

pre-college

Education & Outreach

2012-13



From the Director:

It is my pleasure to share with you our recent accomplishments in education and diversity program at CURENT.

The education, outreach and diversity program at CURENT focuses on an interactive and challenging academic environment, where ERC students working with faculty, postdoctoral research associates, graduate students and industry experts from diverse background can gain the experience they need to be leaders in the field. The education program offers a holistic approach to meet the educational needs for K-12 students and teachers, undergraduate and graduate students, and the industry community. Education programs are purposefully designed to enhance students' adaptability and creativity to enable them to thrive in a global environment.

I view engineering education as an effort among educators, parents, community, and industry that goes beyond just any one individual's influence. CURENT's education program values partnership and collaboration from the community. We are thankful for your support.

Best Wishes,

Dr. Chien-fei Chen
*Co-Director of Education
& Diversity Programs*

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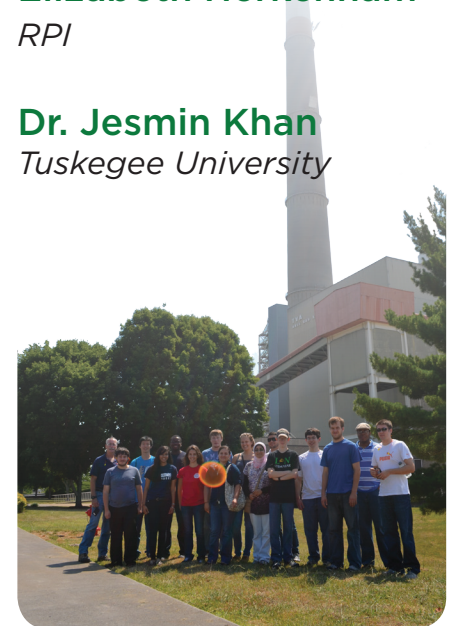


1,070

the UT campus alone impacted 1,070 pre-college participants during 2012-13

682

meanwhile, over 680 pre-college students and teachers participated in partner school education programs



A major facet of CURENT is its education and outreach initiative. At the pre-college level, our goal is to inspire K-12 students and teachers to explore and learn engineering concepts. Ideally, this will increase the number of domestic students that pursue engineering degrees in college. CURENT has incorporated three general education approaches:

- Promote awareness
- Provide knowledge
- Encourage creativity

Considering that CURENT recently completed its first full year as a NSF/DOE Engineering Research Center, a broad (yet solid) foundation of programs and activities has been put in place to impact students and communities locally and nationwide. It is our goal that these innovative approaches to STEM education will encourage a new generation of engineers.

Take a look at what we've been up to...

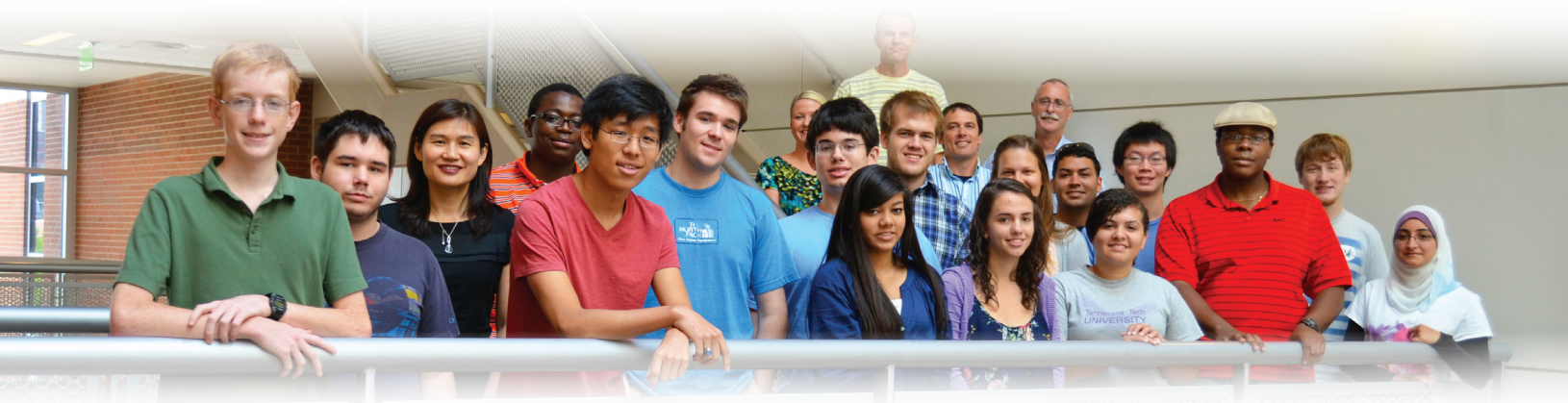
Spring 2012 | **Summer 2012**

- Science Night @ Whittle Springs Middle School
- WS Middle School Lab Tours @ CURENT
- Adventures in STEM for Middle School Girls
- Engineering Summer Camps w/ UT's College of Eng.

Fall 2012 | **Winter 2012/13**

- Tomorrow's Engineers Today @ CURENT
- WS Middle School Circuits & Careers Presentations
- Family Engineering Night @ Sequoyah Elem.

To supplement CURENT's pre-college outreach initiatives, the center offers high school students and teachers the opportunity to work long-term in electrical engineering labs, by way of our paid research programs. The **Young Scholars Program** (YSP) puts talented students into close contact with graduate researchers and faculty working on projects that match the student's interests. Participants come to campus either weekly (academic year program) or daily (summer program), and finish their experiences by completing a poster and presenting it at a collaborative STEM Research Symposium held at the University of Tennessee.



Whether they're looking to incorporate new ideas and projects into a curriculum, or just expand their knowledge of engineering, the **Research Experience for Teachers** (RET) is an opportunity for educators to impact the classroom. Participants work closely with researchers and education staff in the center to explore new engineering concepts and tailor innovative project and lesson ideas for their students. The teachers in the program also complete a poster and present their projects alongside Young Scholars at the Symposium.

Research Projects from 2012:

*Scientific Research, a Vehicle for
a
Tennessee High School Robotics
Class*

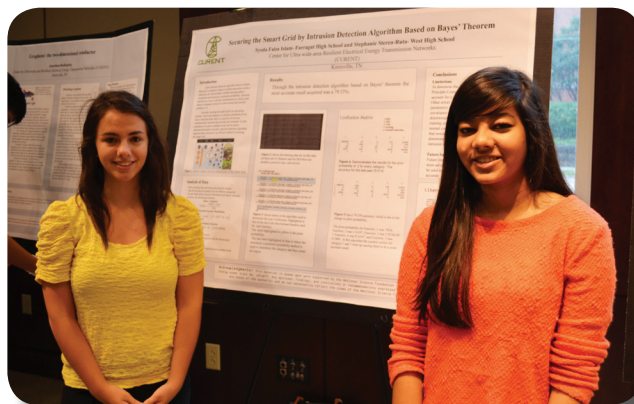
*Modeling Power Grid Dynamics
in the
High School Physics Classroom*

*Bringing Power Technologies
Into High
School Classrooms, First Steps*

*High School Biology I TEAM/
Inquiry-based Renewable
Resources Module*

Compressed Air Energy Storage

*Optimization of PHEV Battery
Fast Charging Mechanisms*



Summer Young Scholars Stephanie Steren-Ruta (L) and Faiza Islam (R) present research posters at the STEM Symposium

"The experience in the YSP program solidified my decision of studying electrical engineering in college."

-YSP Participant

"I was able to develop an entire curricular unit and purchase the necessary tools to implement it in my classroom. This will have a major impact on student engagement and learning of renewable energies."

-RET Participant

Family Engineering Night

signature programs


Neighbors peeking out their windows towards nearby Sequoyah School probably did a double-take at the hundreds of students shuffling in and out with bright yellow hard hats on. The hats can be explained, on this particular occasion, at least: the kids at the local K-5 school were channeling their inner-engineer. After all, it was CURENT’s Family Engineering Night.



Students and their families explored nine different exhibits, each with a hands-on engineering project. Participants were able to build homemade prosthetic hands, design towers out of paper towel rolls, activate solar-powered cars, and take part in other challenges that included engineering communications and environmental engineering. Also, much to the excitement of the athletically inclined students at the event, a student robotics team brought an interactive basketball-throwing robot from nearby Farragut High School. Students earned a sticker for completing each activity, and they turned their checklist in at the end of the night to receive the aforementioned hard hats.

Over 200 people took part in Family Engineering Night, which was designed to bring households together to explore some basic engineering concepts in an effort to promote science, technology, engineering, and mathematics (STEM) fields. Each activity was selected to ensure that it meets Knox County Schools’ Grade Level Expectations in K-5 science curriculum.

“ I’m just so thankful to have been part of this,” said Knox County K-12 Science Instructional Coach Andrea Allen. “I am so proud of an amazing partnership with CURENT.”

The event was a collaboration between Knox County Schools; Sequoyah School; and CURENT. It was organized by Allen; Principal Alisha Hinton and Science Lab Instructor Erin McCollum from Sequoyah School; and Education Co-Director Dr. Chien-fei Chen and Adam Hardebeck from CURENT. 

ADVENTURES IN STEM

Summertime typically means vacations, sleeping in, and lots of free time, but 27 local middle school girls’ summers kicked off with circuits, solar ovens, biodiversity, and mathematics instead. The group was on the University of Tennessee’s campus recently for the Adventures in STEM (science, technology, engineering, and mathematics) camp, a collaborative science program hosted by CURENT Engineering Research Center and the National Institute for Mathematical & Biological Synthesis (NIMBioS).

The five day program was designed so that girls could explore a variety of scientific fields and take part in hands-on activities and projects, led by UT faculty, graduate students, and education staff. The week

culminated with a poster presentation in front of family, friends, and faculty.

“Some people think that girls can’t do well in

engineering, math, or science, but of course I think we can, we’re just as smart as boys...maybe even smarter,” said Cedar Bluff Middle School student Mackenzie Lenoci with a smirk.

Lenoci, along with the rest of the group, spent the week in the Min Kao Electrical Engineering & Computer Science Building working on potato batteries, building electronic dance pads, and simulating a viral outbreak. The girls also got to interview working biologists, mathematicians, and engineers and report their findings to the class. The goal of these activities was to encourage girls to stay interested in studying and pursuing careers in technical fields.

“I think it’s very exciting that two very different National Science Foundation research centers came together on this camp to encourage our next generation of future women scientists and engineers,” said Kelly Sturner, Education & Outreach Coordinator for NIMBioS.



When Travis Griffin began planning the College of Engineering's summer pre-college initiatives for 2012 last August, he saw an opportunity to collaborate with the University of Tennessee's new Engineering Research Center, CURENT.

After several meetings, Griffin, the director of Diversity Programs in the college, tabbed CURENT to create and host the engineering design component of his five middle and high school programs.

"The collaboration with CURENT has provided an exciting opportunity for students to engage with new faculty and students through instruction and laboratory experiments," said Griffin.

Students that participated in the College of Engineering's AT&T MITES (Middle School Introduction to Engineering Systems), Bechtel HITES (High School Introduction to Engineering Systems), and INSTEP (Introduction of Sophomores to Engineering Principles) programs last summer designed solar cars, electric generators, smart

grid neighborhoods, miniature power lines, and solar ovens as part of the collaboration. The program participants devoted four hours per day in UT's newest facility, the Min H. Kao Building, to work with CURENT's education staff, faculty, and students on these projects. Each group wrapped up the week with a design presentation.

MITES 1 & 2

- 64 participants
- 53% minority student participation

INSTEP

- 31 participants
- 67.8% minority student participation

HITES 1 & 2

- 60 participants
- 59.6% minority student participation

Tomorrow's Engineers Today

Twenty-six high school girls arrived on the University of Tennessee's campus with an idea of what engineering was.

"I've always been interested in engineering," said Lenoir City High School sophomore Haylee Hicks, "but I thought it was more about sitting at a desk pushing buttons."

Needless to say, after four hours of exploring labs, asking questions to a panel of UT engineering students, and taking part in hands-on engineering challenges, Haylee and the rest of the group had a new perspective.

"It definitely made me more interested after seeing the hands-on side and seeing the accomplishment of what engineers can create," said Hicks.

The program, called "Tomorrow's Engineers Today," was organized by UT's chapter of Society of Women Engineers (SWE) and CURENT. Girls from Lenoir City High School, West High School,

from Lenoir City High School, West High School, and L&N STEM Academy were all on campus to take part.

Students started the day with a tour of UT's newest engineering facility (and the home of CURENT), the Min H. Kao Building. They then interacted with robots in both Dr. Lynne Parker's Distributed Intelligence Lab and Dr. Itamar Arel's Machine Intelligence Lab. The last tour before lunch was in Dr. Fran Li's Smart Home Testbed Lab, where the girls got to control electrical outlets from their smart phones.

During lunch, four engineering undergraduate students hosted a panel discussion so that the group could get answers to any questions that they had about college, job opportunities in the field, and UT's engineering programs.

To wrap up the day, the girls got some hands-on lab experience designing marshmallow/toothpick bridges and working with fuel cell and solar cars from TN-SCORE (Tennessee Solar Conversion and Storage using Outreach, Research and Education).


Northeastern

Northeastern University's Summer STEM Program is a weeklong summer program organized by Claire Duggan, from Center for the STEM education at NEU. After engaging in a discussion enhanced by a presentation provided by CURENT faculty (Dr. Ali Abur), students built model houses and attached solar panels to their roofs. Using data collected with a voltmeter and after graphing group results, students arrived at the ideal angle in which to position a solar panel on structure. Students participated in a series of lessons centered on green technologies, sustainability, and alternative energy sources. Ideas and lessons learned were then used by the students to

Summer STEM Program

re-design a city after a natural disaster devastated a coastal community. The design of



their city had to address: housing, business, education, health care, transportation, agriculture, energy sources, and telecommunications. Once planned, students constructed a "Future City" model with their team using foam board and recyclable materials. Models were then presented and displayed for students, parents, and educators to view as a culminating program requirement. 

partner school highlights




TUSKEGEE

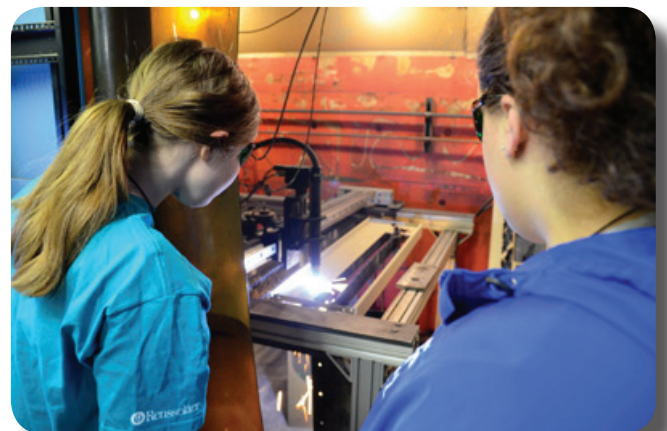
Tuskegee University recently hosted 55 6th-grade students for a lab tour and presentations on renewable energy.



Rensselaer

Design Your Future Day includes lab tours and hands-on projects (wind farm design) for high school girls. Three RPI undergraduate students, under the supervision of Prof. Joe Chow, developed a wind farm design and simulation module, which was designed to encourage female students to pursue careers in STEM fields. Undergraduate students at RPI developed the activity concept and researched relevant data such as wind speed and energy prices in New York. A template used for design discussion and parameter selection and an excel spreadsheet for calculating the design results were developed and used with the high school students.

University of Tennessee faculty then helped develop the assessment plan and analysis. The corresponding article was published in the *IEEE Power and Energy Magazine*, and some of the program curriculum was implemented in local high schools. 



annual accomplishments

- Our first year of summer research programs had 11 Young Scholars and six Research Teachers across all campuses
- Six Young Scholars and one teacher participated in semester-long research programs; all YSPs continued to study engineering after they entered into college
- Curriculum development of power and energy was implemented at several schools
- Eight week-long summer day and residential programs offered to 249 middle/high school students
- Two highly-acclaimed family engineering nights at elementary and middle schools (430+ attendees)
- Three major events promoted learning and awareness of engineering among girls: Adventures in STEM, Tomorrow's Engineers Today, and Design Your Future Day
- One education paper was published in the IEEE Power & Energy Magazine. This paper was led by Dr. Joe Chow and co-authored with undergraduate and graduate students, and Dr. Chien-fei Chen
- Our education faculty members were involved with STEM faculty search committee for the Department of Teaching and Learning at UTK



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