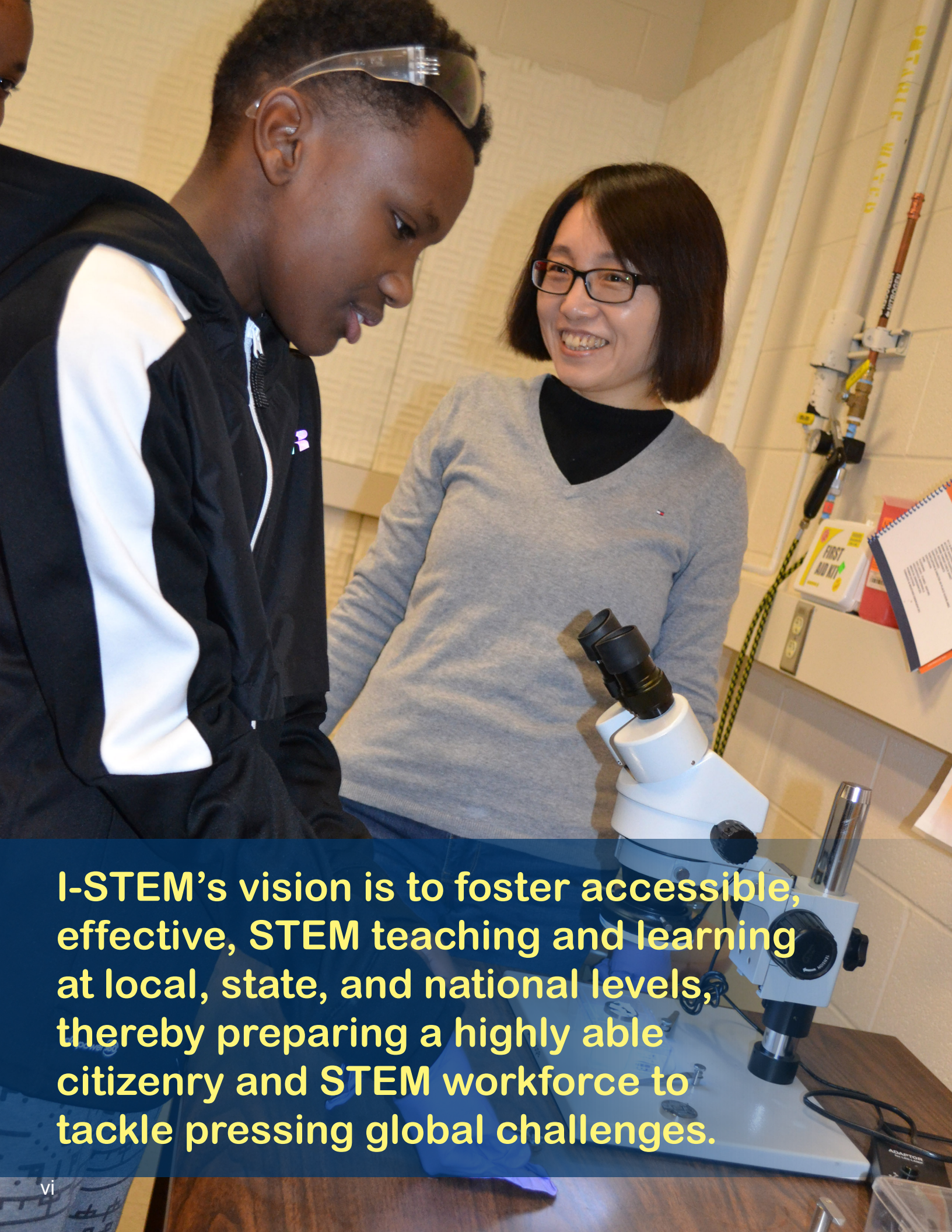
- American Chemical Society
- American Physical Society
- American Society of Materials
- American Association of Universities (AAU)
- Association of Public Land-Grant Universities (APLU)

EXTERNAL COLLABORATORS (CONT.)

- Caterpillar Foundation
- Chicago Public Schools (CPS)
- Department of Commerce & Economic Opportunity (DCEO)
- DREAM-Up
- FIRST/FIRST Lego League
- Illinois Biotechnology Industry Organization (iBIO)
- Illinois Business Roundtable (IBRT)
- Illinois Math and Science Academy (IMSA)
- Illinois Science Olympiad
- Illinois Science Teachers Association (ISTA)
- Illinois State Board of Education (ISBE)
- John Deere Foundation
- Museum of Science and Industry
- National Center for Women in Information Technology
- Office of the Governor, State of Illinois
- O'Donnell Wicklund Pigozzi & Peterson, Inc. (OWP/P)
- Physics Teacher Education Coalition
- Saint Louis Science Center
- Urban Schools Initiative
- University of Illinois at Chicago

LOCAL COLLABORATORS

- Booker T. Washington STEM Academy
- Campus Middle School for Girls
- Champaign Unit 4 School District
- Champaign-Urbana Community Fab Lab
- Champaign-Urbana Schools Foundation
- Don Moyer Boys and Girls Club
- Franklin STEAM Academy
- Next Generation School
- University Laboratory High School
- University Primary School
- Urbana School District 116



I-STEM's vision is to foster accessible, effective, STEM teaching and learning at local, state, and national levels, thereby preparing a highly able citizenry and STEM workforce to tackle pressing global challenges.

I-STEM's Mission and Goals

I-STEM (the *Illinois* Science, Technology, Engineering, and Mathematics Education Initiative) will complete its twelfth full year of operation in January 2021. I-STEM partners with STEM (science, technology, engineering, and mathematics) academic, research, and outreach units at the University of Illinois at Urbana-Champaign (*Illinois*), as well as a number of partners locally and across the state and nation. I-STEM seeks to improve the access to and quality and efficiency of STEM education activities at *Illinois* and in the state and the nation, serving as a model for other universities seeking to improve the number and quality of their own STEM education programs.

WHY FOCUS ON INNOVATIVE STEM EDUCATION?

Our world increasingly relies on science and technology to solve some of today's most intractable problems. As noted in the National Science and Technology Council report, *Federal Science, Technology, Engineering, and Mathematics (STEM) Education Strategic Plan* (2013), improving STEM education will continue to be a high priority. In addition, the character of STEM education "has been evolving from a set of overlapping disciplines into a more integrated and interdisciplinary approach to learning and skill development" (2018, Committee on STEM Education of the National Science & Technology Council). However, U.S. student interest and performance in STEM fields is in decline. Perhaps at no time in our nation's history has a strong, comprehensive system of education been so essential. As challenges mount in such areas as national defense, climate change, health, energy, economic growth, food safety and accessibility, and environmental protection, so does the demand for highly able scientists, engineers, and health professionals. As one of the nation's premier land-grant research universities, *Illinois* is committed to improving interdisciplinary, innovative STEM education at all levels. I-STEM's activities are organized around three primary goals:

Above: A Franklin seventh grader learns how to do dynamical mechanical analysis of a snack food with the help of MRL scientist Roddel Remy.

Opposite on page vi: A Franklin student learns about cutting-edge research equipment during a tour of MRL.

I-STEM seeks to improve the access to and quality and efficiency of STEM education activities at Illinois and in the state and the nation.

- **Goal 1: Foster STEM Citizenship Through STEM Communication & Public Engagement.** Cultivate sustained, coordinated partnerships to engage the public in STEM experiences early and consistently, involving university faculty and students to help meet STEM education challenges. An informed citizen should have the ability to apply critical-thinking skills needed to understand complex, STEM-related issues, to develop his or her own views, and to act accordingly. Disseminate information about STEM Education Initiatives.
- **Goal 2: Foster Undergraduate & Graduate STEM Education Reform.** Stimulate accessible and engaging undergraduate and graduate STEM programs and research experiences to promote interest and success in STEM fields, including teaching, for diverse students.
- **Goal 3: Advocate for STEM Education Innovation; Disseminate Evaluation Information.** Serve as advocates for STEM education in the state and the nation, such as at national conferences. Disseminate results regarding STEM Education evaluations.

Communication Resources

- **I-STEM Website**
  url: istem.illinois.edu/index.html.

  - **Top Stories:** Most recent web articles are organized in descending order, chronologically. **url:** http://www.istem.illinois.edu/news/topstories.html
  - **STEM Education News Story Archives:** Web articles are organized by category. **url:** http://www.istem.illinois.edu/news/archives.html
  - **Directory of Externally Funded STEM Education Projects:** This directory is organized by target audience. **url:** http://www.istem.illinois.edu/stemed/stemed.html
  - **STEM Education External Funding Opportunities, by Funder:** url: http://www.istem.illinois.edu/funding/fundingopps.html
  - **STEM Education External Funding Opportunities, by Upcoming Deadlines (by Month):** url: http://www.istem.illinois.edu/funding/upcomingdeadlines.html;

- **I-STEM-News Listserv.** url: https://lists.illinois.edu/lists/info/i-stem-news
- **I-STEM Print/Electronic Resources.** In addition to this Annual Report, I-STEM produces an annual magazine, a compilation of all of the 2020 web articles, *STEM Education at Illinois in 2020*, which will be released early in 2021 online (url: istem.illinois.edu/resources/resources.html#2020magazine), electronically, and in a limited number of hard copies. I-STEM is also producing a magazine highlighting the CISTEME365 Institute and PD, as well as I-MRSEC outreach activities which will be available electronically, as well as in a limited number of hard copies. (CISTEME365url: http://istem.illinois.edu/resources/resources.html#cisteme365; I-MRSEC url: http://istem.illinois.edu/resources/resources.html#imrsec)

OVERVIEW OF I-STEM ACTIVITIES

During its twelfth year of operation, I-STEM performed a variety of activities, both to serve as a resource to improve/increase STEM education on campus and to foster it locally, in the state, and in the nation. While many of these early in 2020 took place in person, after the advent of the COVID-19 pandemic, the majority of meetings, professional development, and outreach activities took place virtually. Major I-STEM activities in 2020 included:

1. **Fostering and participating in dialogue among key campus and external stakeholders.** Key stakeholders discussed ways to improve STEM education on campus, in the state, and throughout the nation.
2. **Working with campus units to plan, develop, and submit external funding proposals for STEM education.** I-STEM's Director, Luisa Maria Rosu, who has significant expertise in both education and evaluation of educational programs, helped to develop evaluation/education components for a number of proposals. I-STEM will evaluate these projects should they receive funding.
3. **Helping to improve campus STEM education programs by performing summative and formative evaluations.** I-STEM evaluates numerous STEM education programs, which are listed and described on pages 13–21 of this report.
4. **Enabling discourse and networking among STEM educators about effective pedagogy and program components.** I-STEM fosters discourse via meetings, presentations, and discussion groups; interactive directories; and a listserv that serves educators on campus and beyond (see our communication resources to the left).
5. **Disseminating information about campus STEM education programs.** I-STEM's website highlights effective, on- and off-campus STEM Education outreach activities, courses, and programs, such as research opportunities for various groups. STEM Education news stories are organized chronologically in descending order on the home page and in Top Stories, while the News Story Archives organizes them by category, including by various age groups, by discipline, by year, etc. The ISTEM-News Listserv informs members about current STEM education news, upcoming events, and funding.
6. **Disseminating information about campus and external funding opportunities.** The website also reports on upcoming funding opportunities that promote, foster, and improve STEM education for I-STEM's target groups, organized both by funder and by month. I-STEM's Listserv also informs members about upcoming funding opportunities (see communication resources to the left).
7. **Promoting/Organizing K–12 Outreach Activities.** I-STEM has developed an extensive network of STEM outreach projects and organizations and helped to recruit volunteers for several K–12 outreach activities during 2020. For instance, I-STEM serves as a liaison to connect schools or other groups or institutions with STEM education groups or units on campus.

I-STEM'S ROLE: FOSTER STEM EDUCATION

I-STEM's involvement in facilitating STEM education targets four audiences on campus and throughout the state of Illinois and the nation: 1) **P–20 students**, 2) **STEM educators**, 3) **undergraduate/graduate students**, and 4) **STEM education decision makers**. To accomplish our goals, I-STEM seeks to 1) foster communication and collaboration via networking and/or partnering; 2) provide funding opportunity information and assist with grant writing; 3) provide expertise on evaluation and/or education; and 4) disseminate information about campus STEM education programs and outreach.

- **Foster Communication/Collaboration.** I-STEM meets regularly with campus STEM researchers and STEM education coordinators regarding education, outreach, or evaluation components in their projects. The I-STEM-News listserv facilitates communications about STEM education news plus upcoming opportunities and events. I-STEM also connects the general public with university groups/projects who perform outreach activities and helps organize outreach events, such as campus visits.

- **Funding Opportunities.** I-STEM's website offers resources regarding upcoming STEM education funding opportunities involving our target groups: Upcoming Funding Deadlines[1] lists impending deadlines by date; STEM Education Funding Opportunities[2] organizes data by funder. The I-STEM-News listserv apprises subscribers of upcoming funding opportunities. I-STEM staff routinely research funding sites and perform maintenance of I-STEM's resources to catalog and make available current information.

- **Provide Education/Evaluation Expertise.** I-STEM serves in an advisory capacity to faculty, researchers, or units, and assists in writing education, outreach, and/or evaluation components for their proposals and/or research grants/projects. I-STEM evaluates the impact of various programs' outreach activities, teacher development, undergraduate/graduate program reform efforts, or advocacy, both to improve STEM education in a variety of settings and to improve recruitment to *Illinois*. In these roles, I-STEM gathers information about its target groups and the impact of programming on instruction, student achievement, and recruitment into STEM fields.

- **Disseminate STEM Education Program Information.** While I-STEM disseminates information to stakeholders in a variety of ways, it is primarily through the website, where new STEM education articles related to I-STEM's three goals and their target audiences (see above), and/or newly awarded funding with STEM education components are posted regularly. Routine maintenance of external funding resources involves on-going research to both post information, organized by funder and upcoming deadlines, and to send it electronically via email and the I-STEM-News listserv. Most of I-STEM's evaluation reports, annual reports, magazines, STEM education outreach flyer, and posters are available electronically, while some are also available in printed form.

[1] http://www.istem.illinois.edu/funding/upcomingdeadlines.html
[2] http://www.istem.illinois.edu/funding/fundingopps.html

Above: A Franklin STEAM Studio student with her erasable writing sketch pad during the I-MRSEC Musical Magnetism Curriculum's Destroy-A-Toy hands-on activity.

Glossary of Terms

- CPS: Chicago Public Schools
- IGL: Illinois Geometry Lab
- NIH: National Institutes of Health
- NCSA: National Center for Supercomputing Applications
- NSF: National Science Foundation
- PD: Professional Development
- RET: Research Experiences for Teachers
- REU: Research Experience for Undergraduates
- RSO: Registered Student Organization
- STEM: Science, Technology, Engineering and Mathematics
- URMs: Underrepresented minorities

I-STEM seeks to foster STEM citizenship by promoting STEM education outreach both on and off campus.

Goal 1: Foster STEM Citizenship and Public Engagement; Advocate for STEM Education

FOSTER STEM CITIZENSHIP AND PUBLIC ENGAGEMENT

✦ **Increase egagement with STEM in Illinois' STEM teaching and learning, teacher preparation, workforce, and STEM pipeline and mainline.**

I-STEM worked with programs designed to increase student interest in STEM careers, strengthen the state's STEM pipeline, and foster STEM workforce development (see programs I-STEM evaluates, pages 13–21). For instance, I-STEM's director, Luisa Maria Rosu, worked closely with the Carle Illinois College of Medicine's Health Make-a-thons. She served as a judge in the August 2020 Make-a-Thon. Also, I-STEM was supposed as well to evaluate the efficacy of Make-a-thons activities/initiatives since the initiative has started. However, due to COVID-19, this was put on hold.

✦ **Identify/support STEM education reform projects at *Illinois.***

I-STEM identifies and catalogs *Illinois'* current external funding projects, as well as potential resources. As part of this, I-STEM reports on many of these in the Current STEM Ed Highlights section of I-STEM's home page, the News section, and STEM Ed Projects section of I-STEM's website (see page 2). Regarding identifying potential resources for STEM education reform, I-STEM lists potential funding resources in the Funding Opportunities section of the website, plus routinely sends out upcoming funding opportunities via I-STEM's listserv (see page 2).

✦ **Evaluate STEM outreach activities.**

To improve the impact of *Illinois*' STEM outreach activities, I-STEM assesses programs by systematically collecting data on participant and school demographics, satisfaction, and impact on STEM interest and content knowledge. These data also report on the degree to which these STEM outreach activities are easily accessed by families and educators, extend across grade levels, align with school needs, and attract demographically diverse participants. (Table 1 to the right shows the STEM education programs I-STEM evaluated in 2020.)

Above: Summer 2020 I-MRSEC REU participant Diana LaFollette. (Image courtesy of Diana LaFollette.)

Opposite on page 4: During Cena y Ciencias at Dr. Preston Williams Elementary, Felipe Menanteau does a blowtorch demonstration about high-temperature-proof materials.

Table 1: Outreach Programs I-STEM Evaluated in 2020

Program	PI/CoPI/ Program Director(s)
Frontiers in Biomedical Imaging REU	Marina Marjanovic Andrew Smith
CISTEME365	Lynford Goddard
Cyberinfrastructure Program	Daniel LaPine
I-MRSEC	Nadya Mason
INCLUSION REU	Daniel Katz
Mathways	Jeremy Tyson
SING	Ripan Malhi
T35 SRTP	Lois Hoyer
WE CAN REU	Paul Davidson Michelle Green

.Above: Wolcott science teacher Kenny Bae does a hands-on activity during the CISTEME365 Institute. (Image courtesy of Kenny Bae.)

ADVOCATE FOR STEM EDUCATION & DISSEMINATE EVALUATION FINDINGS

✦ **Network to advocate for funding, incentives, and programmatic support for STEM education.**

In 2020, I-STEM staff members continued to network at the local, state, and national levels to promote STEM education and advocate for STEM education programs and resources.

On the local level, I-STEM staff periodically met with campus administration and researchers from various colleges or departments at unit- and campus-level meetings.

On the state, national, and international levels, I-STEM'S Director, Dr. Luisa-Maria Rosu, presented at a number of conferences where she discussed I-STEM's role in STEM education at the University, including the various evaluations I-STEM performs and its outreach activities.

✦ **Increase the number of underrepresented students who enter the STEM pipeline/graduate from *Illinois* in STEM.**

To meet the challenges our society faces today, it is critical that the diversity of STEM creativity be fostered by engaging diverse citizens who are well-informed, active participants in society. Thus, implicit in I-STEM's vision of preparing a diverse STEM workforce is an emphasis which has increasingly gained importance over the last several years—that the university safeguard the multiplicity of perspectives and thinking in classroom, laboratories, and workspaces by increasing the number of students from underrepresented groups who enter the STEM pipeline. One way this may be accomplished is via outreach activities that specifically target K–12 underrepresented population groups, including minorities and women.

Thus, I-STEM collaborates with both campus and off-campus programs which specifically seek to engage talented P–20 students in order to increase the number of underrepresented students who both enter the STEM pipeline and eventually graduate from *Illinois* in STEM fields. These groups target schools (both local and throughout the state, including Chicago Public Schools) as well as other STEM education organizations. One way I-STEM addresses this emphasis is through its evaluation of STEM education programs with similar goals. For example, the CISTEME365 program (see pages 13–16) for which I-STEM'S Director, Dr. Luisa-Maria Rosu is co-PI, focuses on schools with high populations of students underrepresented in STEM. Plus, I-MRSEC (see pages 17–20) has outreaches to local schools with high populations of underserved students. Another program I-STEM evaluated in 2020, Mathways, seeks to ensure retention of students underrepresented in math.

I-STEM collaborates with both campus and other, off-campus programs which specifically seek to engage talented P–20 students in order to increase the number of underrepresented students who both enter the STEM pipeline and eventually graduate from Illinois in STEM fields.

Goal 2: Foster Undergraduate and Graduate STEM Education Reform

UNDERGRADUATE/GRADUATE STEM EDUCATION REFORM ACTIVITIES

✦ **Improve undergraduate STEM courses to increase accessibility, engagement, and success.**

I-STEM continues to work with campus undergraduate STEM educational reform activities in order to reduce attrition and increase student performance in introductory STEM courses and to increase graduation rates for STEM majors, especially students from underrepresented groups. In meetings with faculty, I-STEM personnel address research findings, best practices, and effective pedagogy and models in STEM teaching and learning, especially around increasing diversity and performance of underrepresented groups.

✦ **Evaluate and analyze undergraduate and graduate STEM education projects, such as courses, workshops, and research activities.**

I-STEM identifies strengths and gaps in campus STEM academic programs to assist in developing effective, scalable, and sustainable STEM education models. STEM departments have implemented both campus- and externally-funded reform projects. In 2020, I-STEM conducted evaluations of several of these, including several REUs.

Research Experiences for Undergraduates (REUs). REUs have been found to increase the number of students choosing STEM careers. I-STEM evaluated four summer research experience programs for undergraduate students in 2020. Two were official REU sites funded through the National Science Foundation's REU program and engaged a number of students in research. These included the Biomedical Imaging REU and NCSA's Inclusion REU (see pages 13 and 20, respectively). I-STEM also evaluated a USDA-funded ELI REEU: WE CAN. In addition, I-STEM evaluated the I-MRSEC REU as part of its evaluation of its STEM Education components (see pages 19 and 20, respectively).

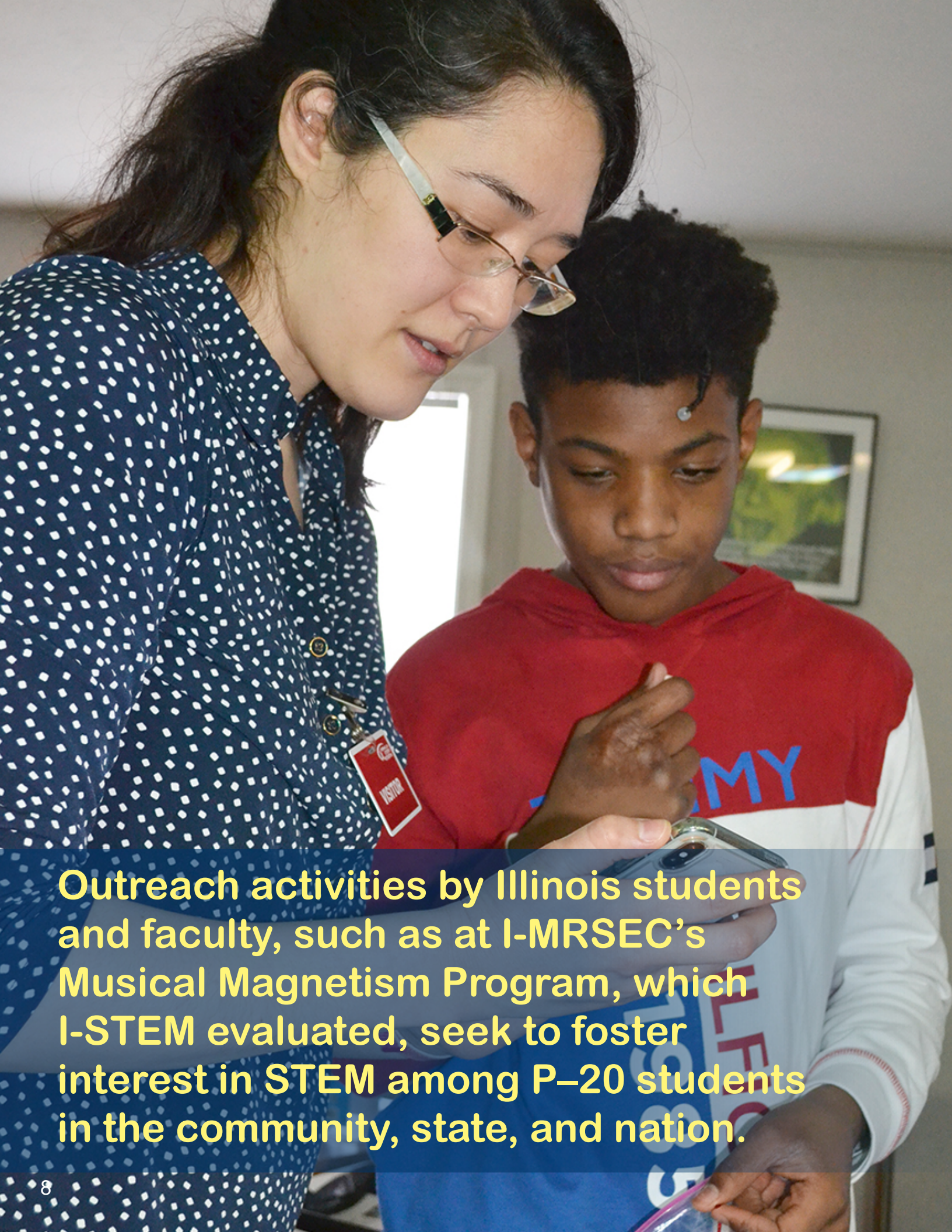
✦ **Increase external funding to improve undergraduate and graduate STEM education.**

To ensure adequate funding to support undergraduate and graduate STEM education reform for consistent, sustained, high-impact programming, I-STEM encourages units to apply for educational improvement resources from major external funders. In 2020, I-STEM apprised faculty of relevant funding sources via a variety of mechanisms, such as upcoming funding opportunities disseminated both on the I-STEM website, as well as through the I-STEM-News Listserv (see page 2).

I-MRSEC REU undergrad Angela Pak. (Image courtesy of Angela Pak.)

Table 2: Selected Undergraduate/Graduate STEM Education Programs I-STEM Evaluated in 2020

Project (Funder)	PIs
Frontiers in Biomedical Imaging REU (NSF)	Marina Marjanovic Andrew Smith
I-MRSEC REU (NSF)	Nadya Mason
Inclusion REU (NSF)	Daniel Katz
T-35 Summer Research Training Program (SRTP [NIH]	Lois Hoyer
WE CAN REU (USDA ELI REEU)	Paul Davidson



Outreach activities by Illinois students and faculty, such as at I-MRSEC's Musical Magnetism Program, which I-STEM evaluated, seek to foster interest in STEM among P–20 students in the community, state, and nation.

Goal 3: Promote P–20 University-STEM Partnerships

STEM COMMUNICATION AND PUBLIC OUTREACH

Following are the types of STEM communication and public outreach activities I-STEM was involved with in 2020. Partners/projects that I-STEM staff collaborated with, evaluated, or disseminated information about are included in the listing that begins on page 13.

✦ Disseminate information about campus STEM education outreach activities.

Illinois colleges, units, faculty, and student organizations hosted numerous STEM Education outreach activities in 2020. I-STEM prominently displayed information about many of these via its website, listserv, and in printed or electronic materials, including this annual report and I-STEM's annual magazine, *STEM Education at Illinois in 2020,* which features articles published on our website throughout the year about STEM education activities by *Illinois* researchers, staff, and students. Website news articles are published under Top Stories[3] and Archives.[4] Information for those seeking to participate in outreach activities is organized by stakeholder groups: *P–20 teachers*[5] who seek professional development or to reinforce classroom instruction with additional activities, and parents and/or students seeking STEM education opportunities via *summer camps*[6] or *academic year activities.*[7] I-STEM continued to develop its STEM Education Outreach Groups webpage[8] that lists outstanding STEM education outreach groups/programs, many of which I-STEM evaluated, collaborated with, and/or featured on its website in 2020.

✦ Work with campus STEM Education sites/outreach groups.

I-STEM works with campus STEM Education sites to promote STEM outreach activities, both campus visits and/or off-site activities that span all age ranges (elementary, middle, and secondary school students) and demographic groups. I-STEM staff often serve as a liaison between campus groups, schools, and other organizations, to increase recruitment of students not engaged with STEM outreach and to boost outreach activities, especially for primary and middle school students.

– In 2020, I-STEM continued to develop a list of campus outreach groups, including *Illinois* projects, faculty/researchers and their labs, and student organizations that conduct outreach activities, with the goal of creating a list that both university and off-campus groups can access to engage groups to perform STEM outreach activities. Many of these occur on campus, while some feature *Illinois* personnel volunteering in schools and at other informal educational settings.

I-STEM Website STEM Education Resources

- STEM Education Top Stories
  [3]http://www.istem.illinois.edu/news/topstories.html
- STEM Education Story Archives
  [4]http://www.istem.illinois.edu/news/archives.html
- Resources for P-20 Teachers
  [5]http://www.istem.illinois.edu/resources/goal2resources.html#teacherdevelop
- Resources for P-20 Students
  [6]http://www.istem.illinois.edu/resources/goal1resources.2.html#summercamps
  [7]http://www.istem.illinois.edu/resources/goal1resources.2.html#acadyear
- STEM Ed Outreach Groups
  [8]http://www.istem.illinois.edu/resources/stem-ed-outreach2.html

Opposite on page 8: As a part of as Part of I-MRSEC's Musical Magnetism Program at Franklin STEAM Academy, Virginia Lorenz shows a seventh grader a YouTube video of someone who created a large art project using materials that react to UV light.

Below: Children at Cena y Ciencias watch I-MRSEC researcher Felipe Menanteau perform a demonstration about heat and temperature.

Above: An eight-year-old participating in the November 2, 2020 Virtual Cena y Ciencias (CyC) does the hands-on activity about surface tension on water.

Top right: A Franklin STEAM Academy seventh grader looks through a microscope during the school's February 2020 field trip to MRL as part of I-MRSEC's Musical Magnetism curriculum.

Bottom right: During her November 2nd CyC presentation, Marilyn Porras-Gómez, a third-year Materials Science and Engineering Ph.D. student, shows how pepper sprinkled on water on a plate floats on the top due to surface tension.

Types of outreach events employed include: after-school programs, Saturday events, mentoring, one-day or weekend campus visits, summer camps, research experiences, and internships. (Note, due to COVID-19, some of these types of events were unable to take place in person; however, many groups were able to rework their programs to be held virtually.)

While our STEM Outreach Groups database is by no means comprehensive, I-STEM staff regularly add groups to the database, which contains the group's name (and acronym), website url, contact information, targeted age groups, plus outreach programs/activities each performs/sponsors. I-STEM's Education Outreach webpages include an alphabetical list of campus outreach groups, located at: http://www.istem.illinois.edu/resources/stem-ed-outreach2.html, plus a more comprehensive database located at http://www.istem.illinois.edu/resources/stem-ed-outreach.html.

I-STEM works with campus groups seeking to engage in STEM education outreach activities, serving as an informal liaison to apprise them of outreach opportunities and aproaching many directly to help with I-STEM campus visits by various groups.

STEM TEACHER TRAINING, RESEARCH, AND PROFESSIONAL DEVELOPMENT IMPROVEMENT

Above: CISTEME365 educator, Dr. Coleman, a CS teacher at Richard T. Crane Medical Preparatory School

Below: CISTEME365 PI Lynford Goddard shows a video about soldering prior to having participants do the hands-on activity during the December 2nd, 2020 Professional Development session.

✦ Increase external funding for teacher preparation and professional development.

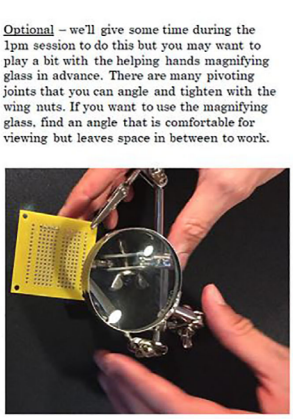
In 2020, I-STEM worked with several units who were submitting STEM teacher development proposals to funding agencies. I-STEM encourages faculty writing proposals to incorporate existing campus teacher development programs into them as a way to sustain and institutionalize these teacher preparation and professional development programs. I-STEM also encourages K–12 school districts to take advantage of campus professional development (PD) resources.

✦ Evaluate STEM teacher training and professional development projects.

In 2020, I-STEM evaluated the CISTEME365 institute which trained K–12 educators in how to promote equity among students (see pages 13–15). I-STEM also evaluated I-MRSEC workshops aimed at improving scientific communication among professors, researchers, and students. I-STEM supported these activities by providing on-campus evaluation services via the engagement of state-of-the art STEM program evaluation models, both on campus and in coordination with external evaluators.

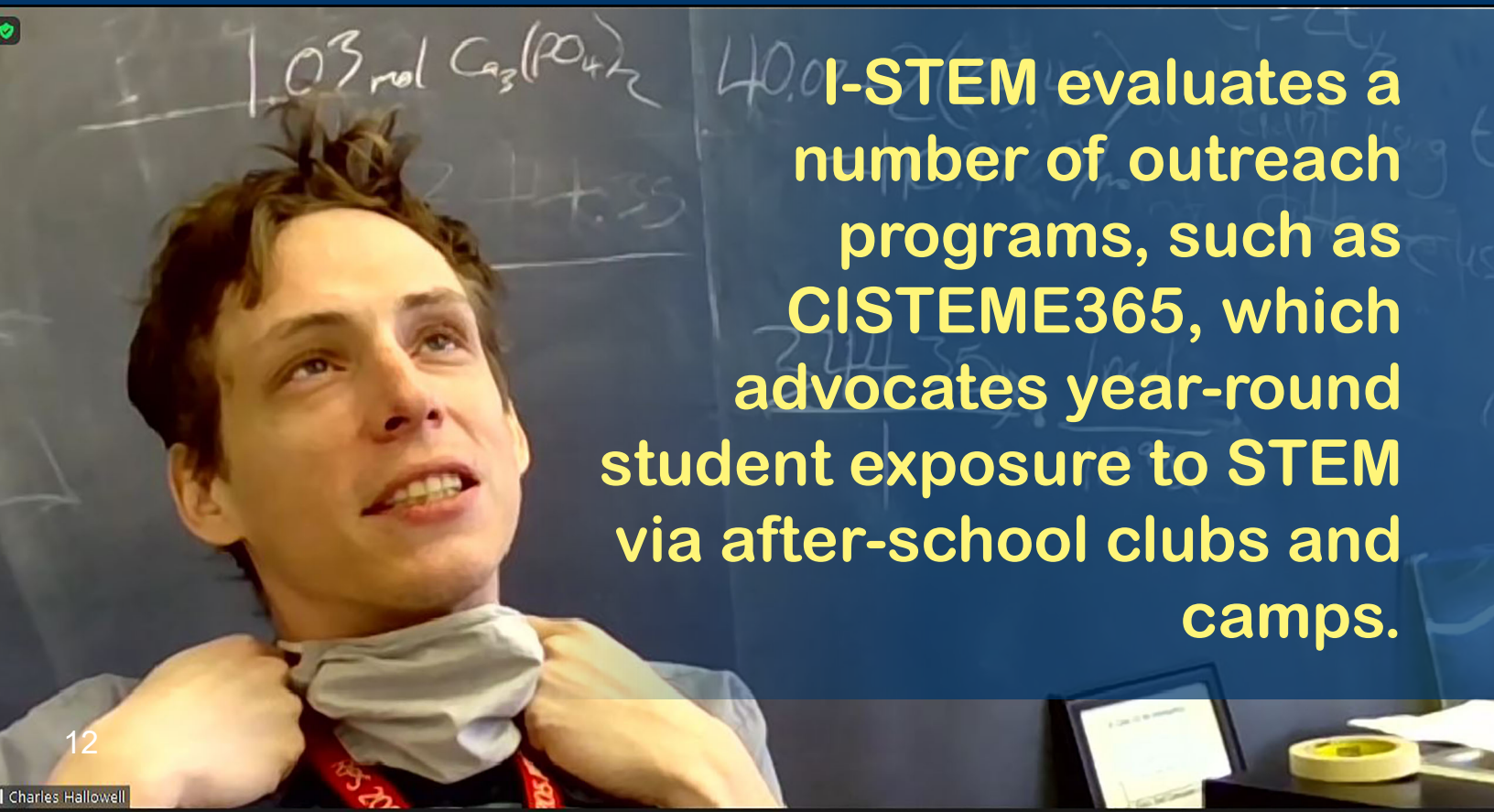
✦ Disseminate information about STEM teacher professional development and research experiences.

I-STEM works to disseminate information about current campus STEM teacher professional development programs that offer workshops and training and work to improve STEM teacher retention, reduce out-of-field teaching, and increase student performance. These programs provide a variety of resources, including induction and mentoring; graduate disciplinary coursework and degree options; leadership development; and research experiences.



I-STEM posts web articles reporting on these programs' activities in its STEM Education News section; for STEM educators seeking these types of activities, I-STEM posts information about upcoming STEM teacher PD and research experience opportunities in its resources section. Information about I-STEM web articles plus upcoming PD and research opportunities are also sent to interested stakeholders via I-STEM's listserv. (See page 2 for communication resources.)

I-STEM works to disseminate information about current campus STEM teacher professional development programs.



I-STEM evaluates a number of outreach programs, such as CISTEME365, which advocates year-round student exposure to STEM via after-school clubs and camps.

STEM Education Programs/Initiatives I-STEM Evaluated in 2020

Following are the individual projects for which I-STEM performed evaluations in 2020, as well the national center, I-MRSEC, for whom we evaluated several components.

- **Discoveries in Biomedical Imaging REU.** A continuation of the Bioimaging REU, the Discoveries in Biomedical Imaging REU is a 10-week summer program of team-based research which integrates social and professional activities to supply a multi-tiered mentoring strategy. Participants are encouraged to develop a network of role models, mentors, and peers to support and encourage their transition to graduate school. This REU's objective is to exploit the unifying link between bioscience, discovery, and bioimaging, an inspirational centerpiece for the *Illinois* campus. This REU targets undergraduate students from underrepresented populations. I-STEM's 2020 evaluation found that the program components with which participants were most satisfied included their research projects, professional development/supplemental programs, and networking opportunities.

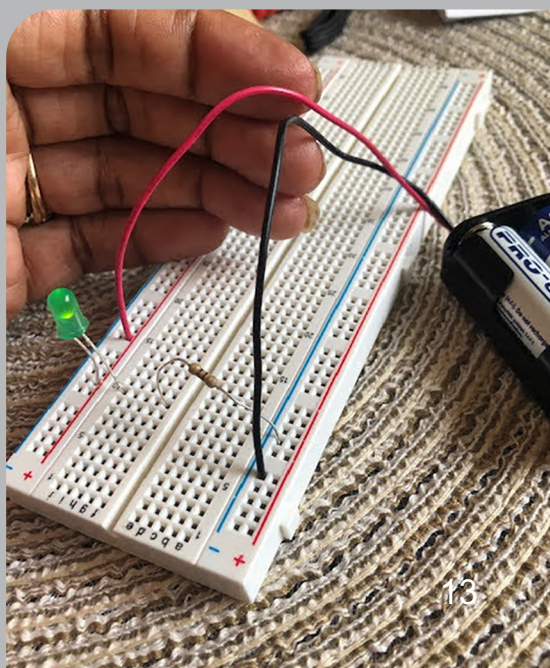
- **CISTEME365.** Catalyzing Inclusive STEM Experiences All Year Round (CISTEME365), a three-year, NSF-funded program in its second year, hypothesizes that experiences with cutting-edge technology must exist all year 'round to effect significant improvement in students' grasp of STEM (Science, Technology, Engineering, and Math). An initiative of the University of Illinois' Grainger College of Engineering, in partnership with NAPE (the National Alliance for Partnerships in Equity), CISTEME365 seeks to provide year-round opportunities via STEM clubs and university-hosted summer camps that enable middle and high school students, especially those underrepresented in STEM, such as females, underrepresented minorities (URMs), and/or low-income students, to participate in sustained, intensive, hands-on STEM learning experiences in order to build technical knowledge and ability and to offer insights into different STEM careers.

  The program is structured to provide students support via three pillars. The first is each school's IDEA (Inclusion, Diversity, Equity, and Access) team, ideally comprised of at least three members: a teacher, a counselor, and school staff member. The goal is to provide students with support at the schools through people who are passionate about providing STEM-related opportunities for their students. The second pillar is the STEM club itself, where students have learning opportunities about electrical and computer engineering through teaching, videos, and hands-on activities. The third is scholarships available to STEM club members that provide students with additional, high-quality STEM experiences—an immersive exploration of other engineering fields through Illinois' summer camps. In addition to the three pillars, the PI Lynford Goddard believes that for STEM clubs to succeed, both administrative staff and the teachers at the school need to be committed to the program.

Above: Englewood STEM High Early College and STEM Program Manager Tasha Henderson does a hands-on activity as part of the CISTEME365 Institute. (Image courtesy of Tasha Henderson.)

Below: Close-up of Tasha Henderson building a circuit. (Image courtesy of Tasha Henderson.)

Page 12: Top: Esmerelda Soto from Marine Leadership Academy shares during a CISTEME365 PD session. Bottom: Roosevelt chemistry teacher Charles Hallowell interacts with fellow participatns during a CISTEME365 PD session.

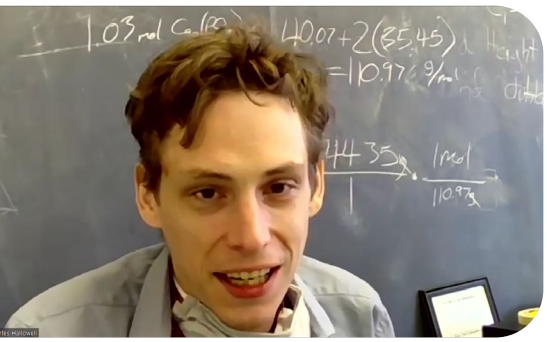


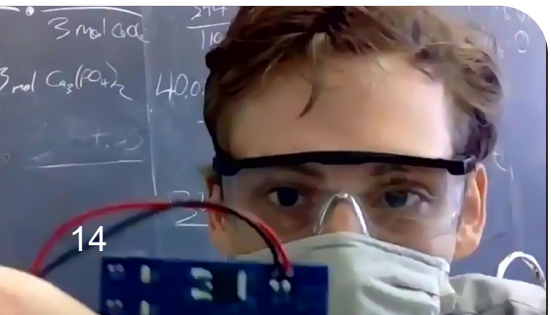
Above: A workshop participant interacts with Lynford Goddard about a soldering issue during the hands-on activity portion of CISTEME365's PD session on December 2nd, 2020.

Bottom right: In a video, PI Lynford Goddard demonstrates how to do the circuit activity.

Immediately below: Charles Hallowell, a Roosevelt chemistry teacher, shares with CISTEME365 educators during the December 2nd, 2020 PD session.

Bottom left: Hallowell exhibits the soldering he's completed during the PD session.



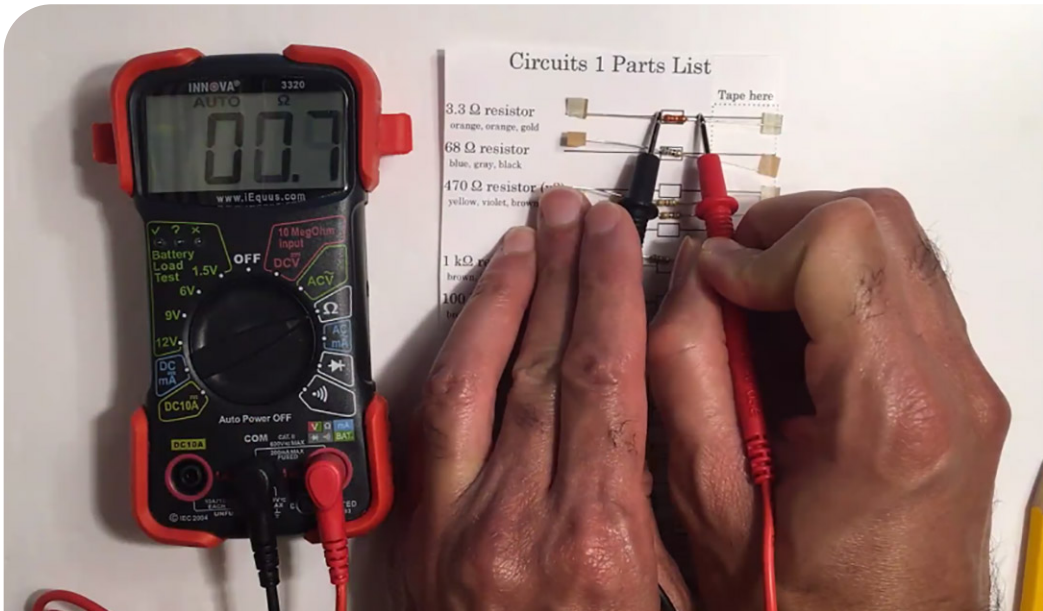


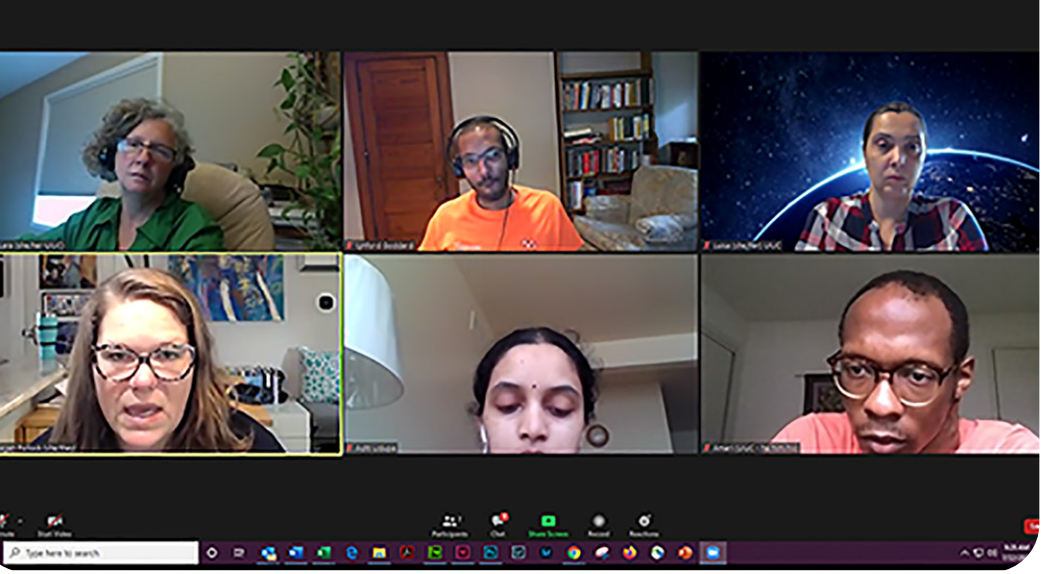
Regarding the first pillar, teachers who are passionate about STEM, the project provides resources to teachers via a summer learning institute combined with a school-year networked improvement community (NIC) for school counselors and teachers.

The goal of the program's CISTEME365 Virtual Institute, held for five days from July 20–30 during the summer of 2020, was to equip educators to give students quality, informal learning opportunities outside of the classroom. Teams from eight different schools joined the program in order to either form or bolster already-existing clubs that pique the interest of under-represented students in STEM, with the long-term goal of increasing the diversity in STEM. The eight new schools comprising the year two cohort, which were mostly from the Chicago area, included Richard T. Crane Medical Preparatory, DeVry University Advantage Academy, Englewood STEM High, Marine Leadership Academy, Jane A. Neil Elementary, Roosevelt Community Education Center, Daniel Hale Williams Preparatory High, and Wolcott College Prep. Also participating were two educators from John M Smyth IB World Elementary, one of the five schools in last year's cohort who had received similar training. Of those five schools, four had implemented STEM clubs (the outbreak of the COVID-19 pandemic significantly hindered one school's efforts.)

Virtual Institute instruction was comprised of Zoom meetings, videos, printed materials, and Institute participants doing hands-on activities using materials from kits that had been mailed to them.

Like last year, educators are receiving a stipend of up to $1,200 per team member. However, the main difference in this year's Institute compared to last year's was that it was virtual; rather than participants gathering on campus, everything was offered on-line. Plus, leadership significantly restructured the institute itself. So while last year's in-person event was from 8:30 AM to 5:00 PM, with a lunch break, and was for two weeks straight, this year's sessions were for five days over a two-week period, and only five and a half hours of content from 8:30 AM to 3:00 PM with more breaks in between, essentially shortening the day because of the difficulty of processing all the material during an eight-hour zoom meeting. In addition, because the Institute is virtual, they weren't able to do some of the things that they did last year, like tours of the ECE Building's teaching lab space.





Top left to bottom right: CISTEME365 leadership team members; Lara Hebert, Lynford Goddard, Luisa Rosu, Meagan Pollock, Aditi Udupa, and Amari Simpson participate in a Zoom session during the summer 2020 institute.

Another change this year is that the CISTEME365 team set clear expectations regarding what participation in the program means—that it's more than just a few sessions of professional development. They underscored expectations regarding launching a STEM club at the school, plus why counselors participate and must learn the materials. Counselors need to believe underrepresented students can succeed in STEM, rather than directing them toward non-STEM areas.

Plus, due to COVID-19, as a companion to the textbook, CISTEME365 staff created tutorial videos to go along with the content. Though the textbook lays out the activities step by step, sometimes in remote environments, either students or instructors need questions answered in order to do the activities on their own.

One additional component added this year: a staff member who is holding office hours for the STEM clubs and the teachers during the school year. Based on feedback from last year, teachers and counselors wanted the opportunity to work with someone while doing the activities during the club itself or while preparing for the activities.

Other than those changes, much of the content was similar to last year's. For instance, to ensure that schools' IDEA Teams were equipped to promote diversity, Meagan Pollock once again provided training on equity, labels and stereotypes, bias, and self-efficacy. Regarding labels, she addressed how they can influence educators' interactions with students and the impact of labels on students.

Also provided were sessions or brief breaks where school teams could create an Action Research for Equity Project (AREP) to broaden STEM participation through their club which they would hopefully implement in the following school year.

In addition to training the educators to promote inclusion, the institute was also structured to provide participants with skills they would need to lead cutting-edge-yet-fun, STEM-related hands-on and other activities. Project-based activities educators experienced included Design of an Experiment, Optics, Circuits, Breadboarding, Algorithms, Designing an LED Calculator, Waves and EM Signals, and Signal Processing. Many of these Goddard had perfected as part

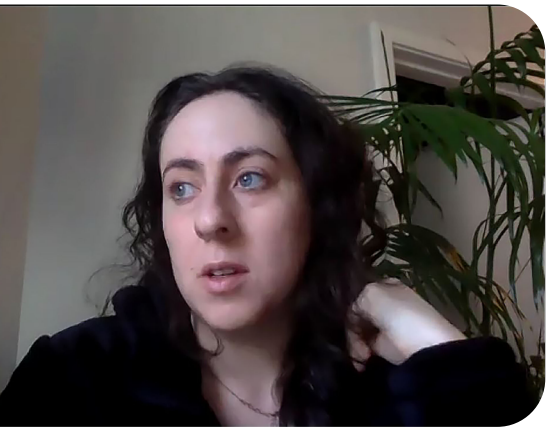
Above: CISTEME365 PI Lynford Goddard shows a video about soldering prior to having participants do the hands-on activity.

Below: During her session about stereotypes, Meagan Pollock used as examples two magazines, one for girls and one for boys, to illustrate how they shape gender stereotypes in kids.

Above: Amari Simpson leads the Engineering Design session for the December 2nd CISTEME365 PD session.

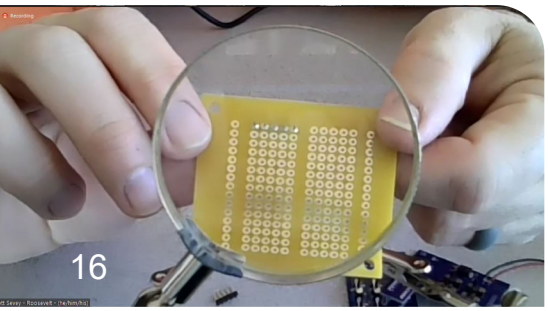
Top right: Meagan Pollock shares with CISTEME365 participants about equity and stereotype threat during a PD session.

Directly below: Geniene Minkus, a science teacher at Wolcott College Preparatory High School, participates in CISTEME365's December 2, 2020 PD.



Above: during the December 2nd CISTEME365 PD session, Roosevelt educator Scott Sevey interacts with PI Lynford Goddard.

Below: Sevey shows the soldering he'd done during Goddard's hands-on activity.



of his long-standing GLEE (Girls Learn Electrical Engineering) camp. However, due to the COVID-19 quarantine, Goddard and his team also incorporated new, internet-based activities, like web-based sound visualizers. The activity involved talks about signals and processing of data, then students can hear and visualize them on their browsers.

The Institute also provided PD related to campus admissions and mock application review, plus information about STEM careers.

While "365" implies weekly student exposure to STEM via school clubs, it also alludes to the continuous training and networking CISTEME365 provides teachers. After the summer institute, the support didn't stop. Cohort 2020–21 educators will receive additional PD once a month throughout the academic year. CISTEME365 is also promoting networking and fostering community across cohort schools this next year via a conference call and/or other online networking platforms. In addition, once the year is over, Grainger College of Engineering will continue networking/collaborating with the schools.

Re the second pillar—after-school STEM clubs—the idea was to help students understand that electrical and computer engineering is accessible to them by providing them with supplies, guidance, and ideas which will enable them to explore and try out new things related to these disciplines. Because the standard curriculum most schools use is comprised of specific learning objectives and outcomes, there isn't much flexibility for students to explore open-ended projects. STEM clubs can give students these much-needed opportunities.

Via these clubs, teachers and counselors would implement equity/inclusion training they'd received, then try out with students fun, hands-on, project-based learning activities they'd experienced.

Plus, while it was hoped that these students would succeed in STEM, program implementers also believe it's important that they fail on certain things in order to get comfortable with the idea that everything isn't always going to work, so they learn to debug and to troubleshoot.

I-STEM's role in CISTEME365 is to evaluate the program, with the goal of promoting the design and implementation of innovative STEM curriculum and instruction and to involve school policy leaders in enhancing the learning experiences for URM students.

- **Cyberinfrastructure (CI) Program.** I-STEM evaluates NCSA's Cyberinfrastructure Internship Program, which has contined online throughout 2020–21, despite COVID-19. CI's aim is to address the shortage of a workforce with specialized skills needed to support advanced CI operations. The goal of CI is to provide motivated individuals the opportunity to obtain real-world CI operational experience through a short, full-time program in an area already supported by NCSA for its own operations. Over the project's three years, CI will train 30 interns to enter the workforce as CI system engineers and system administrators. In the long-term, the program will result in study materials and best practices that can be transferred to other institutions interested in establishing similar internship programs for CI professionals. This evaluation study is collecting and analyzing data and reporting to program coordinators and NSF, evaluating key components of the program (interns and mentors training, seminars, visits and interactions with industry partners in the Research Park) to see if they are operating effectively and how and to what extent they may be improved. Furthermore, to explore the impact and value added of participating in CI activities, the evaluation surveys interns after participation in the program.

- **Expanding the Pipeline and Enhancing Education of Students Pursuing Careers in Space initiative.** The Expanding the Pipeline and Enhancing Education of Students Pursuing Careers in Space initiative is a National Defense Education Program (NDEP) STEM project funded by the Department of Defense (DoD). Located in Aerospace Engineering at Illinois, its goal is to address STEM education and outreach programs focused on space, while expanding the pipeline and enhancing education of students pursuing careers in space. This initiative will create an integrated set of educational resources focused on space and then implement these resources strategically in undergraduate classrooms, K–12 classrooms, outreach events, teacher training events, and workshops. The program officially started in October 2020, with I-STEM Director Luisa Rosu participating in weekly/biweekly leadership meetings to advise and counsel on assessment planning of their online modules.

- **Illinois Materials Research Science and Engineering Center (I-MRSEC).** I-MRSEC's mission is to perform fundamental, innovative research on understanding the dynamic properties of materials, with applications to societal needs, and to support interdisciplinary education and training of students in materials design understanding and application, particularly targeting students from underserved and underrepresented communities. The research and education goals and the associated challenges require the multidisciplinary, collaborative effort of a Center whose vision is to be a world leader in multidisciplinary materials research with broad scientific impact across many fields and to serve as a Midwestern hub of excellence in materials research, innovation, education, and outreach. I-MRSEC's science will form the basis for new technologies in electronics, information storage, photonics, and biomaterials.

  Other core I-MRSEC emphases that are part of its mission are fostering community among Materials Science researchers, as well as promoting/improving scientific communication so researchers may better share their science, both among the broader scientific community as well as to the general public.

Above: Gemima Philippe, a Public Engagement Communication Associate from the Center for Public Engagement with Science and Technology at the AAAS (American Association for the Advancement of Science) presented an I-MRSEC online workshop addressing the importance of Science Communication (Image courtesy of Gemima Philippe.)

Below: A Franklin seventh grader who's just made a necklace from special beads that react to UV light holds it up to the sunlight to see what happens.

Above: A seventh grader proudly displays the bracelet he made during Professor Virginia Lorenz's activity about light, part of I-MRSEC's Musical Magnetism curriculum.

Below: Kisung Kang prepares for Franklin students to enjoy the Musical Magnetism curriculum's Destroy-a-Toy activity.

I-MRSEC's Education, Human Resource Development, and Diversity (EHRD) program is being integrated with research and partnership activities to increase interest, knowledge, and skills for students at many levels, particularly targeting students traditionally underrepresented in STEM. I-MRSEC provides opportunities for teachers and students in rural and underserved schools to participate in materials science research and to interact with Center PIs and students. I-MRSEC will include materials science activities in Science Olympiad for the first time to stimulate interest in the field among students nationwide. The REU program seeks to transition undergraduates to STEM graduate programs or high-tech industrial jobs. An annual Materials Science Boot Camp will enhance connections between academia, industry, and national labs. I-MRSEC seeks to train graduate students and postdocs in both research and professional development to produce scientists with the skill and knowledge to push the boundaries of materials science research in industrial and academic environments.

I-STEM's work with I-MRSEC EHRD programs involves two thrusts: evaluation of EHRD activities includes evaluation planning, data collection, and analysis, and seeks to provide both formative information to guide program improvement and a summative assessment of its effectiveness and impact. Our second thrust involves dissemination of information about the Center's various programs via the website and printed materials. Following are the EHRD activities I-STEM both evaluated and reported on in 2020.

- **I-MRSEC AAAS Science Communication and Public Engagement Fundamentals Workshop.** On October 16, Gemima Philippe, a Public Engagement Communication Associate from the Center for Public Engagement with Science and Technology at the AAAS (American Association for the Advancement of Science) presented an online workshop for around 20 MRSC researchers regarding ways to improve their science communication and public engagement.

- **I-MRSEC's Cena Y Ciencias.** I-MRSEC staff, faculty, and students were involved with the Cena y Ciencias (Spanish for "Supper and Science") program for two bilingual schools: Dr. Preston Williams and Leal Elementary schools. The program exposed bilingual students, including a large percentage of Hispanic K–5 students and their families, to hands-on science activities conducted in Spanish by scientists of Hispanic heritage. Held the first Monday of every month, the CyC theme for the 2019–20 school year was Salvar El Mundo (Saving the Planet). However, due to the COVID-19 quarrantine, rather than extending through May, the last session was March 2, 2020.

  For the 2020–21 academic year, I-MRSEC held a Virtual Cena y Ciencias, which began on Monday, October 5, 2020. Because planners had to figure out a new platform, they didn't limit themselves to a specific theme, but chose to do generic "kitchen science"—science that could be done with things found easily in most homes. The number of students who participated varied; for instance, on the October 5th session, 20 families were logged in, with some families having more than one child participating.

- **I-MRSEC Coffee and Cookies Hour.** On Friday, October 2, 2020, I-MRSEC held a virtual Coffee and Cookies Hour to encourage collegial collaboration and facilitate socialization among researchers, yet abide by COVID-19 social distancing mandates. Around 16 I-MRSEC researchers participated. In conjunction with the coffee & cookies hour was I-MRSEC's first-ever "Bake Your Research Contest," open to all levels of I-MRSEC folk, including students, postdocs, and faculty. The challenge was to cook or bake something that in some way represented one's research.
- **I-MRSEC Delivering Your Presentation Remotely Virtual Workshop.** The 2-hour June 30th virtual workshop, presented by Principiae's Jean-luc Doumont, taught 87 I-MRSEC researchers how to deliver remote presentations. I-STEM's evaluators found that the online presentation was useful and well-received.
- **I-MRSEC Musical Magnetism Curriculum.** The goal of I-MRSEC's "Musical Magnetism" curriculum was to expose Franklin STEAM Academy eighth graders to materials science and magnetism, but also to another of the center's main emphases: scientific communication. Lesson plans embraced a medium today's kids probably like: hip hop or rap. So, after Illinois researchers, students, and staff had exposed the students to multidisciplinary lessons in several related areas, the kids teamed up to create then present raps about specific areas of magnetism.
- **I-MRSEC Virtual REU Program**. Eleven undergraduate students participated in I-MRSEC's virtual REU from May 27th through July 31st, 2020. Due to COVID-19, the REU didn't consist of in-person interactions with researchers while conducting research in a lab. However, just like the in-person program, students still conducted research and gained valuable experiences while earning a stipend. They conducted research mentored virtually by an I-MRSEC faculty member and/or a Ph.D or post-doc researcher, then presented their results at I-MRSEC's Undergraduate Symposium. I-STEM's evaluation found that the REU, although virtual, went pretty well considering the circumstances. The biggest challenges were having the REU students get to know one another, professional networking, and interactions with the faculty mentors.

Top left: Preethah Sarkar, a PhD student in Professor Nadya Mason's group, with the baked representation of her research for I-MRSEC's Bake-Your-Research Contest. (Image courtesy of Preethah Sarkar.)

Above: Onur Tosun shows off his winning entry: "Graphene on Nanospheres in a Hall Bar." (Photo courtesy of Onur Tosun.)

In the two images below: During the "Delivering Your Presentation Remotely Virtual Workshop," Principiae's Jean-luc Doumont demonstrates the result of not giving oneself enough space for hand gestures.

Above: INCLUSION REU undergrad Hector Cruz, a 5th year Computer Engineering senior from Interamerican University of Puerto Rico-Bayamon. (Image courtesy of Hector Cruz.)

. Below: REU INCLUSION undergrad Xiyi Chen, a rising Computer Science senior at the University of Maryland. (Image courtesy of Xiyi Chen.)

- **INCLUSION REU.** I-STEM evaluates the NSF-funded INCLUSION (Incubating a New Community of Leaders Using Software, Inclusion, Innovation, Interdisciplinary, and OpeN-Science) Research Experience for Undergraduates (REU). The 3-year grant was to end in 2019, however PIs obtained a no-cost extension for a fourth year (2020). The initial objective was to train pairs of students in software skills, leveraging and building upon state-of-the-art lessons, with the idea that their work might lead to research advances, and their projects contribute open source tools to the larger scientific community, leading to additional advances.

  Another original INCLUSION goal was to provide interdisciplinary training for undergraduate researchers to facilitate their professional growth, and prepare them for the STEM workplace, while increasing diversity in the STEM pipeline through engagement in research. Students were to work with pairs of mentors on interdisciplinary research projects to develop and use open source software across a wide variety of STEM fields.However, given the limited funds in 2020 due to it being a no-cost extension year, only five students were trained in the summer, and each student worked a project individually with one mentor. Also, no group projects had more than one REU student or more than one mentor, hence there was no interdisciplinary research. Also, one student was from last summer (2019), and two students were from the same university in Puerto Rico.

  I-STEM evaluation data report that the REU went well, despite the pandemic. The five students generally reported a positive and satisfying experience over the summer.

- **Mathways.** Mathways is an NSF-funded program that seeks to create a pathway to encourage underrepresented minorities (URMs) to participate in collaborative mathematics research, mentoring, and instruction. This is achieved by recruiting *Illinois* students in the Merit program, which provides supplemental services to URM students in STEM fields, to the *Illinois* Geometry Lab, a math research lab. Mathways students gain opportunities to conduct and present research, as well as attend summer camps and other outreach programs. The Mathways evaluation currently focuses on. the program's implementation, effectiveness, impact, and sustainability.

- **NASA Artemis.** The Artemis Teaching and Resource Availability Awards project, funded by the National Aeronautics and Space Administration (NASA), is located in Aerospace Engineering on campus and officially began in October 2020. Artemis will develop learning resources, enabling self-study of topics and technologies directly relevant to Artemis, such as habitats, robotics precursor missions, and exploration spacecraft. Products will be disseminated via self-study online learning. This team includes a co-investigator from Northern Illinois University in DeKalb, and a broad partnership of contributors spanning the state of Illinois. In addition, students from seven additional states—Iowa, Indiana, Michigan, Minnesota, Missouri, Ohio and Wisconsin—are expected to participate in the initial evaluation of the learning resources. Regarding the evaluation, I-STEM Director Luisa Rosu participated in weekly and biweekly leadership meetings to advise and counsel on assessment planning of online modules.

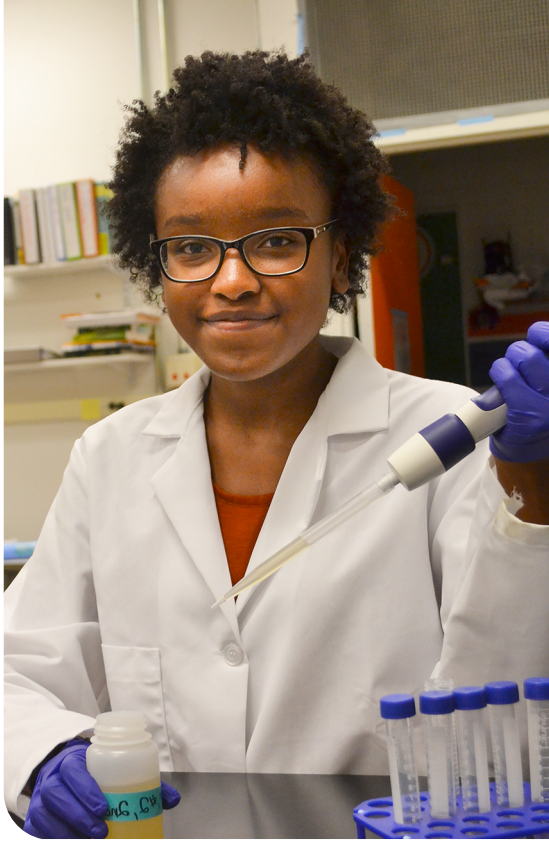
- **Summer Internship for Native Americans in Genomics (SING).** The NIH-funded SING program is a one-week workshop about the uses, misuses, and limitations of genomics as a tool for Native American communities; it also trains Native Americans in the concepts and methods currently used in genomics. The SING program was rescheduled to summer 2021 due to COVID-19.

- **T35 SRTP: Summer Training in Translational Biomedical Research:** I-STEM evaluated this 10-week, NIH-funded, Summer Research Training Program (SRTP), which seeks to foster Illinois veterinary medicine students' interest in research. Project PI Lois Hoyer matched 20 students with faculty mentors who share similar research interests. With faculties' help, students planned and conducted research projects and participated in weekly seminars to explore available careers and be trained in research ethics and compliance and scientific writing. Students contributed to an end-of-the-program poster session at *Illinois*; many also presented at the NIH Veterinary Scholars Symposium. I-STEM evaluators conducted focus groups with vet students and their mentors; the program seemed to go smoothly despite the pandemic. Some research groups were able to work outdoors with the animals.

- **USDA ELI RE EU: WE CAN REU.** The goal of the 3-year USDA ELI RE EU fellowship program, WE CAN REU, is to cultivate leaders in agriculture by providing undergraduate students with unique, multi-disciplinary skills bridging global food security, agri-ecosystems, and technology via an immersive, two-year experience. Scientific research often lacks interdisciplinary collaboration, with engineers and biologists typically isolated and working in "silos," resulting in a gap. This program aims to bridge this gap and break down cross-discipline communication barriers by bringing together undergraduates from diverse backgrounds via a 2-phase internship. Summer One provides undergrads with initial exposure and training in co-management of natural resource conservation and agricultural engineering. Summer Two fellows participate in SROP, Illinois' Summer Research Opportunities Program, where their individual interests and skills will be channeled into independent research mentored by *Illinois* faculty, with students networking with USDA personnel through seminars.

  I-STEM's evaluation seeks to provide the grant's PIs valid, useful information to guide improvement and assess program effectiveness and impact. Evaluators administered online pre and post student surveys, plus held focus groups for students, faculty/mentors, volunteers, and staff in order to understand baseline participation; retention rates; perceptions; and the experiences of all participants. Following are I-STEM's 2020 evaluation findings:

  1. Program organization and structure was well-received by participants. Participants appreciated the breadth and depth of the entire experience.
  2. Participants were highly satisfied with interaction between graduate mentors, faculty advisors, and program leadership.
  3. Participants responded that the majority of the phase I activities/ presentations were useful and that they are looking forward to the next phase.



Above: A WE CAN REU undergrad conducts research on water quality.

Below: Alondra Estrana shows off the 3-D printed "turtle" she used in her research as part of the WE CAN REU.

I-STEM RESOURCES

Above: I-STEM Director Luisa Rosu presents about I-STEM at an Extension Conference.

Below: I-STEM Graduate Research Assistant Molly Galloway.

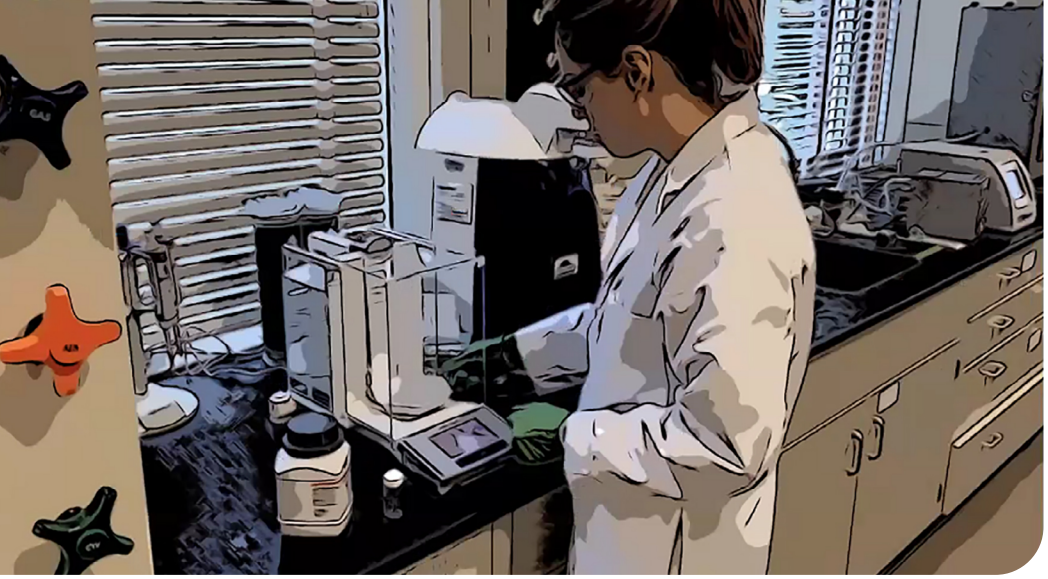
I-STEM STAFF

- Luisa-Maria Rosu, I-STEM Director. Projects: CI, CISTEME365, I-MRSEC, Mathways, NASA Artemis, NDEP: Expanding the Pipeline & Enhancing Education of Students Pursuing Careers in Space, PIRE, SRTP.
- Molly Dawn Galloway, Graduate Research Assistant. Project: Mathways, SRTP.
- Elizabeth Innes, Communications Specialist. Projects: I-STEM website, I-STEM Magazine, I-STEM Annual Report; edit, format, and publish evalution reports if needed.
- Marlon Mitchell, Graduate Research Assistant. Projects: WE CAN REU, Biomedical Imaging REU
- Maggie Phan, Graduate Research Assistant. Projects: I-MRSEC, NCSA INCLUSION REU, and SRTP.

I-STEM UNDERGRADUATE STUDENTS

Undergraduate students assisted I-STEM staff with data entry and interview transcriptions, as well as website maintenance and publication development. Students learned professionalism in a workplace setting; new skills, such as html/CSS coding; and proficiency with new software, such as SPSS, Adobe Dreamweaver, InDesign, and/or Photoshop.

- Joshua Chung (spring & fall 2020). Joshua is majoring in Architecture with a minor in Business. A senior, He hxpects to graduate in May 2021. His career goal is to work in a firm working for a non-profit organization.
- Sooah Park (spring 2020). A junior majoring in Accountancy, she hopes to graduate in 2021, with a career goal of being an accountant.
- Yuna Park (spring 2020). Majoring in Community Health, Yuna is on the Pre-Health Administration track. A junior, she plans to graduate in 2022, go to graduate school then find a job in hospital administration.



At the November Cena y Ciencias, Marilyn Porras-Gómez presents an animated segment showing her doing activities in her lab during her “Un Día en el Lab” video.

I-STEM Funding

Funding for I-STEM comes from a variety of sources. Funding for the office overhead and support staff comes from state money through the Provost’s Office. Funding for I-STEM’s director comes from state funds, as well as through externally funded projects. Additionally, much of the director’s focus is on helping faculty write proposals, which, if funded, could supply additional revenue. The communications specialist/webmaster, who is tasked with disseminating information about STEM education projects across the campus, is also funded by state funds. Many of I-STEM’s evaluators and the undergraduate students are funded through the evaluation projects themselves.

This report contains a comprehensive list of evaluation projects I-STEM worked on in 2020; some were funded externally, such as by NSF and NIH, which requires evaluations for its projects.

Above: Franklin STEAM Studio middle school student dismantes a Magnadoodle during the Destroy-A-Toy activity—part of I-MRSEC’s Musical Magnetism Curriculum conducted at the school early in 2020.

Below: STEM teacher David Amundsen from Daniel Hale Williams School describes an issue he was having while doing the soldering hands-on activity during CISTEME365’s PD session on December 2, 2020.

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