I-STEM EDUCATION INITIATIVE ANNUAL REPORT
January–December, 2015
From the Desk of the I-STEM Director:

In spite of the severe economic challenges at both the local and state levels, 2015 was an eventful year in STEM Education initiatives at the University of Illinois at Urbana-Champaign. With well-known dedication, faculty, graduate students, and undergraduates on our campus extended their research and teaching expertise by working together and participating in interdisciplinary activities to design accessible, high-quality, innovative STEM Education programs.

Concentrating our efforts to improve STEM education does not serve only to prepare the future STEM workforce, but also to respond to the interests and values of all legitimate stakeholders, in particular those traditionally not heard in the STEM education context. Technology inventions, scientific discoveries, engineering applications, and mathematical models cannot happen in a homogenously expressed environment. This I-STEM report illustrates that it is essential to have and ensure diversity of perspectives and thinking in classrooms and laboratories to maintain the vitality of STEM creativity.

We hope you will recognize the benefits of the contextually powerful STEM initiatives in this report and of the increased collaboration and entrepreneurship in STEM education in our campus. They bring new perspectives to what traditionally has been perceived as only disengaged scientific research. We are hopeful that the energy and impact of these STEM initiatives will continue to grow in 2016!

Luisa-Maria Rosu
Interim Director

Front cover: Left to right: Two SACNAS members, Brenda Andrade, a Chemistry Ph.D. student, and Sandy Perez, an undeclared undergraduate, teach Leal students about acids and bases during Cena y Ciencias.

Back cover: Vet Med student Katelyn Bagg, who staffed a booth on reptiles and amphibians at the fall 2015 Vet Med Open House, introduces visitors to her animal friend, Pepper the Snake.
## Contents

FROM THE DESK OF THE I-STEM DIRECTOR: ........................................ FRONT INSIDE COVER

I-STEM PARTNERS .................................................................................. II

I-STEM ADVISORY BODIES .................................................................. IV

I-STEM’S MISSION AND GOALS .............................................................. 1
  Communication Resources .................................................................. 2
  Overview of I-STEM Activities ........................................................... 2
  I-STEM’s Role: Foster STEM Education .............................................. 3
  Glossary of Terms ............................................................................. 3

GOAL 1: FACILITATE P–20 STEM EDUCATION OUTREACH .................. 5
  P–20 STEM Education Outreach ......................................................... 5
  P–20 STEM Education Outreach Programs ....................................... 8
  Programs I-STEM Evaluated in 2015 ................................................ 8
  STEM Education Outreach Programs .............................................. 11

GOAL 2: IMPROVE STEM TEACHER TRAINING AND PROFESSIONAL
DEVELOPMENT QUALITY ..................................................................... 17
  STEM Teacher Training/Professional Development Improvement ......... 17
    Table 2: Selected Teacher Development Programs I-STEM Evaluated in 2015 ................................................................. 17
    Table 3: Campus Research Experiences for Teachers ...................... 18
  STEM Education Teacher Training/Professional Development Programs .......................................................... 20

GOAL 3: FOSTER UNDERGRADUATE AND GRADUATE STEM EDUCATION
REFORM ............................................................................................... 23
  Undergraduate/graduate STEM Education Reform Activities ............... 23
    Table 4: Selected Undergraduate/Graduate STEM Education Programs I-STEM Evaluated in 2015 ......................................... 25
    Figure 1: Research Experiences for Undergraduates, 2005–2015 ........ 23
  Undergraduate/Graduate STEM Education Programs/Initiatives ........... 26

GOAL 4: SHAPE POLICY & ADVOCATE FOR STEM EDUCATION ............ 37
  STEM Education Policy and Advocacy Activities ................................. 37
  STEM Education Policy/Advocacy Partners, Projects, and Events ........... 40
    Figure 2: STEM Education Funding at Illinois, 2009–2015 ................ 43
  STEM Education External Funding at Illinois ....................................... 43
    Figure 3: Active External Investment in STEM Education at Illinois for 2015, by Funder ......................................................... 44
    Figure 4: Active External Investment in STEM Education at Illinois for 2015, by Campus Unit ....................................................... 45

I-STEM STAFF AND STUDENTS ................................................................ 46
  I-STEM Funding ................................................................................ 47
COLLEGES AND SCHOOLS
- College of Agricultural, Consumer, and Environmental Sciences
- College of Applied Health Sciences
- College of Business
- College of Education
- College of Engineering
- College of Fine and Applied Arts
- Division of General Studies
- Graduate College
- 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
- College of Medicine
- School of Social Work
- College of Veterinary Medicine

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

EXTERNAL PARTNERS
- American Chemical Society
- American Physical Society
- American Society of Material
- Association of Public Land-Grant Universities (APLU)
EXTERNAL PARTNERS (CONTINUED)

- Caterpillar Foundation
- Chicago Community Trust (CCT)
- Chicago Public Schools (CPS)
- Department of Commerce & Economic Opportunity (DCEO)
- 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 PARTNERS

- 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
- McClain County Unit 5 School District
- Next Generation School
- University Laboratory High School
- Urbana School District 116
I-STEM ADVISORY BODIES

CAMPUS COUNCIL OF DEANS

- Robert Hauser, Dean, Agricultural, Consumer, and Environmental Sciences
- Tanya Gallagher, Dean, Applied Health Sciences
- Larry DeBrock, Dean, Business
- Mary Kalantzis, Dean, Education
- Andreas Cangellaris, Dean, Engineering
- Kathleen Harleman, Dean, Fine and Applied Arts
- Keith Marshall, Associate Provost and Executive Director, Campus Center for Advising and Academic Services
- Fritz Drasgow, Interim Dean, Labor & Employment Relations
- Vikram David Amar, Dean, Law
- Brian Ross, Interim Dean, Liberal Arts and Sciences
- Victor Prybutok, Interim Dean, Library and Information Science
- Jan Slater, Dean, Media
- Uretz Oliphant, Interim Regional Dean, Medicine
- Wynne Korr, Dean, Social Work
- Peter Constable, Dean, Veterinary Medicine

CAMPUS ADMINISTRATION

- Timothy Kileen, President of the University of Illinois
- Barbara Wilson, Interim Vice President and Chancellor
- Edward Feser, Provost & Vice-Chancellor for Academic Affairs
- Peter Schiffer, Vice-Chancellor for Research
- Renée Romano, Vice Chancellor for Student Affairs
- Ed Ewald, Interim Vice Chancellor for Institutional Advancement
- Wojtek Chodzko Zajko, Associate Provost & Dean, Graduate College
CAMPUS INTERDISCIPLINARY UNITS
- Jennifer Eardley, Associate Vice Chancellor for Research and Interim Director, Division of Biomedical Sciences
- Gene Robinson, Director, Institute for Genomic Biology and Swanlund Chair of Entomology
- Art Kramer, Director, Beckman Institute and Swanlund Chair and Professor of Psychology and Neuroscience
- H. Edward Seidel, Director, National Center for Supercomputing Applications

I-STEM EXTERNAL ADVISORY BOARD
- José M. Torres, President, Illinois Mathematics and Science Academy
- Judy Wiegand, Superintendent, Champaign Unit 4 School District
- Donald Owen, Superintendent, Urbana School District 116
- Molly Delaney, Executive Director, Champaign-Urbana Schools Foundation

I-STEM CORPORATE ADVISORY BOARD
- Abbott Laboratories
- Boeing Company
- Caterpillar Foundation
- John Deere Foundation
- Motorola Foundation
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 (the Illinois Science, Technology, Engineering, and Mathematics Education Initiative) completed its seventh full year of operation in January 2016. I-STEM partnered with STEM (science, technology, engineering, and mathematics) academic and research units at the University of Illinois at Urbana-Champaign (Illinois), and increased the number of partners across the state and nation. I-STEM seeks to improve the access, quality, and efficiency of STEM education activities at Illinois, 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 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. 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 STEM education at all levels.

I-STEM’s activities are organized around four primary goals:

- **Goal 1: Facilitate P–20 STEM Education Outreach.** Cultivate sustained, coordinated preschool through graduate partnerships to engage students in STEM experiences early and consistently. Involve university faculty and students to help meet STEM education challenges.

- **Goal 2: Improve STEM Teacher Training & Professional Development Quality.** Revitalize STEM teacher preservice education, induction, and professional development programs that attract/prepare a diverse group of P–16 STEM teachers and promote their effectiveness, retention, life-long learning, and involvement in research.

- **Goal 3: Foster Undergraduate & Graduate STEM Education Reform.** Stimulate accessible, engaging, undergraduate and graduate STEM programs and research experiences to promote interest and success in STEM fields, including teaching, for diverse students.

- **Goal 4: Shape Policy & Advocate for STEM Education.** Stimulate partnerships with, government agencies, educational institutions, business and industry, and professional associations to understand STEM pipeline; mainline; and workforce development needs, opportunities, and challenges. Serve as advocates in the state and nation.
OVERVIEW OF I-STEM ACTIVITIES

During its seventh 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 STEM education locally, in the state, and in the nation. Major I-STEM activities in 2015 included:

1. **Fostering and participating in dialogue among key campus and external stakeholders** to discuss ways to improve STEM education on campus, in the state, and throughout the nation (see pages ii–iii for lists of I-STEM partners and pages iv–v for lists of I-STEM advisory bodies).

2. **Working with campus units to plan, develop, and submit external funding proposals for STEM education.** I-STEM personnel, who have significant expertise in both education and evaluation of educational programs, were key in the development of education and/or evaluation components for numerous proposals. I-STEM will be evaluating these projects should they receive funding.

3. **Helping to improve campus STEM education programs by performing summative and formative evaluations.** I-STEM evaluates numerous programs, which are listed and described throughout this report.

4. **Enabling discourse and networking among STEM educators about effective pedagogy and program components** via meetings, seminars, presentations, and discussion groups; interactive directories; and a listserv that serves educators on campus and beyond (see our communication resources below).

5. **Disseminating information about campus STEM education programs and funding opportunities.** I-STEM’s website plays a prominent role in highlighting effective programs/funding sources that promote, foster, and improve STEM education for I-STEM’s four target groups (see communication resources below and on page 41).

6. **Promoting K–12 Outreach Activities.** I-STEM has developed an extensive network of STEM outreach projects and organizations. I-STEM staff played a significant role in recruiting volunteers for a variety of K–12 outreach activities during 2015, as well as sponsoring campus visits by several Illinois schools.

Communication Resources

- **I-STEM Website.** Incorporates information about campus STEM education outreach activities and upcoming funding opportunities for both internal and external audiences. The STEM Education news stories and Directory of Externally-Funded Projects are organized by target audience. The STEM Education Funding Opportunities, are organized both chronologically and by funder. urls: istem.illinois.edu/index.html; istem.illinois.edu/funding/upcomingdeadlines.html; istem.illinois.edu/funding/fundingopps.html

- **I-STEM-News Listserv.** Informs campus and non-university listserv members about current STEM-education-related news, events, and upcoming funding opportunities. url: https://lists.illinois.edu/lists/info/i-stem-news

- **I-STEM Print/Electronic Resources.** In addition to this Annual Report, I-STEM produced a new magazine: 2015: The Year in STEM Education. A new outreach programs flyer is scheduled to be released in spring 2016. url: istem.illinois.edu/resources/resources.html
I-STEM’S ROLE: FOSTER STEM EDUCATION

I-STEM’s involvement in facilitating STEM education targets four goals/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 policymakers (see page 1 for descriptions). 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, upcoming opportunities and events. I-STEM also connects the general public with university groups/projects who perform outreach activities (see pages 2 and 41 for communication resources and links).

🌟 Funding Opportunities. I-STEM’s website offers resources regarding upcoming STEM education funding opportunities involving our target groups: Upcoming Funding Deadlines¹ lists impending deadlines by date; STEM Education Funding Opportunities² 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 Grant-Writing/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 assesses the impact of various programs’ outreach activities, teacher development, undergraduate/graduate program reform efforts, or policy, 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 four goals and their target groups (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. I-STEM’s evaluation reports, annual reports, magazine, STEM education outreach flyer, and posters are available electronically or in printed form.

¹[http://www.istem.illinois.edu/funding/upcomingdeadlines.html](http://www.istem.illinois.edu/funding/upcomingdeadlines.html)
²[http://www.istem.illinois.edu/funding/fundingopps.html](http://www.istem.illinois.edu/funding/fundingopps.html)
Outreach activities by Illinois students and faculty, such as at the Grand Opening of the Orpheum’s Air Maze, Leal’s Science Night, and G.A.M.E.S. camps, seek to foster interest in STEM among Illinois P–20 students.
Goal 1: Facilitate P–20 STEM Education Outreach

P–20 STEM EDUCATION OUTREACH

Following are the types of P–20 STEM education outreach activities in which I-STEM was involved in 2015, including specific partners or projects with whom staff collaborated or about whom I-STEM disseminated information.

📍 Identify campus STEM P–20 outreach activities.

Illinois hosts numerous STEM Education P–20 outreach activities sponsored by individual faculty, units, or colleges. I-STEM has been systematically identifying and prominently displaying these outreach activities via the I-STEM website and in printed or electronic materials. Information about activities is organized by stakeholder group, including P–20 teachers\(^3\) seeking professional development or to reinforce STEM classroom instruction with additional activities, and parents and/or the students themselves seeking STEM education opportunities via summer camps\(^4\) or academic year activities.\(^5\)

I-STEM has also identified programs which serve as examples of highly effective STEM education P–20 outreach programs, such as G.A.M.E.S. Camp (see page 15) and Research Experiences for Undergraduates (see page 22). I-STEM evaluated many of these in 2015, or featured them on our website.

📍 Partner with state and national organizations.

To ensure that Illinois is strategically positioned to promote collaboration and leverage resources to improve P–20 STEM education experiences for students in the state, especially those from underrepresented groups, I-STEM partnered with state and national STEM P–20 organizations/initiatives, such as Illinois' P–20 Council and AAU’s (Association of American Universities) Undergraduate STEM Education Initiative (see pages 8 and 24, respectively).

📍 Evaluate P–20 STEM outreach activities.

In order to improve the impact of Illinois’ STEM P–20 outreach activities, I-STEM continues to assess programs to systematically collect standardized data on participant and school demographics, satisfaction, and impact on STEM interest and content knowledge. These data, aggregated, represent campus-level impact and assess the degree to which Illinois’ STEM outreach activities are easily accessed by families and educators, extend across all grade levels, align with local school needs, and attract demographically diverse participants. Table 1, which follows on page 6, lists a number of P–20 outreach programs I-STEM evaluated in 2015.

3http://www.istem.illinois.edu/resources/goal2resources.html#teacherdevelop
4http://www.istem.illinois.edu/resources/goal1resources.2.html#summercamps
5http://www.istem.illinois.edu/resources/goal1resources.2.html#acadyear

Above: During Leal Science Night, a 3rd grader at the Physics Van table dips a blossom into liquid nitrogen, which caused it to quickly freeze and turn stiff.

Opposite on page 4: During the Grand Opening of the Orpheum’s Air Maze, a Martin Luther King third grader examines a flunny fluid.

I-STEM partnered with state and national STEM P–20 organizations in 2015, such as the Illinois P–20 Council and the American Association of Universities’ Undergraduate STEM Education Initiative.
Clockwise from above: During the Next Generation School’s Science and Engineering Fair, an Illinois researcher (center) interacts with a student.

Bottom right: David Bergandine’s class of students from Uni High appreciate seeing researcher Marty Burke’s molecule-making machine up close.

Bottom left: A local girl proudly displays a structure she made at the civil engineering table during the fall 15 Mommy, Me, and SWE outreach.

<table>
<thead>
<tr>
<th>Program</th>
<th>Principal/Co-Principal Investigator(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center for Sustainable Nanotechnology (CSN)</td>
<td>Robert Hamers, Chemistry, UW-Madison</td>
</tr>
<tr>
<td>CMMB (Cellular &amp; Molecular Mechanics &amp; BioNanotechnology) IGERT</td>
<td>Rashid Bashir, Electrical &amp; Computer Engineering &amp; Bioengineering; Martha Gillette, Cell &amp; Developmental Biology; Jimmy Hsia &amp; Taher Saif, Mechanical Science &amp; Engineering</td>
</tr>
<tr>
<td>EBICS (Center for Emergent Behaviors of Integrated Cellular Systems) High School Research Program</td>
<td>Rashid Bashir, Engineering Lizanne DeStefano, I-STEM</td>
</tr>
<tr>
<td>M-CNTC: Midwest Cancer Nanotechnology Training Center</td>
<td>Rashid Bashir, Electrical &amp; Computer Engineering; Ann Nardulli, Molecular &amp; Integrative Physiology</td>
</tr>
<tr>
<td>Research Experiences for Undergraduates (REU)</td>
<td>1) Stephen Boppart, Chemistry 2) Robert Hamers, Chemistry, UW-Madison 3) Alexander Scheeline, Chemistry 4) Rashid Bashir, Engineering 5) Cathy Murphy, Chemistry</td>
</tr>
<tr>
<td>1) Bioimaging</td>
<td></td>
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<tr>
<td>2) CSN</td>
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</tr>
<tr>
<td>3) Chemistry</td>
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<tr>
<td>4) EBICS</td>
<td></td>
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<tr>
<td>5) Nano@Illinois</td>
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<tr>
<td>VINTG (Vertically Integrated Training with Genomics) IGERT</td>
<td>Andrew Suarez, Entomology</td>
</tr>
<tr>
<td>XSEDE (eXtreme Science and Engineering Discovery Environment)</td>
<td>John Towns, NCSA (National Center for Supercomputing Applications)</td>
</tr>
</tbody>
</table>
Work with and disseminate information about STEM P–20 partners and campus STEM demonstration sites.

To help Illinois reach more elementary, middle, and secondary school students through campus STEM outreach—and to ensure that activities span all age ranges and demographic groups—campus STEM demonstration sites are working to increase recruitment of local schools not engaged with STEM outreach and boosting outreach activities for primary and middle school students. In 2015, thousands of P–20 students engaged with STEM researchers and students during campus visits or off-site activities. I-STEM promoted Illinois’ P–20 STEM outreach activities via its website, plus developed an informal network of campus outreach groups and served as a liaison to apprise them of outreach opportunities (see pages 10–13.)

Increase the number of Chicago Public School students who graduate from Illinois in STEM.

To increase the number of Chicago Public School (CPS) students graduating from Illinois in STEM fields, Illinois strives to repeatedly engage talented 7th–12th grade CPS students via after-school programs, summer camps, mentoring, internships, and campus visits through programs like Illinois’ Chicago Pre-College Science and Engineering (ChiS&E) STEM enrichment program, the R&D STEM Mentor-Matching Engine, and I-STEM-facilitated campus visits.

Increase external funding for P–20 STEM education and outreach.

To establish an adequate, sustainable campus funding base for P–20 STEM education and outreach, I-STEM participated in the submission of at least 48 external funding proposals totaling approximately $92 million in requested funds in 2015. I-STEM also supports the centralization of funds awarded to campus by NSF’s Education and Human Resources Directorate (approximately 15% of direct costs) to support sustainable P–20 STEM education and outreach (see pages 41–43 for I-STEM’s analysis of STEM education funding on campus).
**P–20 STEM EDUCATION OUTREACH PROGRAMS**

*Programs I-STEM Evaluated in 2015*

- **Centrality of Advanced Digitally ENabled Science (CADENS).** This three-year, NSF-funded project uses visualization of computational data to develop high-resolution dome shows, documentary programs, and supplementary educational material for the general public. Thus far, the project has produced *Solar Superstorms*, a dome show narrated by Benedict Cumberbatch, that visualizes the inner workings of the sun and is being shown at planetariums across the country. Several other shows and documentaries are also being developed. I-STEM evaluates the accessibility of the visualizations and the clarity of the accompanying script and supplementary materials to assess these films’ impact on children’s and adults’ understanding of and interest in the scientific material and the importance of computational data and visualization.

- **Community Outreach and Translation Core (COTC).** COTC serves as an organizing hub of information about health effects on the developing infant, child, and adolescent that comes from exposure to everyday chemicals, combined with diets high in packaged foods. Funded by the U.S. Environmental Protection Agency and the National Institute of Environmental Health Sciences, COTC aims to link scientific investigators from Illinois’ I-Kids Children’s Environmental Health Research Center with various community stakeholders. I-STEM evaluates the Community Advisory Board which assists the COTC in translating this information through community-based research and community engagement.

- **Center for Emergent Behaviors of Integrated Cellular Systems (EBICS).** As part of EBICS’ evaluation, I-STEM staff visited three African-American high schools in Atlanta, Georgia in which EBICS does outreach: the Business, Engineering, Science, and Technology Academy; Coretta Scott King Young Women’s Leadership Academy, which is all female students; and KIPP Atlanta Collegiate. 

*Expands upon and provides details on programs included in Table 1 (see page 6).*
**Illinois P–20 Council.** Illinois’ P–20 Council guides education policy and seeks to develop an integrated P–20 system in the state. In 2015, Dr. DeStefano served on all its committees: the Coordinating Committee; Family, Youth, and Community Engagement; Implementation Review; Joint Education Leadership; Postsecondary & Workforce Readiness; Teacher & Leader Effectiveness; and the Research & Development STEM Coalition Steering Committee (see pages 39 and 40 for more on the P–20 Council).

**MakerGirl.** I-STEM is evaluating this after-school program begun and run by female Illinois students hoping to pique girls’ interest in STEM. Held in the Business Instructional Facility’s MakerLab, MakerGirl offers 3D printing sessions to local 7–10-year-old girls. Themed sessions introduce girls to the science behind 3D printing. Girls watch a short presentation, then use free, web-based software for kids, Tinker CAD, to create 3D designs then print them.

**Mississippi River Transportation Distribution and Logistic Consortium (MRTDL).** I-STEM evaluated this consortium of nine community colleges representing eight states that border the Mississippi. MRTDL seeks to advance the region’s economic development by using Trade Adjustment Assistance Community College Career Training funds to train unemployed workers, such as veterans and members of other underserved groups, and place them in high-wage, high-skill occupations.

7 [http://www2.illinois.gov/gov/P20/Pages/default.aspx](http://www2.illinois.gov/gov/P20/Pages/default.aspx)
8 [http://stemlearningexchange.org/](http://stemlearningexchange.org/)
**Research & Development STEM Learning Exchange (RDLE).** Dedicated to educating, recruiting, and retaining the next generation of STEM talent for Illinois industry research and development (R&D), RDLE connects students, teachers, families, universities/colleges, federal laboratories, student organizations, not-for-profits, and private sector employers so Illinois students can participate in authentic, high-quality, student-driven R&D. RDLE’s three initiatives include STEM Challenges, the Mentor-Matching Engine, and a STEM Resource Repository. Funded by the Illinois Science & Technology Institute, I-STEM’s evaluation seeks to provide program managers useful information to guide program improvement, effectiveness, and suitability. In addition, in 2015, I-STEM organized two Mentor-Matching Engine recruitment luncheons to recruit Illinois STEM graduate students to mentor Illinois high schoolers.

**Russian, East European, and Eurasian Center (REEEC).** In spring 2015, REEEC conducted an outreach program to expose Savoy Head Start students to Russian, East European, and Eurasian cultures. I-STEM’s evaluation included individual interviews with REEEC’s program coordinator and Savoy Head Start classroom teachers and attendants, plus observations of classrooms as well as an end-of-the-program Family Fun Day event.
STEM Education Outreach Programs

- **Booker T. Washington STEM Academy (BTW).** Numerous units/programs provided outreach at BTW in 2015. Following are a number of programs/activities.
  - **Engineering Club.** At BTW’s after-school Engineering Club, MechSE and Aerospace students taught BTW students engineering via fun, hands-on activities.
  - **NanoSTRuCT.** Graduate students introduced BTW 3rd graders to nanoscience and nanotechnology.

- **Brady STEM Academy.** Faculty member Jerrod Henderson started this after-school program targeting male African-American students at Booker T. Washington and Garden Hills Schools. Activities are led by STEM undergraduate and graduate students, many from Illinois' Chemical and Biomolecular Engineering.

9I-STEM disseminates information about these campus groups/outreach programs and informally networks with them to help meet STEM education outreach needs/requests locally and statewide.
- **Burke Lab Outreach.** Students in a University Laboratory High class were invited to researcher Marty Burke’s lab to learn about creating molecules that replicate the function of proteins and to experience Burke’s new invention, a molecule-making machine. Burke’s Lab Partners program also exposes students from rural high schools to his lab’s research.

- **Cena y Ciencias.** Spanish for Supper and Science, Cena y Ciencias met Monday nights once a month with Dual-Language Program K–5 students from Leal and Prairie Elementary Schools. Conducting the outreach were *Illinois* graduate and undergraduate students who are members of SACNAS (Society for Advancement of Hispanics/Chicanos and Native Americans in Science).

- **ChicTech.** A number of *Illinois*’ female Computer Science (CS) students devoted an entire weekend in November 2015 to host a group of high school girls as part of the 2015 ChicTech Retreat, which is sponsored by Women in Computer Science, a student organization for female CS students at *Illinois*.
– **ChiS&E.** Illinois’ Chicago Pre-College Science and Engineering (ChiS&E) STEM enrichment program exposed Chicago Public School 5th through 7th grade students to math and physics activities in both the fall and spring semesters. Staffing the activities are Illinois graduate and undergraduate students from math and engineering, as well as other disciplines.

– **Engineering Open House.** The 2015 iteration of this annual, student-led event featured exhibits that showcase the talent and ingenuity of Illinois’ engineering students. This outreach drew thousands of visitors, ranging from families with preschoolers, to teachers bringing their classes on field trips, to high school students considering Illinois’ engineering program.

– **Foundations 4 Advancement campus visit.** In fall 2015, 30 Chicago youngsters, P–5th grade (the youngest was 3) visited campus for a tour and some hands-on STEM activities led by a number of engineering students.

– **G.A.M.E.S. Camp.** Illinois graduate and undergraduate students served as instructors and counselors at the 2015 G.A.M.E.S. Camp, which exposed high school girls to engineering disciplines.
Above: At Leal Science Night, Physics Van student Brian Korn (left) blows on a liquid-nitrogen-shriveled balloon animal to heat the gas inside it to make it expand.

Top right: Two Animal Biology graduate students encourage Leal Science Night visitors to identify the skeleton in the case (it’s a cat’s).

Below: A Leal student prepares in case the next Physics Van demonstration produces a loud noise. (It didn’t).

- **Illinois Science Olympiad.** Numerous Illinois personnel volunteered in the 2015 state tournament held on campus, including current students who had participated in Science Olympiad themselves.

- **iRobotics.** Members of iRobotics, an RSO comprised mostly of engineering students, participated in several STEM-related events in 2015, both to share their love of the sport and to get kids interested in STEM.

- **Leal Science Night.** Numerous STEM students, student organizations, and professionals shared their love of STEM with local students and their parents at Leal School’s annual Science Night, including Physics Van, REACT, MechSE undergraduate student Patrick Slade, and two graduate student groups: PBAGS (Plant Biology Association of Graduate Students) and GEEB (Graduates in Ecology and Evolutionary Biology). Also participating were graduate and undergraduate student members of SACNAS (Society for the Advancement of Chicanos/Hispanics and Native Americans in the Sciences).

- **MechSE Open House.** Illinois’ Department of Mechanical Science and Engineering held a fall 2015 Open House which featured numerous exhibits by students, staff, and professors, and introduced visitors/current students to a number of student societies, labs, and professors’ research.

- **Next Generation School (NGS) Partnerships.** In 2015, Illinois staff and students participated in a number of programs at the local school: for example, around 20 Illinois researchers and graduate students judged the school’s 2015 Science Fair.

- **Physics Van.** This outreach by mostly undergraduate Physics students did outreach in schools and community STEM events, such as the Leal Science Night in spring of 2015.

- **REACT.** REACT chemistry students visited most of the local schools as well as other community events to help teach local youngsters about chemistry via hands-on demonstrations.
- **Rheology Zoo.** Students who are part of MechSE professor Randy Ewoldt’s research group performed outreach about rheology (non-Newtonian fluids) at numerous events, such as EOH and MechSE Open House, and the grand opening of the Orpheum Children’s Science Museum Air Maze.

- **SWE.** In the Society of Women Engineers’ (SWE) many outreach events (Mommy, Me, and SWE; High School Engineering Round Robin, Introduce-a-Girl-to-Engineering Day, DADDS (Dads and Daughters Do Science); FKO (For Kids Only); Step-Up; and CU Special Recreation Outreach), female engineering students experienced what teaching is like while exposing kindergarten through high school students, plus some parents, to engineering.

- **University Laboratory High School Engineering Class.** Uni High’s engineering class designed and built an air maze for the Orpheum Children’s Science Museum.

- **Vet Med Open House.** At the fall 2015 Open House, Vet Med students provided fun, hands-on activities for visitors, both young and old, to show the public what goes on at an animal hospital.

- **WYSE Camps.** Illinois’ 2015 WYSE (Worldwide Youth in Science and Engineering) camps, which expose high school students to engineering, helped a number of engineering graduate and undergraduate students discover how rewarding teaching can be.
I-STEM partners with campus projects, such as the Nano@Illinois RET, which provides research experiences for teachers.
Goal 2: Improve STEM Teacher Training and Professional Development Quality

STEM TEACHER TRAINING/PROFESSIONAL DEVELOPMENT IMPROVEMENT

✦ Increase the number and quality of STEM teachers who graduate from Illinois.

To increase the number of STEM teachers who graduate from Illinois, improve their retention in the field, and increase their impact on student performance, I-STEM works with organizations like APLU/SMTI (see page 18) and campus units which share this same goal.

✦ Evaluate STEM teacher training and professional development projects.

In 2015, I-STEM evaluated several NSF-funded STEM teacher training and professional development projects operating at Illinois, including the NASA Astrobiology Institute Teacher Workshop and Nano@Illinois RET, which exposed STEM teachers to cutting-edge research in nanotechnology. I-STEM supported these activities by providing on-campus evaluation services, ensuring important continuity and cross-fertilization opportunities among the initiatives, as well as the engagement of state-of-the-art STEM program evaluation models, both on campus and in coordination with external evaluators.

✦ Strengthen campus STEM teacher professional development.

I-STEM works to help Illinois’ teacher education programs provide a comprehensive, high-quality continuum of professional development for STEM teachers, including induction and mentoring; graduate disciplinary coursework and degree options; research experiences; and leadership development in order to improve STEM teacher retention, reduce out-of-field teaching, and increase student performance.

Table 2: Selected Teacher Development Programs I-STEM Evaluated in 2015

<table>
<thead>
<tr>
<th>Program</th>
<th>Principal Investigator(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EnLIST: Entrepreneurial Leadership in STEM Teaching &amp; Learning</td>
<td>Mats Selen, Physics; Patricia Shapley, Chemistry; Fouad Abd-El-Khalick, Curriculum &amp; Instruction; Raymond Price, Engineering</td>
</tr>
<tr>
<td>nano@illinois Research Experience for Teachers (RET)</td>
<td>Xiuling Li, Chemistry</td>
</tr>
<tr>
<td>NASA Astrobiology Institute Teacher Workshop</td>
<td>Lynford Goddard, ECE</td>
</tr>
<tr>
<td></td>
<td>Nigel Goldenfeld, Physics</td>
</tr>
<tr>
<td></td>
<td>Brouce Fouke, Geology</td>
</tr>
</tbody>
</table>

Above: Nano@Illinois RET participant Bharathi Subramaniasiva works on her research on Self-Rolled Up Membranes in MNTL’s cleanroom lab.

On opposite page, (page 14): a 2015 RET participant presents the results of her research to a visitor to the Nano@Illinois RET final poster session.

I-STEM works to help Illinois’ teacher education programs provide a comprehensive, high-quality continuum of professional development for STEM teachers.
To prevent duplication of services and professional development topics offered by university programs, I-STEM is working to ensure that educators have access to unique PD experiences in a logical sequence across campus STEM teacher PD programs that offer workshops and training. I-STEM also encourages programs to target teachers in high-need districts/regions in order to improve retention and student performance. STEM teacher PD opportunities are posted on I-STEM’s website and sent to interested stakeholders via I-STEM’s listserv. (See pages 2 and 41 for communication resources.)

† Increase external funding for teacher preparation and professional development.

In 2015, 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. In addition, I-STEM recommends that projects/labs offer Research Experiences for Teachers (RET; see Table 3 to the left). In 2015, 46+ campus projects fostered collaboration with K–12 teachers by offering PD, lesson plans, and/or research opportunities.

Table 3: Campus Research Experiences for Teachers

<table>
<thead>
<tr>
<th>Years</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008–2009</td>
<td>4</td>
</tr>
<tr>
<td>2009–2010</td>
<td>8</td>
</tr>
<tr>
<td>2010–2011</td>
<td>12</td>
</tr>
<tr>
<td>2011–2012</td>
<td>13</td>
</tr>
<tr>
<td>2012–2013</td>
<td>16</td>
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<tr>
<td>2013–2014</td>
<td>17</td>
</tr>
<tr>
<td>2014–2015</td>
<td>12</td>
</tr>
<tr>
<td>2015–2016</td>
<td>17</td>
</tr>
</tbody>
</table>
Increase teacher education candidates/student volunteers.

Encouraging STEM majors to participate in outreach in schools and other informal educational settings may produce benefits beyond exposing youngsters to STEM. These students may discover that they enjoy teaching and choose to continue doing similar activities once they graduate...or even choose teaching as a career. Thus, I-STEM recommends that units/projects include components where students perform community outreach with the goal of increasing the number of teacher education candidates and fostering commitment to outreach. In 2015, Illinois staff and students volunteered in numerous programs targeting P–12 students, including camps, open houses, and outreach in schools.

In 2015, I-STEM developed an informal network of Illinois projects and student organizations that conduct outreach activities which feature Illinois students volunteering in schools and at other informal educational settings and the types of activities in which they participated in 2015. (See pages 10–13 for an incomplete listing of these organizations/projects and outreach activities.) Additionally, as part of I-STEM’s mandate to disseminate information about STEM education activities, web articles were published on I-STEM’s website about many of these student groups/outreach activities.
STEM EDUCATION TEACHER TRAINING/PROFESSIONAL DEVELOPMENT PROGRAMS

**APLU/SMTI.** A member institution of the Association of Public and Land-Grant Universities (APLU), Illinois is committed to APLU’s Science and Mathematics Teacher Imperative (SMTI), a national effort to increase the number and improve the quality/diversity of science and math teachers. SMTI’s Mathematics Teacher Education Partnership fosters university-K–12 district collaboration to transform math teacher preparation.

**Bridging Cultures.** This Center for Global Studies initiative provides cross-cultural, international programming on educational practice, pedagogy, and policy. International secondary educators from 20 countries and a cohort of American teachers gained a multicultural perspective while exploring each others’ cultural and educational practices. Collaboration in workshops, discussions, and lesson planning fostered relationship-building. I-STEM staff conducted a focus group to assess program effectiveness.

**Distinguished Teacher-Scholar Project.** Gretchen Adams, Chemistry Merit Program Director and I-STEM affiliate, taught a monthly workshop series, “Instructional Strategies That Increase the Retention and Academic Performance of Underrepresented Students on Campus” from fall 2014 through spring 2015. The goal of the workshop was to help faculty identify issues related to underrepresented groups in their classrooms, explore research-based programs and instructional strategies for improvement, and design an evaluation plan. I-STEM evaluators observed sessions and administered surveys.
**Fulbright Early Career Scholar Fellowship.** In 2015, I-STEM’s Luisa-Maria Rosu spent nine months in Romania as a Fulbright Early Career Scholar. The overarching theme of her Fulbright project was to understand how conversations about quality criteria reveal the espoused values of various stakeholders in the Romanian education programs in higher education (students in education, future teachers, faculty members, or members of the Educational Studies Institute) and refine the conceptualization of the educative approach of evaluation (Ryan & DeStefano, 2000). Prior work on theory-based and responsive evaluation contributed to the conceptualizations of the evaluator’s role as an educator and of the program evaluation as an educative springboard for alternative plans for social action (Cronbach & al, 1980; Greene, J. 2005; Stake, R. 2004; Weiss, H., 1998). These studies have advanced supporting frameworks for the educative approach evaluation. While the current project used these conceptualizations, it did so by giving attention to the lesser-studied aspect of the researcher’s educational thinking in relation to the contextual power of the educational program and practice studied. The quality representations of educational initiatives in STEM disciplines are particularly of interest because their contextual power is often limited to the quality criteria from content area and/or pedagogy. Few quality criteria also consider narratives of power, equity, and diversity. The aim was to relate particular questions of quality representations in educational evaluation to puzzling issues in STEM teacher education research: internal tensions related to meritocracy and equity, the value added model for teacher evaluation, and the assessment of teaching and learning.

**Nano@Illinois RET.** I-STEM evaluates the NSF-funded Nano@Illinois Research Experience for Teachers (RET). The RET aims to expose a diverse set of in-service and pre-service STEM teachers and community college faculty from across the nation to cutting-edge research in nanotechnology. In 2015, teachers conducted research and attended professional development at Illinois over six weeks during the summer, with four follow-up sessions during the academic school year.

According to the 2015 evaluation report, the majority of professional development activities were rated as useful or very useful by teacher participants. Activities teachers rated as most useful were: interaction with graduate students, stipend, Illinois campus, interaction with other RET participants, networking opportunities, and social outings.
I-STEM is working to promote student success in STEM fields through the creation of accessible and effective undergraduate and graduate STEM programs and engaging research experiences.
Goal 3: 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 identify and 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.

✦ Perform student satisfaction/climate studies.

I-STEM also provides expertise to help campus units interested in self-evaluation understand student data patterns regarding performance, why students choose/leave STEM majors, and impacts of reform on student performance. In 2015, I-STEM assessed student satisfaction with a large course for Biology, whose courses are offered across various STEM disciplines (see page 27).

✦ Develop support programs to improve recruitment, retention, and graduation of STEM students.

Student support programs (i.e., learning communities, mentoring, and bridge programs) can improve recruitment, retention, and matriculation of students in STEM fields, but are often not well coordinated or sustainable or lack academic support beyond the freshman year. Plus, students are often unaware of these programs, qualifications, or how to access services. To improve undergraduate programs, and thus improve recruitment and retention in STEM fields, I-STEM recommends that units adapt strategies successful Illinois programs, like Merit, have used to increase student support, and to incorporate Research Experiences for Undergraduates (see page 22).

✦ Evaluate and analyze undergraduate and graduate STEM education reform projects.

I-STEM identifies strengths and gaps in campus STEM academic programs to assist in developing effective, scalable, and sustainable STEM education models, including bridge and support models, such as exploring the use of on-line courses to bridge with high schools and community colleges. To improve academic offerings, STEM departments have implemented both campus- and externally-funded reform projects. In 2015, I-STEM conducted evaluations of several of these (see Table 4 on page 23), including several IGERTs and REUs.
IGERTs. Funded by NSF, the Integrative Graduate Education and Research Traineeship (IGERT) program seeks to develop a diverse, globally-engaged science and engineering workforce via innovative graduate education models in collaborative research. IGERTs also seek to broaden participation, particularly from groups typically underrepresented in the sciences. In 2015, I-STEM evaluated the CMMB and VINTG IGERTs, described later in this section.

Research Experiences for Undergraduates. I-STEM advocates employing research experiences for undergraduates (REUs) to increase the number of students choosing STEM careers. In 2015, at least 248 campus projects offered research experiences for undergraduates (see Figure 1 on page 23). Some were funded through NSF’s REU (Research Experiences for Undergraduates) program, such as the five NSF REU Sites on campus which each engaged a number of students in research. In addition, many NSF-funded, as well as non-NSF-funded campus projects, offered research experiences for one or more undergraduates.

I-STEM evaluated six NSF-funded REU programs in 2015: three were individual REUs (Bioimaging, Chemistry, and Nano@Illinois REUs); three were for larger centers, which offered REU components as one of their STEM education emphases: CBMM (the Center for Brains, Minds, and Machines), CSN (the Center for Sustainable Nanotechnology), and EBICS (Emergent Behaviors of Integrated Cellular Systems Science and Technology Center). Individual programs are described in more detail in the following section.

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 2015, I-STEM was involved in a number of grant submissions seeking to improve undergraduate and graduate STEM education. I-STEM provides support to faculty via a variety of mechanisms (see pages 2 and 41).
Table 4: Selected Undergraduate/Graduate STEM Education Programs I-STEM Evaluated in 2015

<table>
<thead>
<tr>
<th>Program</th>
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<tbody>
<tr>
<td>AAP (Access and Achievement Program) STEM Initiative</td>
</tr>
<tr>
<td>Bioimaging Research Experience for Undergraduates</td>
</tr>
<tr>
<td>Chemistry CCLI: Discovering the Nanoworld: Module for Teaching About Molecules/Bonding in Chemistry</td>
</tr>
<tr>
<td>CMMB (Cellular &amp; Molecular Mechanics &amp; BioNano-technology) IGERT</td>
</tr>
<tr>
<td>CBMM (Center for Brains, Minds, and Machines)</td>
</tr>
<tr>
<td>CSN (Center for Sustainable Nanotechnology)</td>
</tr>
<tr>
<td>EBICS (Emergent Behaviors of Integrated Cellular Systems)</td>
</tr>
<tr>
<td>Illinois Cyber Security Scholars Program (ICSSP)</td>
</tr>
<tr>
<td>M-CNTC (Midwest Cancer Nanotechnology Training Center): Training the Next Generation of Researchers in Cancer Nanotechnology at the NCIM</td>
</tr>
<tr>
<td>Merit Fellows Scholarship Program (S-STEM)</td>
</tr>
<tr>
<td>Network for Computational Nanotechnology - NanoBIO Node</td>
</tr>
<tr>
<td>Program in Digital Forensics</td>
</tr>
<tr>
<td>REU Site: nano@illinois REU: Research Experience for Undergraduates</td>
</tr>
<tr>
<td>REU Site: Research Experience for Undergraduates at Illinois (Chemistry)</td>
</tr>
<tr>
<td>Sustained-Petascale In Action: Blue Waters Enabling Transformative Science And Engineering: Blue Waters Community Education</td>
</tr>
<tr>
<td>VINTG (Vertically Integrated Training with Genomics) IGERT</td>
</tr>
<tr>
<td>XSEDE: eXtreme Science and Engineering Discovery Environment</td>
</tr>
</tbody>
</table>

Figure 1: Research Experiences for Undergraduates, 2005–2015

Above: Students working in an Illinois chemistry lab.
Below: A Merit Scholar (left) with her dad in attendance, has just received an award at the Merit Scholar Luncheon at the end of the spring 2015 semester.
UNDERGRADUATE/GRADUATE STEM EDUCATION PROGRAMS/INITIATIVES

**AAP STEM Initiative.** The Access and Achievement Program (AAP), a student-centered academic program within Illinois’ College of Liberal Arts & Sciences (LAS), seeks to provide matriculation services to both declared and undeclared LAS students affiliated with the President’s Award Program and Educational Opportunities Program at the University. In 2015, AAP administrators, in conjunction with the departments of Biology, Chemistry, and Microbiology, requested that I-STEM’s evaluators assess the effectiveness of prescribed course-taking patterns on the matriculation of AAP students into and through STEM degree programs. Data spanning six AAP cohorts are being used to conduct the assessment. Two meetings were held with the stakeholders during the fall of 2015; a final report will be submitted to AAP administrators and department representatives in spring 2016.

**AAU Initiative to Improve Undergraduate STEM Education.** Illinois participates in AAU’s (Association of American Universities) 5-year initiative on STEM undergraduate teaching. The initiative helps higher education institutions assess the quality of STEM teaching, share best practices, and use the most effective STEM teaching methods. In 2015, Lizanne DeStefano served on the technical advisory committee of experts in undergraduate STEM teaching and learning which guides the initiative.

**Bioimaging REU.** Discoveries in Bioimaging Research Experience for Undergraduates (REU) exploits the link between Bioscience, Discovery, and Bioimaging which is employed at all scales in a state-of-the-art, interdisciplinary, research environment. This 10-week program targets undergraduate students from underrepresented populations. The program utilizes team-based research and integrated social and professional activities to supply a multi-tiered mentoring strategy. I-STEM’s 2015 evaluation found that REU participants regarded Bioimaging REU’s inaugural year as a success.
Blue Waters. I-STEM evaluates the Community Engagement programs for Illinois’ Blue Waters, one of the world’s most powerful supercomputers. In 2015, I-STEM assessed the quality of its educational outreach programs, internship program for undergraduate students, fellowship program for the graduate students, and also virtual school courses for students across the country. I-STEM also collected data with all the participants through the symposium, workshops, interviews, and focus groups to study the program’s community engagement aspects. NSF reviewed the assessments and concurred that the assessment process was sound and the findings were informative and substantive. Following are several Blue Waters education outreach components I-STEM evaluated:

- **Blue Waters Symposium.** I-STEM evaluators conducted an evaluation of the 2015 Blue Waters Symposium for Petascale Computing and Beyond. Attending the symposium were innovative thinkers in science who shared keynotes; leaders in petascale computing who shared successes and challenges; and Blue Waters science teams who presented their work and summarized recent activities. Participants also had opportunities to share and discuss specific topics of interest. Based on participant survey responses, open-ended responses, and evaluator observations, the Symposium had extremely high participant satisfaction.

- **Petascale Institute.** A joint program of both the Blue Waters and XSEDE projects, this two-week institute introduces mostly non-computer-science undergraduate and graduate students to HPC (High-Performance Computing).

- **VSCSE (Virtual School of Computational Science and Engineering).** I-STEM conducted the evaluation of the spring 2015 Designing and Building Applications for Extreme Scale Systems course. Provided in three different institutions, Illinois, and two other universities, North Dakota, and Wyoming, this course was largely seen as valuable.
Center for Brains, Minds, and Machines (CBMM). In 2015, I-STEM evaluated CBMM, a multi-institutional collaboration headquartered at Massachusetts Institute of Technology. CBMM seeks to develop an understanding of intelligence and the ability to engineer it; to train the next generation of scientists and engineers in the emerging field of Science and Engineering of Intelligence; and to foster cross-fertilization among the many disciplines comprising the field. I-STEM evaluated the following educational outreach activities.

- **CBMM Teacher Workshop.** The goal of this program is to provide a one-week summer research workshop in collaboration with the department of Brain and Cognitive Sciences (BCS) to provide K–12 teachers research opportunities in the fields of computational and cognitive neuroscience. The ultimate goal of this program is to provide students with a strong research experience in preparation for graduate school and to encourage them to pursue careers in neuroscience.

  The purpose of the evaluation is to provide valid and useful information to CBMM leadership, program managers, and NSF funders to guide planning and decision making; inform program improvement; assess short- and long-term effectiveness and impact; and increase the likelihood of sustainability. Teachers found the Teacher Workshop to be very informative and useful overall as they plan to integrate new material into their classroom curricula.

- **CBMM REU.** The 2015 iteration of the CBMM Research Experience for Undergraduates (REU) took place at MIT from June to August 2015. The goal of the CBMM REU program was to provide a 10-week summer research internship in collaboration with the department of Brain and Cognitive Sciences (BCS) for advanced undergraduates from institutions with limited research opportunities to introduce women, students from under-represented minority groups, first-generation college students, students with disabilities, and students from economically disadvantaged backgrounds to the fields of computational and cognitive neuroscience.

  CBMM’s REU seeks to provide students with a strong research experience in preparation for graduate school and to encourage them to pursue careers in neuroscience. Results suggest:

  1. Participant satisfaction regarding interactions and communication with faculty advisors and graduate student/post doc mentors was high.

  2. Substantial technical skills were gained as a result of the REU program. Participants also experienced a gain in their self-confidence as a result of their REU program participation.
IAM Climate Studies. I-STEM conducts evaluations for campus units and provides expertise to units interested in self-evaluation to help them understand student data patterns regarding performance, why students choose/leave STEM majors, and impacts of reform on student performance. I-STEM also met with decision makers from several units to plan future climate studies. Following are several climate studies I-STEM performed in 2015 or will conduct in 2016.

- Biology Climate Study. In 2015, as part of the Biology climate study, I-STEM surveyed 500+ students in Integrative Biology 150 to obtain their perceptions of course quality, aspects of the course they found the most or the least helpful to their learning, usefulness of course components, and how the course could be improved.

- Chemistry Student Experiences Study. As a follow-up to I-STEM’s 2011 and 2013 Chemistry climate studies, in 2015, I-STEM staff met with chemistry faculty and decision makers to plan a study for 2016 regarding undergraduate and graduate students’ experiences in the Department, including programmatic requirements, financial support, department resources, race/ethnicity, gender, and student satisfaction. Chemistry uses these data to aid in decision making to better serve its students.

- Engineering Climate Study. During 2015, I-STEM staff met with faculty and decision makers to plan a follow-up study in 2016 regarding undergraduate and graduate students’ experiences, plus barriers and opportunities to increasing recruitment and retention. The College and individual departments have considered data from I-STEM’s 2009, 2011, and 2013 studies during decision making to determine to what degree policy changes and course reforms implemented over the last seven years have impacted students’ satisfaction and perceptions of climate.

- Mathematics Department. I-STEM will conduct a 2016 climate study addressing satisfaction of graduate students in the Mathematics Department.

- Center for the Physics of the Living Cells (CPLC). I-STEM will also conduct a 2016 climate study addressing satisfaction of graduate students in the Center for the Physics of the Living Cells (CPLC) in Physics.

- CMMB IGERT. The Cellular & Molecular Mechanics & BioNano-Technology (CMMB) IGERT seeks to train the next generation of leaders in cellular and molecular mechanics and bionanotechnology.

- Community Outreach and Translation Core COTC. The COTC is designed to serve as an organizing hub of information about health effects on the developing infant, child, and adolescent from exposure to everyday chemicals combined with diets high in packaged foods. Funded by the U.S. Environmental Protection Agency and the National Institute of Environmental Health Sciences, COTC aims to link scientific investigators from Illinois’ I-Kids Children’s Environmental Health Research Center with various community stakeholders. I-STEM evaluates the Community Advisory Board that aims to assist COTC in translating this information through community-based research and community engagement.
Center for Sustainable Nanotechnology (CSN). A multi-institutional partnership, CSN is an NSF Center for Chemical Innovation which investigates fundamental molecular mechanisms by which nanoparticles interact with biological systems. CSN seeks to use fundamental chemistry to enable the development of nanotechnology in a sustainable manner for societal benefit. I-STEM evaluates the educational and outreach activities.

- CSN REU/REV. CSN’s 2015 REU program provided a 10-week, authentic research experience for undergraduate students, exposing them to advanced degree options and careers in the chemistry fields with the goal of increasing the number of students, especially those from underrepresented groups, who go on to graduate school in chemistry-related fields.

- Discovering the Nanoworld. This NSF-funded project developed teaching modules about molecules and bonding in general chemistry. A cohort of 200 students will be taking the new post-Chem102 course in spring 2016. In 2015, I-STEM staff held meetings with PI David Woon of Chemistry to discuss the 2016 evaluation.

- EBICS. Emergent Behaviors of Integrated Cellular Systems (EBICS) STC is an NSF-funded Center at Illinois, MIT, and Georgia Tech to advance research in complex biological systems and develop programs to attract students to STEM fields. In 2015, I-STEM provided leadership for the education component and evaluated educational activities, i.e., EBICS’ Graduate Teaching Consortium, Project ENGAGES (see page 8), and REU.

  - BioE 306 course. In fall 2015, Bioengineering piloted a new course, BioE 306, BioFabrication Lab, which introduced undergraduate students to biointegrated machines, or biobots. The course distilled down cutting-edge EBICS research and initiated eight juniors and seniors into the mysteries of building with biology.

  - Project ENGAGES. This EBICS STEM outreach program targets four African-American high schools in Atlanta, Georgia, partnering high school students with Georgia Tech graduate students engaged in scientific research and engineering projects.

  - EBICS REU. The 2015 REU exposed five undergraduates to cutting-edge research and what being a graduate student is like.
Illinois Cyber Security Scholars Program (ICSSP). ICSSP is open to Illinois undergraduate and graduate students in computer science and computer engineering, as well as to law students. Funded by NSF, the program is designed to financially and academically support qualified students to pursue careers in Information Assurance (IA) and computer security. I-STEM’s evaluation found that ICSSP provides students adequate financial support, opportunities to develop as IA professionals, and a good educational experience overall.

iFoundry. The Illinois Foundry for Innovation in Engineering Education (iFoundry), a cross-disciplinary curriculum incubator in the College of Engineering, is dedicated to transforming undergraduate education and experiences to align with 21st Century challenges and opportunities. In 2015, I-STEM evaluated iFoundry’s James Scholar Quest Program:

– James Scholar Quest Program. Begun in 2013, this program continued its collaboration with both Civil and Environmental Engineering and Mechanical Science and Engineering Departments to engage James Scholar students in a dialogue about:

1. Department support and community building for James Scholars.
2. Ways to broaden choices to get honors credit.
3. Research, entrepreneurship, and leadership interests.

The task of I-STEM’s evaluation was to better understand students’ motivation to remain in Engineering’s James Scholars program, which, as with many other colleges at Illinois, is a college-level honors program. Students can be admitted to the program prior to freshman enrollment or can apply for admission once on campus. Students in the program are expected to maintain a minimum 3.3 GPA, complete a course with an Honors Credit Learning Agreement during their freshman year, and fulfill the yearly requirements of an honors contract prior to graduation. Students in the James Scholar program receive priority registration, access to honors-only courses, and are awarded James Scholar distinction at graduation.

Just over 300 James Scholar alumni, representing 13 engineering majors and nine cohorts, responded in part or in full to an online survey. Out of 271 respondents, over half selected important or very important when asked if pursuing a minor or second degree motivated them to remain in the program. Nearly 75% of 272 respondents selected important or very important when asked if being able to mention the James Scholars Honors program on their resume provided motivation to remain in the program. Dissemination activities will include a final report to key stakeholders. Additionally, a manuscript proposal, based on this work, will be submitted for presentation at the 2016 Association for the Study of Higher Education (ASHE) conference.
Indiana University Advanced CyberInfrastructure Value Assessment. In 2015, Indiana University’s Office of the Vice President for IT and CIO asked I-STEM to assess faculty perceptions of IU’s cyberinfrastructure. During this short, one-month project, I-STEM conducted 23 faculty and senior administrator interviews and provided a comprehensive report on the findings to inform system-wide decisions regarding cyberinfrastructure.

Master of Arts in EU Studies Degree Program (MAEUS) Program. In spring 2015, I-STEM conducted an evaluation of MAEUS, a Master’s Degree program in European Union Studies of the European Union Title VI Center. As part of the evaluation, I-STEM staff conducted an exit survey and interviews with students who graduated from MAEUS in 2015. Overall, the majority of respondents indicated high levels of satisfaction with the degree program’s quality, and recommended improving promotion strategies both on and off-campus, showcasing the unique nature of the program as one of the few Master’s program in European Union studies in the country and emphasizing the research opportunities, interdisciplinary emphasis, language study, study-abroad/internship, and funding components.

Midwest Cancer Nanotechnology Training Center (M-CNTC). I-STEM evaluates M-CNTC, which seeks to train the next generation of leaders who will define the new frontiers and applications of nanotechnology in cancer research. It also seeks to build a community of faculty, PhD students, postdocs, and colleagues from clinical institutions to collaborate on education and research. Thus, participants will not only be trained in the interdisciplinary area of cancer biology, nanotechnology, and nanoengineering, but also develop a network of resources (people, facilities, international connections) beneficial in their future careers.

Merit Fellows Scholarship Program. I-STEM evaluates this NSF-funded S-STEM (Scholarships in Science, Technology, Engineering, and Mathematics) grant, which provides financial support for academically talented, financially needy Merit program students majoring in mathematics, chemistry, or integrative biology.
**Nano@Illinois REU.** The NSF-funded Nano@Illinois Research Experience for Undergraduates (REU) program seeks to provide undergraduates with interdisciplinary research and educational nanotechnology experiences across a range of disciplines and applications to address many grand challenges facing our world. By embedding participants in a rich environment, the REU provides integrated research experiences to a diverse set of REU trainees in Nanoelectronics, Nanophotonics, Nanomanufacturing, Nanomaterials, and Nanobiotechnology, and infuses critical thinking, leadership, communication, team building, and ethics training in innovative ways. I-STEM’s 2015 evaluation sought to help program administrators improve the REU experience in regards to student content knowledge, research skills, leadership building, and graduate recruitment outcomes.

**NanoBIO Node.** The NSF-funded NanoBIO Node is a resource for nanobiotechnology. This resource, a collaboration between Illinois and the University of California at Merced, provides simulation building blocks and educational resources for use in nanobio device engineering. It aims to create a community of researchers and students who are interested in using nanoscale tools and methods to drive progress and research in biotechnology and bridge engineering and biology through strategic partnerships and outreach activities. I-STEM evaluators conducted an interview of External Advisory Board members regarding their knowledge, familiarity, feedback, and roles for the NanoBIO node. In addition, evaluators surveyed graduate students, researchers, and faculty in order to identify the needs for development of simulation software for nanobio applications.

**Program in Digital Forensics (PDF).** Funded by NSF, PDF is developing an interdisciplinary undergraduate educational curriculum focusing on the recovery and investigation of data found in digital devices. Unlike most digital forensics programs, which mainly focus on computer science, PDF is also incorporating aspects of law, sociology, accounting, and psychology. Once the curriculum is developed, PDF will then work for its acceptance as the national digital forensics standard. I-STEM’s 2015 evaluation found that students enjoyed the course, viewed its interdisciplinarity as a strength, were satisfied with material covered, and provided insight into potential areas for improvement.
**Readying Illinois Students for Excellence (RISE).** In 2015, I-STEM evaluated RISE, a summer program offered by Illinois’ Office of the Dean of Students New Student Programs, Office of Inclusion and Intercultural Relations, and Office of the Provost. RISE participants, incoming freshmen who are first-generation and/or underrepresented students, attend a three-day, on-campus program to facilitate transition to college life. I-STEM began the evaluation in 2015. In order to guide program activities for future participants, I-STEM is tracking RISE participants throughout their freshman year at Illinois in order to document their experience.

**Science in the Classroom.** I-STEM evaluated this long-standing service program of the Northwestern University chapter of Phi Lambda Upsilon (PLU). In this science outreach program, PLU graduate students provided monthly hands-on science experiences for 3rd and 4th grade classes at Chicago’s Hayt school. Plus, for the final event of the year, Hayt students attended a science show on Northwestern’s campus.

**Summer Internship for Native Americans in Genomics (SING).** SING, a one-week workshop about the uses, misuses, and limitations of genomics as a tool for Native American communities, also trains Native Americans in the concepts and methods currently used in genomics. I-STEM’s 2015 evaluation included a focus group to determine the effectiveness of SING’s programs.

**STRONG Kids.** As part of STRONG Kids, a Family Resiliency Center program, students enroll in an undergraduate research course, HDFS 494, conduct interdisciplinary research related to children’s health and obesity, then, during the Undergraduate Research Symposium at the end of the Spring semester, present their research to the public. I-STEM evaluated this project in 2015.

**Summer Training in Translational Biomedical Research.** I-STEM staff met with PI Lois Hoyer in 2015 to plan the evaluation for this NIH-funded, 10-week Summer Research Training Program to identify and train veterinary students who have the ability and motivation to become research scientists. Ten students will be matched with faculty mentors who share similar research interests. Each trainee will formulate a hypothesis, design experiments, collect and analyze data, and report the conclusions via an abstract submitted to a national meeting, a poster presentation, and a short manuscript to a scientific journal. Instruction in research will include orientation week activities and a seminar series on veterinary career opportunities and scientific writing. Trainees will present their work at an in-house poster session and at NIH’s Veterinary Scholars Symposium. I-STEM will begin the evaluation in 2016.

**Transdisciplinary Obesity Prevention Research Sciences (TOPRS).** The aim of TOPRS is to develop and implement a transdisciplinary curriculum for undergraduate students that focuses on the causes and consequences of childhood obesity. The curriculum’s “flip-the-classroom” format consists of students viewing video lectures prior to attending class then spending class time on interactive group activities. The evaluation is designed to contribute to the quality and implementation of TOPRS during the first year of implementation.
Vertically Integrated Training with Genomics (VInTG)

VInTG IGERT seeks to train students in the interdisciplinary field of genomics—how an organism’s traits emerge from, and are shaped by, a complex interplay of genetic information stored in DNA and environmental information the organism experiences throughout its life. In 2015, I-STEM administered surveys and an end-of-course focus group for VInTG’s Integrative Biology Tropical Biology course.

**eXtreme Science and Engineering Discovery Environment (XSEDE).** NSF-funded XSEDE, led by Illinois’ National Center for Supercomputing Applications offers advanced digital resources and services to a broad range of researchers. XSEDE allows scientists nationwide to collaborate remotely on over 16 supercomputers and high-end visualization and data analysis resources. Some highlights of I-STEM’s 2015 external evaluation for XSEDE’s Training, Education, and Outreach Services include:

- Development and testing of student program application forms to reduce selection bias and increase the number of diverse participants in high-performance computing (HPC). I-STEM’s application form is currently being used and tested by cyberinfrastructure organizations in Canada, the European Union, Japan, and the United States.

- Development and implementation of an interactive, live dashboard for tracking project-wide metrics. Historically, longitudinal tracking within XSEDE required considerable effort and planning. Program managers and coordinators can now view and track their program’s success at the click of a button. Due to the reduction of effort, XSEDE is now shifting to even more proactive decision making and strategic planning.
I-STEM is working to stimulate partnerships to understand the Illinois STEM pipeline and workforce development needs and to serve as an advocate within the state of Illinois.
Goal 4: Shape Policy & Advocate for STEM Education

STEM EDUCATION POLICY AND ADVOCACY ACTIVITIES

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

In 2015, I-STEM staff members continued to network at the local, state, national, and international levels to promote STEM education and advocate for STEM education programs and resources.

On the local level...
I-STEM staff regularly met with campus administration and researchers and presented at unit-level meetings, such as with College of Engineering administrators. Former I-STEM Director Lizanne DeStefano served on the Office of Technology Management Advisory Committee and the Biology Coordinating Committee, which planned a climate study. Her research-related activities included the Campus Research Administrators’ Working Group.

On the state level...
Dr. DeStefano was a member of the following organizations and committees: Illinois Research-Practice-Policy Partnerships on Children and Families, the Illinois State Board of Education’s Technical Advisory Committee, the Early Learning FIT Validation Process Advisory Committee, and Illinois’ Assessment in STEM Education: Some Conceptual and Pragmatic Considerations Taskforce. As P–20 Council Coordinator, she served on all P–20 committees (see page 8). I-STEM Interim Director Luisa Rosu also served as a member of the P–20 Council in 2015.
On the national level...

I-STEM staff participated in and presented at a number of important conferences, STEM-related task forces, and committees in 2015.

- **American Evaluation Association 2015.** I-STEM Director Luisa-Maria Rosu gave a presentation at AEA 2015 in Chicago regarding her Fulbright research entitled, “Addressing Diversity of Values: The Educative Commitment of the Evaluator and the Educational Narrative Overreach.”

- **The 19th Colloquium for Information Systems Security Education (CISSE).** I-STEM Research Associate Gabriela Garcia presented “Utilizing a Workshop Format to Foster Discussion: Multidisciplinary Undergraduate Curriculum in Digital Forensics Development” at CISSE.

- **SC15: The International Conference for High-Performance Computing, Networking, Storage, and Analysis.**
  
  At SC15, I-STEM evaluator Lorna Rivera took part in a panel hosted by Intel Corporation about diversity in high-performance computing (HPC) which addressed the following questions:
  1. What would you like to see implemented during SC’16 that would improve the cultural perception around diversity?
  2. How do you start to tackle gathering a community headcount around diversity within the HPC community?
  3. What are 2 or 3 key things that the SC’16 committee could do/offer, in order to draw more diversity at the conferences?
  4. What can we collectively create at SC’16 that would promote a healthy pipeline of professional growth during the conference?

Rivera also gave the keynote presentation, “Women in HPC: Changing the Face of HPC,” at the “Women in HPC Workshop” at SC15. Rivera presented on I-STEM’s evaluation findings during the development and testing of student program application forms to reduce selection bias and increase the number of diverse participants in HPC.


On the international level...


International Supercomputing Conference (ISC) 2015. In July 2015, Lorna Rivera gave the keynote presentation, “Women in HPC: Changing the Face of HPC,” at the “Women in HPC” workshop” at ISC 2015 in Frankfurt, Germany. Rivera addressed I-STEM’s evaluation findings on the development and testing of student program application forms to reduce selection bias and increase the number of diverse participants in HPC.


I-STEM worked with programs designed to increase student interest in STEM careers, strengthen the state’s STEM pipeline, and foster STEM workforce development. Dr. DeStefano served on the Entrepreneurship Roundtable Committee and worked with the Illinois Pathways Initiative’s R&D STEM Learning Exchange Resource Repository and Mentor-Matching Engine (see pages 9 and 39).
Evaluate and analyze STEM policies.

One of I-STEM’s roles is to examine broad policy initiatives affecting STEM education at all levels. This often includes formal evaluation of policies and initiatives, like the study on the Implementation of Key Illinois Education Initiatives done for the P-20 Council (see page 38).

Identify 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, we conduct an annual review of current external STEM education investments on campus (see pages 41–43). I-STEM reports on many of these in the Current STEM Ed Highlights of I-STEM’s home page, the News section, STEM Ed Projects section of the I-STEM website. 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 pages 2 and 41).

STEM EDUCATION POLICY/ADVOCACY PARTNERS, PROJECTS, AND EVENTS

Danielson Framework Validation Study. I-STEM evaluates this project for Illinois State University’s Center for the Study of Education Policy. It aims to validate and examine the appropriateness of the Charlotte Danielson Framework for Teaching as a tool for evaluating Pre-K to 3rd grade teachers. This comprehensive, research-based protocol identifies aspects of teachers’ responsibilities proven to promote improved student learning.

Illinois Lt. Governor’s Visit to Illinois. In September 2015, the State of Illinois’ Lt. Governor, Evelyn Sanguinetti, contacted I-STEM to arrange a visit to campus in order to dialogue with Illinois administrators, faculty, staff, and students, as well as I-STEM evaluators, regarding increasing the number of underrepresented students in STEM. During the meeting, faculty, staff, and students showcased their outreach projects and the impact Illinois is having on exposing underserved students to STEM.

I-STEM identifies and catalogs Illinois’ current external funding projects, as well as potential resources. As part of this, we conduct an annual review of current external STEM education investments on campus.
**Illinois Pathways Initiative.** This program’s STEM Learning Exchanges are partnerships to promote collaboration and engagement of K–12 students in real-life scientific problems via the web, which students may access for career-related educational resources. In 2015, Dr. DeStefano served on the Illinois Pathways Steering Committee. I-STEM staff contributed information about university P–12 STEM education programs to the STEM Research and Development committee’s new STEM Learning Exchange Resource Repository\(^{11}\), which enables organizations to provide enhanced learning experiences for students and teachers, and its Mentor-Matching Engine\(^ {12}\) program, which connects STEM graduate students and professionals to serve as mentors for the students.

**Learning Performance Management System.** Using NCSA’s petascale computing equipment to track student performance from pre-school through workforce, this system will learn about effective STEM pathways—ways of moving through the system and entering STEM careers. During 2015, Dr. DeStefano continued to participate in a working group to design the system’s infrastructure.

**National Assessment of Education Progress (NAEP).** Dr. DeStefano continued to serve as a member of the NAEP Validity Studies Expert Panel.

\(^{11}\)http://stemlearningexchange.org/
\(^{12}\)http://coolhub.imsa.edu/web/mentor-matching-engine
Statewide Study of Feedback on Implementation of Key Illinois Education Initiatives. I-STEM staff conducted a statewide study for the Illinois P-20 Council obtaining feedback on the implementation of four key Illinois education initiatives: rigorous, internationally benchmarked student learning standards; a standards-based student assessment; a redesigned educator performance evaluation system; and the P-20 longitudinal education data system.

The study consisted of both focus groups and an online survey targeting specific stakeholder groups, namely school administrators, business community members, local community members, parents, and teachers. Seventy focus groups were conducted across the state and over 2700 stakeholders took the online survey. The majority of survey respondents were teachers (59%) who identified as White (87.2%). The majority of focus group participants resided in Cook County (61.4%) and were parents (52%). Based on feedback from survey and focus-group participants, the following takeaways were submitted to the P-20 Council:

- Some factors are independent of direct teacher or administrator control but have a significant impact on student learning and educator impact. Such factors include parent involvement, socioeconomic status, attendance, other student characteristics, as well as disciplinary or behavioral issues.
- Regular contact and communication with parents is essential.
- Consideration for all education policy discussions need to reflect that all students, including college bound and workforce bound students, receive life preparation skills to meet the need to become productive and successful citizens.
- Due to the timing of the survey and focus groups, data on PARCC must be considered in the context of the pre-test administration period.

UI-CPS Joint Task Force. In 2015, Dr. DeStefano was a member of this task force that seeks to improve coordination of programming between the University of Illinois and Chicago Public Schools.
STEM EDUCATION EXTERNAL FUNDING AT ILLINOIS

I-STEM annually assesses existing resources campus-wide to create a snapshot of active external STEM education investments on campus. To build a comprehensive database, I-STEM researches available campus databases, such as the Proposal Data System of Illinois’ Division of Management Information, as well as funders’ electronic databases.

Since funding awards may be completely or only partially dedicated to STEM education; we estimate the STEM education amount by calculating a percentage of the total award. For example, for projects whose sole thrust is STEM education or its evaluation, we calculate 100% of the award. For STEM research projects with education components, we estimate that 30% is devoted to education (i.e., NSF CAREER funding requires education or outreach components). For large research centers, we estimate that 15% of the award is devoted to STEM education components. These estimates apply to calculations for Figure 2 below and Figures 3 and 4 on pages 42 and 43, respectively.

Figure 2 below presents estimated STEM Education funding at Illinois from 2009 through 2015. Estimates of STEM education award amounts per year are based on data retrieved by the time each year’s annual report is published and are not necessarily inclusive of all grants awarded to the university in the area of STEM education over the seven-year period. For 2015, the estimated total of $337.4 million in active STEM education investments by funding sources (see Figure 3 on page 42) spans federal agencies (i.e., the National Science Foundation, the U.S. Department of Education, and National Institutes of Health), the state of Illinois (i.e., the Illinois State Board of Education and Illinois Board of Higher Education), as well as private and corporate support.

This external investment supports STEM education activities across 16 academic, research, and campus-level administration units (see Figure 4 on page 43). Projects include STEM P–20 outreach, teacher training and professional development, undergraduate/graduate disciplinary training programs and research experiences, graduate and postdoctoral fellowship support, STEM education research and evaluation, as well as STEM research projects and centers with education components.

A Garden Hills student learns how to measure accurately during Brady STEM Academy hands-on activity.

I-STEM Website
Externally Funded Projects and Funding Resources

- Directory of Externally Funded STEM Education Projects
  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

- Upcoming Funding Deadlines
  url: http://www.istem.illinois.edu/funding/upcomingdeadlines.html

- I-STEM-News Listserv
  url: https://lists.illinois.edu/lists/info/i-stem-news

![Figure 2: STEM Education Funding at Illinois, 2009–2015](image)
Figure 3: Active External Investment in STEM Education at Illinois for 2015, by Funder

<table>
<thead>
<tr>
<th>FUNDER</th>
<th>INVESTMENT</th>
</tr>
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<tbody>
<tr>
<td>National Science Foundation—Disciplinary Directorates/Other Offices (NSF–Disciplinary)</td>
<td>$196,440,790</td>
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<tr>
<td>National Science Foundation—Education &amp; Human Resources Directorate (NSF–EHR)</td>
<td>$45,743,368</td>
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<tr>
<td>National Institutes of Health (NIH)</td>
<td>$32,692,944</td>
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<tr>
<td>State of Illinois Agencies (State of Illinois)</td>
<td>$29,294,184</td>
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<tr>
<td>Private (Foundations, Associations)*</td>
<td>$10,006,855</td>
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<tr>
<td>U.S. Department of Agriculture</td>
<td>$6,275,251</td>
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<tr>
<td>Other Federal Agencies (DoD, DoE, NASA)</td>
<td>$6,182,032</td>
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<tr>
<td>Educational Institutions</td>
<td>$4,604,040</td>
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<td>U.S. Department of Education (DoED)</td>
<td>$3,357,343</td>
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<tr>
<td>Industry*</td>
<td>$2,795,073</td>
</tr>
<tr>
<td>Total</td>
<td>$337,391,879</td>
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</tbody>
</table>

Note: STEM education resources in Figures 3 and 4 were calculated based on a percentage (100%, 30%, 15%) of each funding award (see the discussion on page 41).

*Notable private support for STEM education projects includes numerous foundations and associations, such as: American Educational Research Association, American Society of Heating, Refrigeration, and AC Engineers, Howard Hughes Medical Institution, National 4H Council, National Academy for Nuclear Training, Neisen Foundation, and the Sloan Foundation. Corporate/industry support includes companies such as Abbott Laboratories, AbbVie, Eli Lilly & Company, Intel, IBM, John Deere & Co, and Microsoft.
### CAMPUS UNIT

<table>
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<tr>
<th>Campus Unit</th>
<th>Investment</th>
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<tr>
<td>Agricultural, Consumer and Environmental Sciences (ACES)</td>
<td>20,332,678</td>
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<tr>
<td>Applied Health Sciences (AHS)</td>
<td>6,916,326</td>
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<tr>
<td>Beckman Institute</td>
<td>14,592,998</td>
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<td>Business</td>
<td>76,755</td>
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<tr>
<td>Campus/University Administration</td>
<td>18,879,463</td>
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<td>Education</td>
<td>9,674,457</td>
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<tr>
<td>Engineering</td>
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<td>Graduate School of Library and Information Sciences (GSLIS)</td>
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<tr>
<td>Institute for Genomic Biology (IGB)</td>
<td>1,625,233</td>
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<td>Labor and Employment Relations (LER)</td>
<td>41,915,939</td>
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<tr>
<td>Liberal Arts and Sciences (LAS)</td>
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<td>Medicine</td>
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<tr>
<td>National Center for Supercomputing Applications (NCSA)</td>
<td>115,158,797</td>
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<tr>
<td>Veterinary Medicine (Vet Med)</td>
<td>6,169,652</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$337,391,879</strong></td>
</tr>
</tbody>
</table>
I-STEM STAFF AND STUDENTS

Above (left to right): Sarai Coba and Emily Gates.
Below (left to right): Ayesha Tillman, Dominic Combs, and Marlon Mitchell.
Bottom left: Gabriela Garcia (right) hands a survey to a student in the PDF course.

Above: Some of the I-STEM team (clockwise from the left): Betsy Innes; Ayesha Tillman; former Director, Lizanne DeStefano; Interim Director, Luisa Rosu; Christine Shenouda; Vijetha Vijayendran; Carie Arteaga; Gabriela Garcia; Jung Sung; and Lorna Rivera.
Bottom right: Left to right: Dominic Combs, Betsy Innes, Maggie Phan, Sergio Contreras, Luisa-Maria Rosu, Marlon Mitchell, Christine Shenouda, Sarai Coba, Derrick Houston, Lorna Rivera, Sherla Carpenter, Jung Sung

I-STEM DIRECTORS
- Lizanne Destefano, I-STEM Founder and Former Director
- Luisa-Maria Rosu, I-STEM Interim Director

I-STEM RESEARCHERS/AFFILIATES
- Gretchen Adams, I-STEM Affiliate, Director of the Chemistry Merit Program, the Merit Fellows Program
- Sarai Coba-Rodriguez, Graduate Research Assistant. Projects: COTC, TOPRS, RDLE, Danielson Framework Validation Study
- Dominic Darrell Combs, Graduate Research Assistant. Projects: Nano@Illinois RET, CBMM Teacher Workshop and REU, CSN REU/REV
- Sergio Andres Contreras Pinto, Graduate Research Assistant. Project: XSEDE.
- Gabriela Garcia, Graduate Research Assistant. Projects: Program for Digital Forensics, Merit Scholars (S-STEM), COTC, TOPRS
- Derek Houston, Graduate Research Assistant. Projects: P-20 Council Study; AAP STEM Initiative; Engineering James Scholar Program
- Marlon Mitchell, Graduate Research Assistant. Projects: REEC; VInTG IGERT; Bioimaging REU, Nano@Illinois REU, EBICS Project ENGAGES and EBICS REU
- Maggie Phan, Graduate Research Assistant. Project: NanoBio Node
I-STEM Support Staff

- Sherla L. Carpenter, Extra Help Office Associate Two
- Debby Ann Reynolds, Administrative Assistant

I-STEM Undergraduate Students

- Emily Alameda, an undeclared freshman, hopes to be a Chemistry professor.
- Cherie Chin, a senior in ACES, Finance in Agribusiness, minor in Business, who hopes to be an analyst in a financial technology company
- Derrick Domi, a senior in Technical Systems Management, with a minor in Business, who will be seeking a Master’s in Technology Management at Illinois.
- Valentina Gill, a senior in Speech and Hearing Science with a minor in Spanish Linguistics. Gill hopes to be a Bilingual Speech Language Pathologist, and will attend graduate school in fall 2016 in Communication Disorders.
- Anna Jedralski, Materials Science and Engineering major
- Deepa Kote, Materials Science and Engineering major
- Payal Malik, a sophomore in Economics, finance; Payal’s career goal is to be the chief economist of some small, open economy
- Paulina Rodriguez, a freshman in Psychology with a concentration in Behavior Neuroscience, premed track and a minor in Chemistry; Paulina hopes to attend medical school to become a neurosurgeon.
- Megan Sullivan, Mathematics major
- Nicoletta Wagner, Psychology major
- Chelsea Wilson, a senior in Earth, Society & Environmental Sustainability, hopes to become a GIS analyst for an environmental engineering firm or a global security corporation.

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 as complete a listing as possible of the many evaluation projects I-STEM worked on in 2015; some were funded externally, such as those funded by NSF, which now requires evaluations for its projects. Climate studies, like those performed for Engineering or Chemistry, were funded internally by the units themselves. Additionally, I-STEM completed several pro bono projects in hopes that these might become a source of revenue in the future.