

ATECENTERS

IMPACT

PARTNERS WITH INDUSTRY FOR A NEW AMERICAN WORKFORCE



2016-2017



ADVANCED TECHNOLOGICAL EDUCATION CENTERS

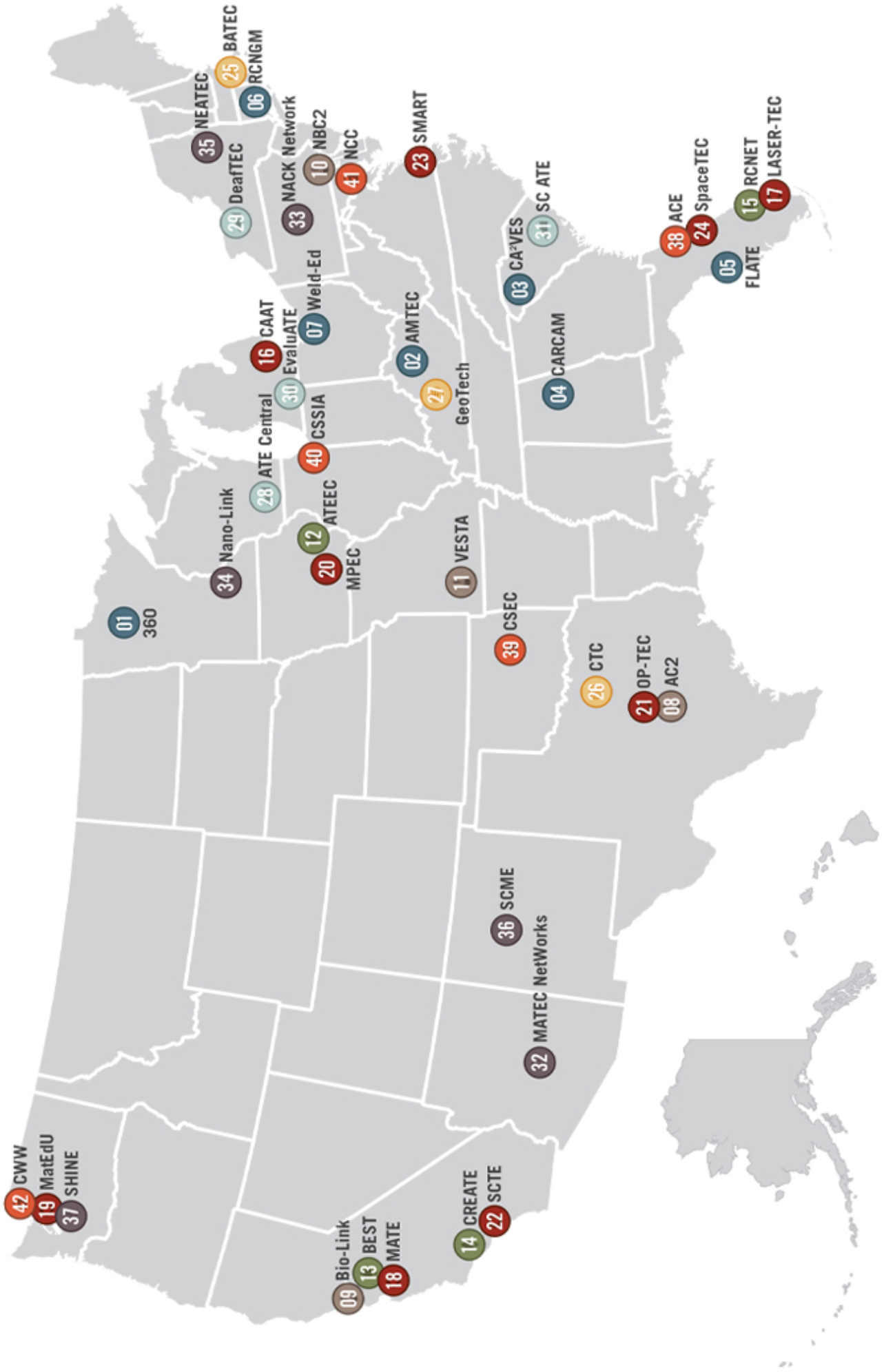
ATECENTERS

Welcome to Advanced Technological Education

The National Science Foundation's Advanced Technological Education program supports the development of innovative approaches for educating highly skilled technicians for the industries that drive the nation's economy.

The ATE program features two-year college educators as leaders in this endeavor because public community and technical colleges are the major sources for technician education in the US. The competitive grant program's structure also encourages partnerships with employers as well as secondary school and university educators. As a result, the innovations that ATE centers and projects devise and test are model programs that reach students from secondary schools to community colleges and universities. They also generate career pathways for students to follow from certificate and degree programs to employment in established and emerging industries.

This publication focuses on the activities and accomplishments of 40 ATE centers and two large ATE projects. Depending on their funded mission, the 40 centers lead national or regional initiatives in particular fields, or serve as support centers. The two large projects serve as catalysts within the ATE community and as sources for program-wide dissemination and capacity building.



IMPACT 2016-2017

PARTNERS WITH INDUSTRY FOR A NEW AMERICAN WORKFORCE

LEGEND



ADVANCED MANUFACTURING TECHNOLOGIES

- 01 **360** | Bemidji, MN
- 02 **AMTEC** | Versailles, KY
- 03 **CA²VES** | Clemson, SC
- 04 **CARCAM** | Gadsden, AL
- 05 **FLATE** | Tampa, FL
- 06 **RCNGM** | Farmington, CT
- 07 **Weld-Ed** | Elyria, OH



AGRICULTURAL & BIO TECHNOLOGIES

- 08 **AC2** | Austin, TX
- 09 **Bio-Link** | San Francisco, CA
- 10 **NBC2** | Blue Bell, PA
- 11 **VESTA** | Springfield, MO



ENERGY & ENVIRONMENTAL TECHNOLOGIES

- 12 **ATEEC** | Davenport, IA
- 13 **BEST** | Oakland, CA
- 14 **CREATE** | Santa Clarita, CA
- 15 **RCNET** | Fort Pierce, FL



ENGINEERING TECHNOLOGIES

- 16 **CAAT** | Warren, MI
- 17 **LASER-TEC** | Fort Pierce, FL
- 18 **MATE** | Monterey, CA
- 19 **MatEdU** | Lynnwood, WA
- 20 **MPEC** | Ottumwa, IA
- 21 **OP-TEC** | Waco, TX
- 22 **SCTE** | Norco, CA
- 23 **SMART** | Virginia Beach, VA
- 24 **SpaceTEC** | Cape Canaveral, FL



INFORMATION TECHNOLOGIES

- 25 **BATEC** | Boston, MA
- 26 **CTC** | Frisco, TX
- 27 **GeoTech** | Louisville, KY



LEARNING, EVALUATION & RESEARCH

- 28 **ATE Central** | Madison, WI
- 29 **DeafTEC** | Rochester, NY
- 30 **EvaluATE** | Kalamazoo, MI
- 31 **SC ATE** | Florence, SC



MICRO & NANO TECHNOLOGIES

- 32 **MATEC NetWorks** | Phoenix, AZ
- 33 **NACK Network** | University Park, PA
- 34 **Nano-Link** | Rosemount, MN
- 35 **NEATEC** | Troy, NY
- 36 **SCME** | Albuquerque, NM
- 37 **SHINE** | Seattle, WA



SECURITY TECHNOLOGIES

- 38 **ACE** | Daytona Beach, FL
- 39 **CSEC** | Tulsa, OK
- 40 **CSSIA** | Palos Hills, IL
- 41 **NCC** | Largo, MD
- 42 **CWW** | Bellingham, WA



National
Science
Foundation

Highlighting the Advanced Technological
Education (ATE) centers sponsored by the
National Science Foundation (NSF)

TABLE OF CONTENTS

i IN THE NATIONAL SPOTLIGHT

ii ATE BY THE NUMBERS



ADVANCED MANUFACTURING TECHNOLOGIES

- 01 **360** | Manufacturing and Applied Engineering ATE Regional Center of Excellence
- 02 **AMTEC** | Automotive Manufacturing Technical Education Collaborative
- 03 **CA²VES** | Center for Aviation and Automotive Technology Education Using Virtual E-Schools
- 04 **CARCAM** | Consortium for Alabama Regional Center for Automotive Manufacturing
- 05 **FLATE** | Florida Advanced Technological Education Center of Excellence
- 06 **RCNGM** | Regional Center for Next Generation Manufacturing
- 07 **Weld-Ed** | National Center for Welding Education and Training



AGRICULTURAL & BIO TECHNOLOGIES

- 08 **AC2** | AC2 Bio-Link Regional Center
- 09 **Bio-Link** | Next Generation National ATE Center for Biotechnology and Life Sciences
- 10 **NBC2** | Northeast Biomufacturing Center and Collaborative
- 11 **VESTA** | Viticulture and Enology Science and Technology Alliance



ENERGY & ENVIRONMENTAL TECHNOLOGIES

- 12 **ATEEC** | Advanced Technology Environmental and Energy Center
- 13 **BEST** | Building Efficiency for a Sustainable Tomorrow Center
- 14 **CREATE** | California Regional Consortium for Engineering Advances in Technological Education
- 15 **RCNET** | Regional Center for Nuclear Education and Training



ENGINEERING TECHNOLOGIES

- 16 **CAAT** | Center for Advanced Automotive Technology
- 17 **LASER-TEC** | Southeast Regional Center for Laser and Fiber Optics Education
- 18 **MATE** | Marine Advanced Technology Education Center
- 19 **MatEdU** | National Resource Center for Materials Technology Education
- 20 **MPEC** | Midwest Photonics Education Center
- 21 **OP-TEC** | National Center for Optics and Photonics Education
- 22 **SCTE** | National Center for Supply Chain Technology Education
- 23 **SMART** | Southeast Maritime and Transportation Center
- 24 **SpaceTEC** | National Resource Center for Aerospace Technical Education



INFORMATION TECHNOLOGIES

- 25 **BATEC** | Broadening Advanced Technological Education Connections
- 26 **CTC** | National Convergence Technology Center
- 27 **GeoTech** | National Geospatial Technology Center of Excellence



LEARNING, EVALUATION & RESEARCH

- 28 **ATE Central** | Supporting the ATE Community
- 29 **DeafTEC** | Technological Education Center for Deaf and Hard-of-Hearing Students
- 30 **EvaluATE** | Evaluation Resource Center for Advanced Technological Education
- 31 **SC ATE** | South Carolina Advanced Technological Education Center of Excellence



MICRO & NANO TECHNOLOGIES

- 32 **MATEC NetWorks** | MATEC NetWorks National Resource Center
- 33 **NACK Network** | Nanotechnology Applications and Career Knowledge Network
- 34 **Nano-Link** | Center for Nanotechnology Education
- 35 **NEATEC** | Northeast Advanced Technological Education Center
- 36 **SCME** | Southwest Center for Microsystems Education
- 37 **SHINE** | Seattle's Hub for Industry-driven Nanotechnology Education



SECURITY TECHNOLOGIES

- 38 **ACE** | Advanced Cyberforensics Education Consortium
- 39 **CSEC** | Cyber Security Education Consortium
- 40 **CSSIA** | National Center for Systems Security and Information Assurance
- 41 **NCC** | National CyberWatch Center
- 42 **CWW** | CyberWatch West



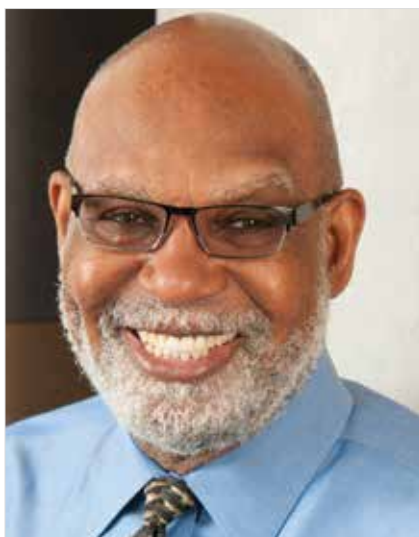
V. CELESTE CARTER, PhD

The National Science Foundation (NSF) awards grants to support research and education in science and engineering. With an emphasis on two-year colleges, NSF's Advanced Technological Education (ATE) program focuses on the education of technicians for the high-technology fields that drive the nation's economy.

“As a community college biotechnology instructor, I had the good fortune to receive an ATE grant. More recently, as an NSF program director it has been a privilege to facilitate partnerships between faculty, academic institutions, and industry to improve the education of science and engineering technicians at the undergraduate and secondary school levels.”

V. Celeste Carter, PhD

Lead ATE Program Director
Division of Undergraduate Education
National Science Foundation



RUFUS GLASPER, PhD

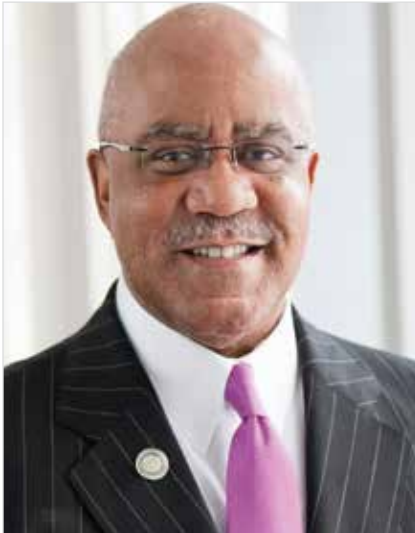
The League for Innovation in the Community College is an international nonprofit organization dedicated to catalyzing the dynamism of community colleges. With more than 800 institutions in its League Alliance and 160 corporate partners, the league hosts conferences and institutes, develops print and digital resources, and leads initiatives.

“The league shares ATE's focus on innovation, learning, diversity, and quality at community colleges. While chancellor of the Maricopa Community Colleges I enjoyed observing faculty test their ideas for improving STEM education with ATE support. The ATE projects and center that Maricopa has been privileged to host sparked innovations that benefit students, employers, the communities served by the 10-college district, and the nation.”



Rufus Glasper, PhD

President & CEO
League for Innovation in the Community College
Former Chancellor of The Maricopa County
Community College District (MCCCD)
Host institution of Maricopa Advanced Technology
Education Center (MATEC)



Walter G. Bumphus, PhD
President & CEO
American Association of Community Colleges

WALTER G. BUMPHUS, PhD

The American Association of Community Colleges (AACC) is the primary advocacy organization for the nation's community colleges representing nearly 1,200 two-year, associate degree-granting institutions and more than 13 million students. Uniquely dedicated to access and success for all students, AACC's member colleges provide an on-ramp to degree attainment, career training, and are a gateway to the middle-class for many Americans.

“AACC is proud to serve as a long-standing partner of the National Science Foundation's ATE program, which provides invaluable support to our nation's community colleges enabling them to expand institutional capacity, develop effective collaborations with industry, and strengthen innovative STEM technician education programs across the country.”



Achieving the Dream™

Community Colleges Count



Karen A. Stout, EdD
President & CEO
Achieving the Dream
Former President of Montgomery County
Community College
Host Institution of the Northeast
Biomanufacturing Center & Collaborative (NBC2)

KAREN A. STOUT, EdD

Achieving the Dream, Inc., is a national nonprofit dedicated to helping more community college students, particularly low-income students and students of color, stay in school and earn a college certificate or degree.

“Community colleges play an increasingly vital role in strengthening students' technical skills so they are prepared for STEM careers that offer family-sustaining wages. Achieving the Dream helps community colleges in our network come together through peer learning communities to share information about practices and policies that ensure STEM career pathways play an essential role in their student success efforts. ATE provides exactly the kind of research-based information about innovative technical teaching and learning that our colleges expect from us.”



ATE BY THE NUMBERS

ATE centers and projects incubate innovative STEM technician education programs.

They test new ways of teaching about established and emerging technologies at their host colleges and partner institutions. The results of these structured studies are instructional modules, new courses, and entire certificate and degree programs.

In tandem with creating products to improve students' learning, many ATE centers and projects offer professional development for faculty. At these programs community college instructors and secondary school teachers learn how to utilize the creative teaching techniques that centers have designed to meet a wide array of industry-identified workforce needs.

MOST ATE GRANTEES ARE LOCATED AT TWO-YEAR COLLEGES

(n=230)



65%



16%



10%

DIRECT MOST OF THEIR ACTIVITIES TO ENHANCE STEM EDUCATION PROGRAMS AT TWO-YEAR COLLEGES.

IN 2014, ATE PROJECTS AND CENTERS DEVELOPED



2,430
MATERIALS



SUCH AS COURSES, MODULES, LAB EXPERIMENTS OR OTHER TYPES OF EDUCATIONAL ACTIVITY.

Source: ATE 2015 Annual Survey Report by EvaluATE | www.evalu-ate.org

IN 2014, ATE PROGRAMS HAD



82,909
MALE STUDENTS



32,054
FEMALE STUDENTS

91%

OF THE STUDENTS PARTICIPATING IN ATE PROGRAMS DURING 2014 EITHER CONTINUED IN THEIR PROGRAM OR COMPLETED A PROGRAM.



ACCORDING TO THE RESULTS OF THE 2015 SURVEY OF ATE GRANTEES, UNDERREPRESENTED MINORITY (URM) STUDENTS COMPRISE 44% OF ALL STUDENTS IN ATE-SUPPORTED PROGRAMS.

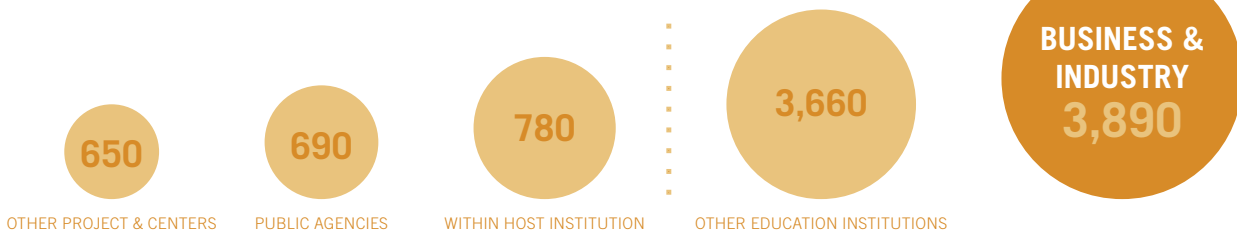
NUMBER OF URM STUDENTS 47,090 44%

URMS IN US POPULATION 34%

22%
URMS IN STEM PROGRAMS NATIONALLY

NSF CONSIDERS UNDERREPRESENTED MINORITIES IN STEM TO BE AMERICAN INDIANS, ALASKA NATIVES, BLACKS/AFRICAN AMERICANS, HISPANICS/LATINOS, NATIVE HAWAIIANS, AND OTHER PACIFIC ISLANDERS.

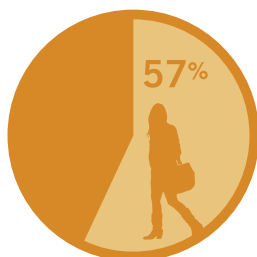
ATE PROJECTS & CENTERS HAVE THE MOST COLLABORATIONS WITH BUSINESS & INDUSTRY.



COLLABORATORS PROVIDED MORE THAN \$20 MILLION IN MONETARY AND IN-KIND SUPPORT.



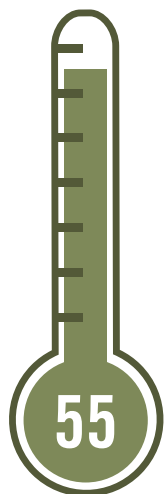
IN 2014, 90 ATE PROJECTS AND CENTERS OFFERED 2,190 PROFESSIONAL DEVELOPMENT ACTIVITIES ATTENDED BY 45,830 EDUCATORS.



WOMEN HAVE SIGNIFIGANT LEADERSHIP ROLES IN ATE. 24 OF THE 42 ATE CENTERS HAVE FEMALE PRINCIPAL INVESTIGATORS.



ATE CENTERS COLLABORATE



55 of the **61** Mentor-Connect colleges have submitted proposals

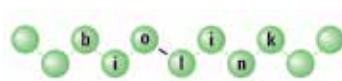
Mentor-Connect Tests Regenerative Leadership Development System

The South Carolina Advanced Technological Education Center and the American Association of Community Colleges created Mentor-Connect to help community college faculty prepare competitive grant proposals. Nine ATE center principal investigators serve on Mentor-Connect's leadership team or as mentors.

In addition to improving the institutional capacity of colleges that have not recently received ATE grants, Mentor-Connect aims to develop a new generation of STEM faculty leaders. Selected faculty receive mentoring over a nine-month period, technical assistance, and digital resources. Mentor-Connect's digital resources are free to the public.

NSF has awarded grants to 22 of the 36 Mentored Colleges (61%) that submitted proposals in 2013 and 2014; 19 proposals submitted in 2015 were under review at press time.

Bio-Link Nurtures Biotech Educator Network



ATE biotechnology educators are a tight-knit group. Nearly all of them can trace their involvement in ATE back to Bio-Link, the Next Generation National Advanced Technological Education Center of Excellence for Biotechnology and Life Sciences. The collaborative spirit of Bio-Link's leaders encourages educators at affiliated colleges not only to adopt innovative ATE curricula, but to submit proposals to the National Science Foundation. Consequently, two ATE centers and numerous ATE projects are spin-offs from Bio-Link's activities and programs.

Two entry points to the welcoming community are Bio-Link's Summer Fellows Forum and the Community College Program at BIO, which the biotech educators host at the international industry conference.



National Cyber League Offers Safe Space to Develop Cybersecurity Skills

The National Cyber League (NCL) was launched in 2011 by four ATE cybersecurity centers: National Support Center for Systems Security and Information Assurance (CSSIA), National Cyberwatch Center (NCC), CyberWatch West (CWW), and Mid-Pacific Information and Communication Technologies Centers (MPICT).

NCL integrates learning objectives in all of its virtual training activities for faculty and students. Its virtual gymnasiums, run by CSSIA, offer simulations and individual and team games that are aligned with curricula, industry certifications, and job roles.

The 2015 NCL Fall Season had more than 2,100 individual players and 300 faculty from more than 230 institutions.



HI-TEC Takes ATE Innovations to Practitioners



The High-Impact Technology Exchange Conference (HI-TEC) is the national conference organized by the principal investigators of ATE centers to share information about the centers' resources and activities. Held annually since 2009, HI-TEC attracts more than 650 secondary and postsecondary educators, career counselors, industry professionals, trade organizations, and technicians from across the US and other countries.

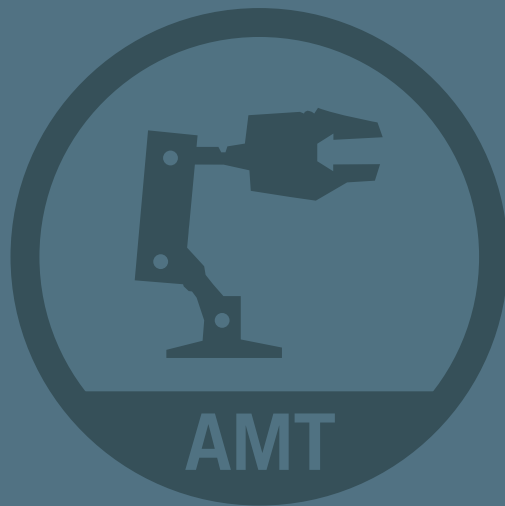
Improvements to technician education and general STEM education are the focus of HI-TEC technology showcases, industry site visits, breakout sessions, and keynote speakers.

The 242 HI-TEC attendees who completed surveys ranked five aspects of their conference experiences in order of importance.

HI-TEC Attendees Find Value In:







ADVANCED MANUFACTURING TECHNOLOGIES



360

Manufacturing and Applied Engineering
ATE Regional Center of Excellence

BEMIDJI STATE UNIVERSITY | BEMIDJI, MN

www.360mn.org



LEADING THE
MANUFACTURING
TALENT REVOLUTION



360 Develops Workforce

360, led by Bemidji State University, works with 14 technical and community colleges to develop a qualified workforce for advanced manufacturing. 360 impacts affiliated programs through program improvement funds, faculty professional development, learning modules, online and blended education programs, and career pathway opportunities. Since 2012,

KEY ACTIVITIES

- Designs a 21st century education system that prepares individuals for careers in advanced manufacturing.
- Meets the needs of the region's manufacturing employers through an enhanced pipeline and industry-driven curricula.
- Increases the quantity, quality, and diversity of talent in the field of manufacturing.

- 294 individuals gained foundational skills through 360 eTECH, a consortium-based online and hands-on education program;
- 360 partner colleges saw a 36% increase in their graduates in just two years, from a baseline of 466 graduates compared to 636 graduates in May 2014;
- 50%, or 55 students out of 110 students, in Bemidji State University's BAS degrees transferred credit from a 360 partner college.

Technology students learn to verify a model engine component to ensure the part meets specifications.





360 Recruits with Dream It. Do It.

360 works closely with manufacturing businesses throughout Minnesota to promote advanced manufacturing through Dream It. Do It. Minnesota, a recruitment strategy. 360 leads Dream It. Do It. Minnesota by providing resources and hosting events to reach youth and their families. Since 2012,

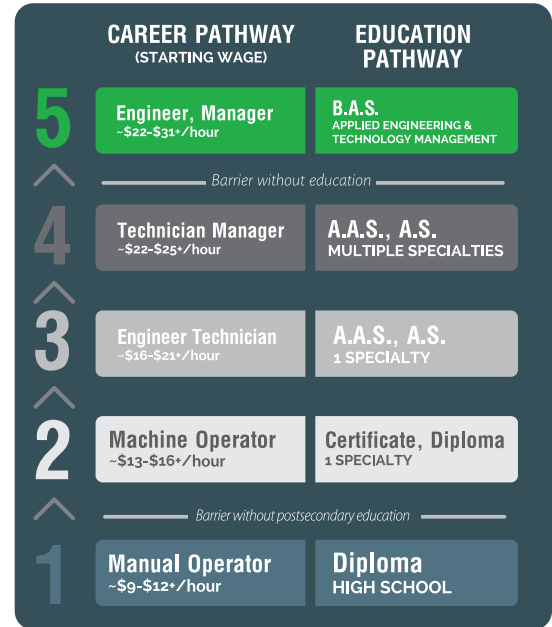
- more than 25,000 individuals in Minnesota have been educated about modern manufacturing careers;
- 1,200 teacher guides with lessons, activities, and videos have been disseminated; and
- more than 200 total businesses participated in the Statewide Tour, opening their doors for the public to experience modern manufacturing, reaching an estimated 13,530 total individuals.

The 360 eTECH program has been leveraged to develop new technicians. The program is now offered in six high schools. Since fall 2014, 31 students have enrolled in high school and college dual-credit courses that enable them to learn the technical skills needed to start manufacturing careers.

360 developed 26 Career Success Skills learning modules on topics prioritized by industry. They are free and can be used by instructors and employers to help individuals develop their soft skills. Since they were launched in 2014, 659 individual learning modules have been viewed.

360 Career Ladder for Manufacturing Shows Advancement Potential

360's Career Ladder shows how individuals can advance their manufacturing careers through lifelong learning and attainment of additional skills.



An operator programs a turret press.



“Manufacturing is the engine that drives our economy. Innovative collaborations between education and industry like 360 Manufacturing and Applied Engineering ATE Regional Center of Excellence are crucial in order to keep that engine running on all cylinders.”

*Bill King, Manufacturing Manager
Mate Precision Tooling*



AMTEC Leads US in Mechatronics Education

AMTEC leads the nation in industry-driven quality mechatronics education. Its competency-based modules prepare students to meet advanced manufacturers' expectations in 12 core subject areas: electricity, drafting-schematics, fluid power, mechanical drives, preventive and predictive maintenance, welding, machine tools, controls and instrumentation, programmable logic controllers, robotics, safety, and computer literacy.

Industry needs have also led to AMTEC's research and development of multiple assessments to validate the knowledge students and incumbent multi-skilled maintenance technicians gain in AMTEC certificate programs.

AMTEC utilizes a continuous improvement process to foster evidence-based decisions that guide enhancements of its curricula, assessment tools, and faculty professional development programs.

KEY ACTIVITIES

- Implements industry-led, competency-based online curricula to increase students' critical-thinking and problem-solving skills.
- Provides assessments to validate learning.
- Institutionalizes AMTEC's Career Pathway model to develop multi-skilled technicians.
- Expands AMTEC's industry-endorsed collaborative model.
- Disseminates Career Pathways research.



A Bluegrass Community and Technical College student troubleshoots a problem with a robot.



“The AMT (Advanced Manufacturing Technician) program with the AMTEC curriculum and skills assessments has accelerated the student to be fully job ready for a multi-skilled maintenance position at the end of the two-year program vs. current five to seven years for a new employee.”

*Mary Batch, Assistant Manager of Human Resource Development
Toyota Motor Manufacturing Texas, Inc.*

Modules Cut Employer Training Costs

AMTEC's nationally standardized competency-based modules provide students with valuable knowledge and skills that they are able to put to use immediately on the manufacturing floor.

AMTEC's modules are so effective that Nissan North America in Tennessee has reduced its apprenticeship from six years to three years for substantial savings in training costs. As of mid-2015, 22 AMTEC graduates of Tennessee College of Applied Technology – Murfreesboro had transitioned from the general assembly area to maintenance apprenticeships with a minimum increase of \$10 per hour. After one year, the apprentices will be multi-skilled maintenance technicians.

AMTEC Fosters Productive Connections

AMTEC's e-learning portal makes technical education easier to access. Its careers portal provides links to information about open positions at AMTEC industry partners' facilities.

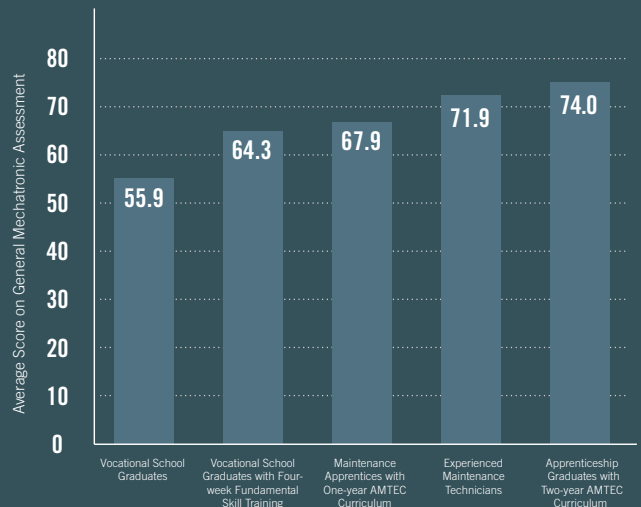
AMTEC has recently grown to 55 collegiate partners and 30 industry partners in 15 states. One AMTEC college offers technical instructor training in Mexico. AMTEC has hosted visitors from India and Brazil who want to incorporate AMTEC into their educational systems.

A technician checks the precision shaft alignment on a chain drive.



AMTEC Modules Improve Scores

The scores of students who learn with AMTEC modules are, on average, better than incumbent multi-skilled maintenance technicians' scores.





EducateWorkforce.com Enhances the Talent Pipeline

Through its online learning platform, EducateWorkforce.com, CA²VES has impacted more than 1,500 students nationally. Recent research studies indicate that CA²VES's digital learning tools positively impact student learning.

As of April 2015, the platform supported 140 virtual reality (VR) modules and digital learning tools used by students in 23 states. This reach has sparked partnerships with ATE centers, such as CAAT and FLATE, to create and disseminate high-impact VR modules and courses for two-year colleges. The capacity to create, disseminate, and research the effectiveness of VR on technician education sets CA²VES apart as a resource that two-year college faculty can explore to equip their students.

KEY ACTIVITIES

- Facilitates accelerated distribution and implementation of digital learning tools.
- Designs and develops virtual reality (VR) and digital curricula.
- Increases the diversity and quality of the advanced manufacturing talent pipeline.
- Provides research and other resources for two-year colleges.

A student identifies workplace hazards using VR simulations in CA²VES's safety course.





CA²VES Seeks to Redefine Advanced Technological Education

Since the center's origination, CA²VES has built a network of 150+ collaborators spanning education, industry, and government who have helped it pioneer the use of VR in technician education. The center's in-house experts have worked with industry and two-year colleges to design, develop, and implement high-end VR to support technician education needs. These VR simulations can be accessed 24-7 through CA²VES's online platform, EducateWorkforce.com. Students experience hands-on interaction with virtual equipment without the cost of physical equipment. Additionally, CA²VES engages in rigorous, evidence-based research about the impact of VR in technician education and the use of materials by affiliates.

CA²VES's leaders realize the importance of a diverse, qualified workforce. Consequently, the center pursues efforts to develop an advanced manufacturing talent pipeline through sustainable pathways and outreach campaigns that reach underserved populations. Combining outreach initiatives and the research and development of VR learning tools helps the center's personnel understand the broader impacts of innovations in teaching and learning, as well as technology integration and workforce development. Based on their findings, CA²VES and its partners intend to redefine advanced technological education.

3-D rendering in a VR simulation allows students to practice removing electric vehicle batteries.



Digital Learning Tools Expand Two-Year Colleges' Technician Education Capacity

More than 1,500 students and instructors at two-year colleges use digital learning tools developed by CA²VES.

Virtual reality modules | 72

CAD models | 47

Courses | 8

e-learning modules | 75

e-learning sections | 373

Interactive e-books | 5



“We’re excited that CA²VES is developing VR to help increase quality, quantity, [and] maximize instructor and program flexibility for all curriculum levels. These resources are necessary to help advance technological education for aerospace and automotive industries—our state’s fastest-growing sectors.”

*Chuck Spangler, Interim CEO
South Carolina Manufacturing Extension Partnership*



KEY ACTIVITIES

- Provides industry-recognized workforce development and STEM learning.
- Recruits and educates multi-system technicians for careers in emerging technologies and advanced manufacturing.
- Supports professional development to meet technology trends.
- Partners with educators and manufacturers for innovative curriculum and skills development.

CARCAM Prepares Students for Wide Array of Careers

CARCAM's advanced manufacturing partnerships unite educators and employers to develop highly skilled technicians. In 2014, more than 600 students earned certificates or degrees in CARCAM programs. These credentials position graduates to pursue careers in advanced manufacturing and industrial research.

CARCAM's partnership with the Alabama Automotive Manufacturing Association provided 239 scholarships to date totaling \$358,500. Before graduating from the electronics engineering technology program at Gadsden State Community College in 2015, Corey Edwards echoed other scholarship recipients when he said, "I am glad that I am a part of the program, and I think it is a really good fit for me."

CARCAM's advanced hydraulics curriculum thoroughly covers this challenging aspect of modern manufacturing.





“The technology component of the automotive industry is very dynamic. There is a continual demand for students entering the workforce, and, for those already employed, to be educated and trained on the latest developments. CARCAM does this exceptionally well.”

*Gene Cleveland, Senior Manager
KTH Leesburg Products*

CARCAM Delivers Innovative Workforce Solutions

CARCAM and its partner colleges continually work with industry leaders to develop and redesign workforce education for evolving technologies.

Today’s workforce environment requires that associates have technological skills as well as excellent communication skills, workplace ethics, and problem-solving abilities. CARCAM recognized this multi-faceted need and in collaboration with the Alabama State Department of Postsecondary Education developed an industry-vetted curriculum that addresses it.

CARCAM colleges' utilization of dual enrollment, stackable credentials, and credit for prior learning adds flexibility to CARCAM's certificate and degree programs.

CARCAM has also responded to a survey finding that 81% of employers feel additional industrial experience would make students more employable. It works with industry partners to facilitate cooperative, internship, and apprentice programs that help students launch highly successful careers. The relationships CARCAM-affiliated colleges had with 56 companies in 2014-15 provided 188 students with work-study opportunities designed to improve their employment prospects.

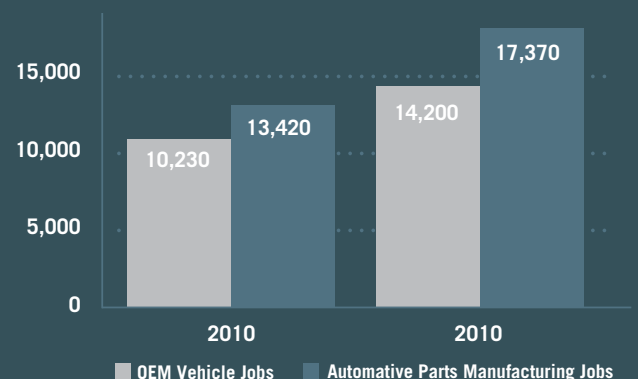
CARCAM's faculty professional development programs are similarly outcomes-based. For instance, the general industry-related safety program CARCAM provided to 44 instructors in 2014 was quickly followed by 275 students earning industry-recognized stackable safety credentials.

Technicians not only program robots, but perform vital maintenance on mechanical components.



CARCAM Prepares Technicians for Automotive Manufacturing Job Growth

The Alabama Department of Labor forecasts that jobs will increase 30% in original equipment manufacturing (OEM) for motor vehicles between 2010 and 2020, and 22% in automotive parts manufacturing.





KEY ACTIVITIES

- Facilitates adoption of Engineering Technology (ET) Associate in Science (AS) degree.
- Integrates the Manufacturing Skill Standards Council Certification (MSSC) into ET core courses.
- Promotes and supports advanced manufacturing through “Made in Florida” student outreach and faculty professional development.

FLATE Leads Expansion of ET AS Degree Programs

FLATE's leadership fosters expansion of Florida's ET AS degree program. Enrollments grew from 145 in 2008-09 to 1,525 in 2013-14. Completion of the associated MSSC Certified Production Technician (CPT) certificate also increased from 11 in 2007 to 2,336 in 2014.

In a survey of ET AS graduates, 92% of 24 respondents reported using the technical knowledge acquired in college in their jobs. A separate state study found that 86% of 30 ET graduates in a quarterly sample were employed.

Gulf Coast State College students learn how to program a PLC.





FLATE's Credential Articulation Pathways Address Florida Manufacturers' Needs

In 2007, using FLATE's established integrated credentialing procedure, the Manufacturing Skill Standards Council Certification (MSSC) Certified Production Technician (CPT) credential was aligned to the FLATE-designed and Florida Department of Education-maintained ET AS degree program. This articulated, credential pathways model now extends into secondary, postsecondary, and workforce programs. In 2015, 21 secondary and postsecondary institutions offered programs with MSSC CPT alignment and articulation to ET AS degrees.

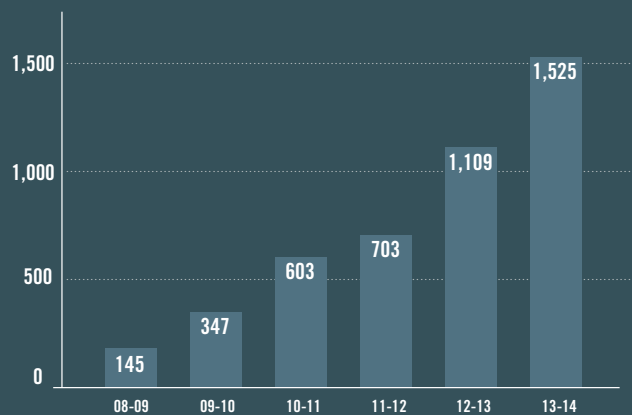
Leveraging the workforce-training pathway to the ET degree, FLATE and its Florida TRADE Consortium partners have successfully educated new audiences including veterans and the underemployed. In 2015, this consortium reported that 450 students had applied their earned MSSC CPT toward college degrees. The use of FLATE's pathway for attaining this employer-preferred credential has grown in Florida from 11 in 2007 to 2,336 in 2014. Many of the CPT holders have gone on to enroll in ET AS degree programs. Statewide, ET degree enrollment has grown from 145 in 2008 to 1,525 in 2014.

ET AS degree holders know to inspect and measure before soldering.



ET AS Degree Enrollment Grows

Enrollment continues to grow across Florida in FLATE-designed ET AS degree programs.



“We greatly appreciate the service FLATE is providing to the region and look forward to producing even more extraordinary future events in collaboration with FLATE.”

Jay Matteson, Director
Palm Beach State College Institute for
Energy & Environmental Sustainability



KEY ACTIVITIES

- Develops hands-on student experiences to create interest in manufacturing careers.
- Provides faculty externship opportunities in manufacturing companies.
- Produces and distributes manufacturing career materials.
- Develops industry-driven career programs, engineering and technology certificates, and AS and BS degree pathways.

RCNGM Expands Career Opportunities

The primary impact of the RCNGM has been to make students, educators, and other persons involved in career choices aware of the opportunities available in advanced manufacturing. In 2014 more than 700 students earned certificates or degrees in RCNGM programs at Connecticut community colleges.

RCNGM builds interest in manufacturing through faculty externships that provide educators with insights into technicians' work at local industry facilities, career expos that give students the opportunity to meet manufacturers, and marketing materials that feature manufacturing careers. Since the RCNGM's creation in 2004, enrollment in Connecticut manufacturing programs has increased 190% from 598 to 1,733 students.

A student uses a grinding machine with a polishing wheel to smooth a finished part.



“These experiences enriched my lectures and labs and enabled me to talk with confidence about how what I was teaching my students is being used by manufacturers in our region.”

*Sharon Gusky, Professor
Northwestern Connecticut Community College
Faculty Extern, BD Medical*

Industry Input Equals Successful Output

In 2014 RCNGM, in collaboration with the Connecticut Business and Industry Association (CBIA), surveyed 246 local manufacturers regarding workforce needs. The results reported that 99% of the manufacturers hire graduates from Connecticut community colleges; 72% of them reported higher than average satisfaction with Connecticut community college graduates.

A well-prepared workforce can be credited to RCNGM initiatives such as faculty externships in industry. Externship participants develop curriculum that is incorporated into the College of Technology (COT), a statewide initiative that includes all 12 Connecticut community colleges.

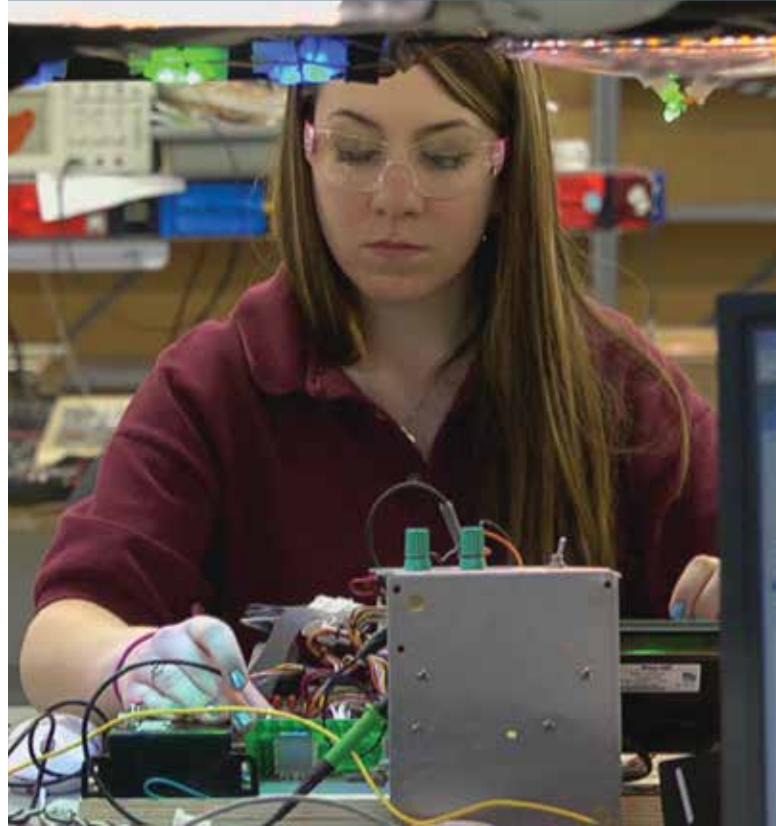
RCNGM Impacts Connecticut, New England & Nation

In 2015 the RCNGM organized the first Greater Hartford Mini Maker Faire where 1,500 attendees participated in entrepreneurial activities highlighting “making” and next-generation manufacturing.

The COT model was leveraged for both state funds and US Department of Labor grant funds to create or expand manufacturing centers in seven Connecticut community colleges.

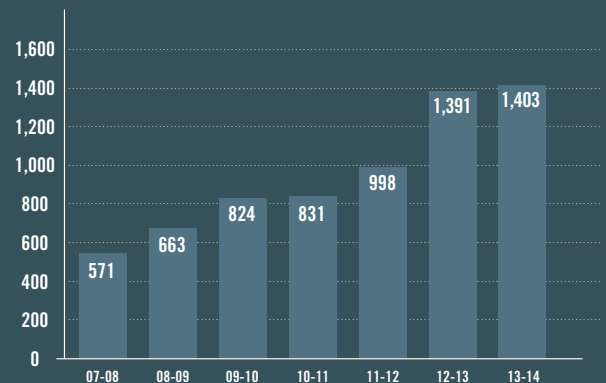
RCNGM works with regional partners to ensure the growth of advanced manufacturing in New England and to disseminate nationally promising practices such as professional development initiatives that are open to faculty throughout the US.

A test technician inspects LED lights for police cars.



Total Connecticut Community College STEM Certificates & AS Degrees Awarded

The number of STEM certificates and AS degrees awarded continues to rise in Connecticut community colleges.





KEY ACTIVITIES

- Strengthens diversity and quantity of welding technicians in industry.
- Improves the quality of education offered to welding technology students.
- Designs and delivers professional development for welding educators.
- Provides data on welding education and employment trends.

Weld-Ed Strengthens Welding Education Programs

Weld-Ed partner institutions have graduated more than 3,000 students. In 2014 the graduation rate increased 113% from 99 to 211. Weld-Ed has helped 10 institutions strengthen their 21 certificate, diploma, associate, bachelor, master, and PhD welding technology/engineering programs.

More than 700 welding instructors from 40 states have participated in at least one Weld-Ed professional development program. Altogether these educators have shared what they learned with 40,000 students. The first community college Society of Women Engineers Collegiate Interest Group is now an established success at Lorain County Community College. The group hosted the Cleveland Engineering Society's fall conference with more than 200 professionals and students in attendance.

Weld-Ed graduates possess the skills welding industry employers need.





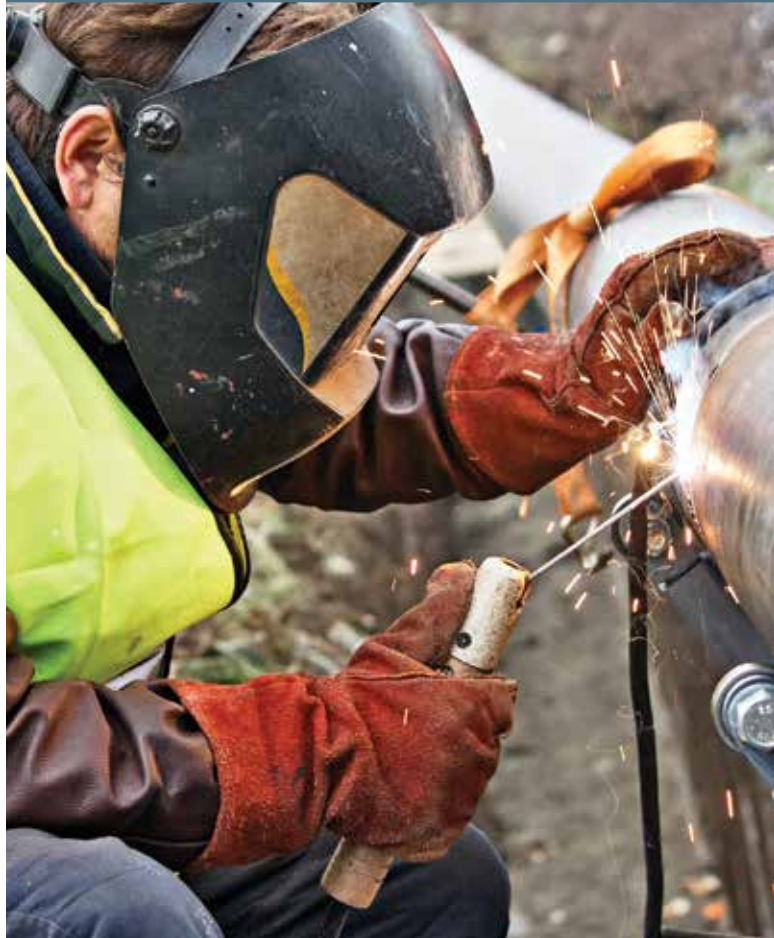
Two-Pronged Approach Addresses Workforce Needs

Welding plays an important role in Americans' everyday lives from bridges to highways, automobiles to pipelines. As many current welding professionals near retirement age, demand is growing for new and replacement workers. Weld-Ed's *State of the Welding Industry* highlights the critical shortage the nation faces: by 2024 more than 350,000 welding professionals will be needed.

Weld-Ed is immediately impacting the workforce by increasing the number of skilled graduates who are ready to fill these openings today due to the standardization of associate degree programs using Weld-Ed's national core curriculum model. Weld-Ed is also focused on creating a pipeline of skilled workers to fill the jobs of tomorrow by educating faculty through its summer professional development offerings.

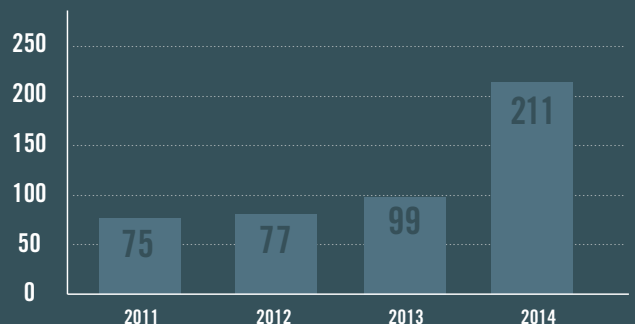
The Careers in Welding mobile exhibit features virtual reality welding simulators. It offers an educational experience and a wealth of career information to prospective students, their families, and educators. The mobile exhibit, on tour for four years, has introduced more than 115,000 visitors at 65 events to the many highly technical career opportunities available in the welding industry.

Welding technicians work in many industries including petro-chemical.



Weld-Ed Adds Technicians to Workforce

The number of students completing AAS Welding Technology degrees increased 113% from 2013 to 2014 at Weld-Ed's 10 partner institutions.



“Ten years ago, we were at about 10 students. Since I have been working with Weld-Ed, our program’s exposure has increased and I have had a dramatic increase in students from across the US. We have now topped over 100 students in the program.”

*Mark Baugh, Welding Program Chair
Weber State University*





AGRICULTURAL & BIO TECHNOLOGIES



AC2

AC2 Bio-Link Regional Center

AUSTIN COMMUNITY COLLEGE | AUSTIN, TX

www.ac2.bio-link.org



AC2 Offers Internships with Contract Services & Incubator

The Austin Community College (ACC) Biotechnology Department established the AC2 Institute in 2014 to improve its industry connections. The college's biotechnology program previously established a contract service organization to provide students with internship opportunities while helping companies conduct research and product development. Industry partners include Austin-based Bioo Scientific, which has worked with the college to develop curriculum and has hired several ACC biotechnology students.

The institute received funding to develop a wet lab commercialization incubator, which will further connect economic development with educational opportunities when it opens in 2016. The AC2 Institute is also home to the AC2 Bio-Link Regional Center.

KEY ACTIVITIES

- Creates distributed leadership network for grant compliance.
- Broadens high school-to-college mentoring.
- Establishes course-based pipeline for student recruitment.
- Develops and promotes new entry-level certificate program.
- Promotes contract service organization to biotech employers.
- Standardizes statewide articulation agreements.

An ACC student prepares a solution needed to purify His-tagged Taq polymerase.



“Our company has been fortunate to tap into the pool of biotech students from ACC. This local talent has definitely contributed to our success.”

*Marianna Goldrick, Senior Scientist, Research & Development/ISO Manager
Bio Scientific*

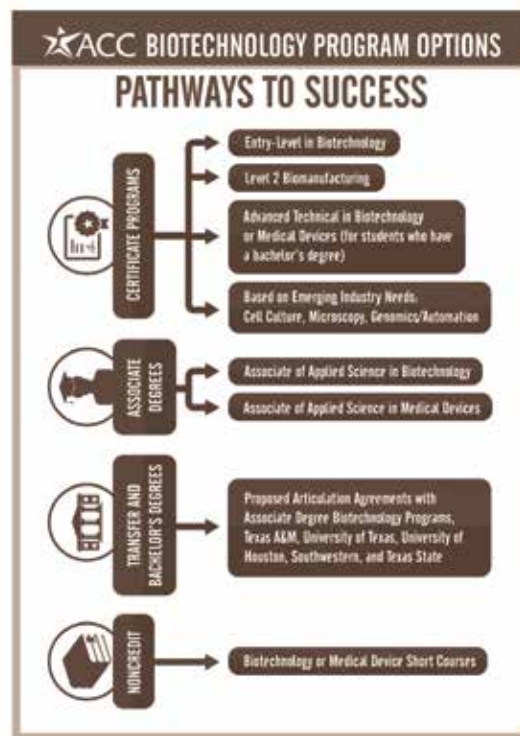
AC2 Bio-Link Regional Center Builds on Biotech Network

AC2 is expanding the successful Bio-Link network across the state of Texas through a number of initiatives to help individuals progress in biotech careers. These include offering an entry-level certificate, standardizing articulation agreements among educational institutions, and developing new sources of biotechnology students by reaching out to students in biotechnology prerequisite courses such as biology or chemistry.

AC2 is working with high schools and two-year colleges to introduce an entry-level certificate as part of a tiered certificate-to-degree program. The tiered credential will reflect the latest industry developments so that graduates of either two- or four-year programs are well-equipped for employment. Technicians in the field can use the new program to build upon their knowledge and skills.

New standardized, statewide articulation agreements will ensure that coursework at all levels—high school, community college, university, and graduate—transfers among institutions.

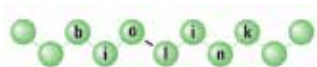
Finally, students taking high school and community college biotechnology prerequisite courses will be exposed to biotechnology research and career experiences to foster a recruitment pipeline.



ACC's biotechnology program options are the model for the biotech career pathways AC2 plans to spread throughout Texas.

An ACC biotechnology alumnus tests kits at Bio Scientific.





KEY ACTIVITIES

- Provides resources at www.bio-link.org and Biotech-Careers.org.
- Shares instructional materials through its Curriculum Clearinghouse and Course-in-a-Box.
- Offers Summer Fellows Forum.
- Leads Communities of Practice such as Bridge to Biotech and Circles.
- Coordinates the Biotech Equipment Depot.

Growing Bio-Link Network Improves Quality of Instruction

Bio-Link's network of community colleges reaches across 37 states, Puerto Rico, and the District of Columbia. This network has grown from 44 programs in 2011 to 105 programs today.

One of the important resources Bio-Link provides is a Curriculum Clearinghouse of instructional materials that can be accessed through www.bio-link.org. The goal of the clearinghouse is to improve the quality of instruction in biotechnology programs across the country so that students complete certificates, degree programs, and either enter employment or continue their education. Talented instructors, from diverse backgrounds across the nation, have contributed their insights and curriculum ideas, thus enriching the Bio-Link community.

Student transfers CHO cells in a City College of San Francisco class.





“Bio-Link is playing a key role in preparing our industry’s talent pipeline by developing and disseminating practical, industry-relevant technical training across its vast national network.”

Lori Lindburg, Executive Director
California Life Sciences Institute

Biotech-Careers.org Uses Multimedia to Explain Biotech Careers

Bio-Link’s Biotech-Careers.org website offers students a place to explore what they can do with a biotech degree or certificate from a community or technical college. The website provides valuable information to students about what it is like to work in different bioscience careers and how to decode job descriptions.

The site also provides detailed information about biotechnology occupations and links to job announcements. For each occupation there is a detailed description of the position, education and training requirements, and starting wages. The site compiles lists of biotech-related internships past and present in a format that allows students and faculty to filter internships by education level. Students can also search for internships by date, organization, or state. Students can link to the website for an organization to find the information they will need to apply.

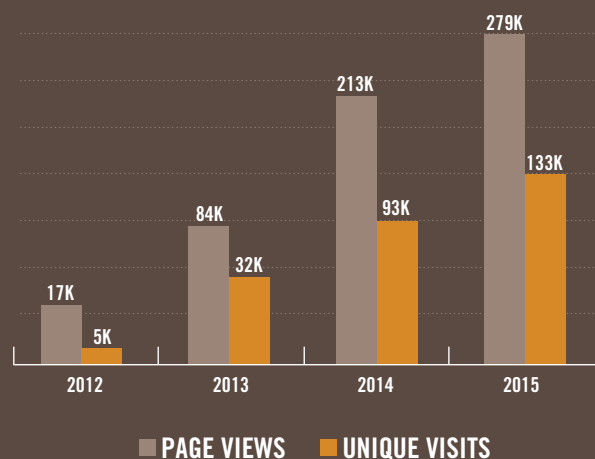
Videos featuring biotechnicians provide prospective students and other viewers with insights about what it is like to work in biomanufacturing, cell culture, biofuels, environmental monitoring, biopharmaceuticals, and medical devices.

A technician monitors reclaimed water quality at Heron’s Head Park EcoCenter in San Francisco.



Biotech-Careers.org Attracts New & Repeat Users

Bio-Link’s Biotech-Careers.org website has shown a steady increase in page views and unique visits since its inception in June 2012.





NBC2

Northeast Biomanufacturing Center
and Collaborative

MONTGOMERY COUNTY COMMUNITY COLLEGE | BLUE BELL, PA

www.biomanufacturing.org



NBC2 Impacts Students at Hub Colleges & Beyond

Just since fall 2012, NBC2 has impacted more than 1,800 students directly; 1,187 students have enrolled in associate or applied associate degree programs or in certificate programs at NBC2 hub community colleges.

Furthermore, 200 community college instructors and high school teachers have attended NBC2 professional development activities. As a result, educators have incorporated aspects of the NBC2 biomanufacturing curriculum into their programs or integrated a new biomanufacturing course into an existing biotechnology, biology, or chemistry program. Follow-up surveys indicate that adding biomanufacturing curriculum improved the instruction of approximately 600 students in addition to those enrolled at NBC2 hub community colleges.

KEY ACTIVITIES

- Convenes Bioeconomy Workforce Roundtables that nurture biomanufacturing career pathways.
- Facilitates partnerships between educators, employers, and organizations to provide a skilled biomanufacturing workforce.
- Provides hands-on education using biomanufacturing industry equipment, processes, and current good manufacturing practices.

A biomanufacturing student scales up CHO cells using a process-controlled bioreactor.



NBC2 Materials Used in Academic & Industry Settings

Materials developed by NBC2 support hands-on learning and theoretical understanding of biomanufacturing. The NBC2 instructional process utilizes biomanufacturing industry equipment, processes, and regulatory structure to teach about the development, production, and analysis of bioproducts.

NBC2 resources are utilized by educators at community colleges, universities, high schools, and biomanufacturers such as Genentech and AstraZeneca.

Sales of books and modules help sustain the center. These products include

- *Introduction to Biomanufacturing, 2nd Edition*, textbook;
- *Biomanufacturing Laboratory Manual*, brand-specific editions;
- *Biofuels Production & Analysis* textbook and lab manual;
- Pichia pastoris – HSA Core Production System module; and
- CHO – tPA Core Production System module.

NBC2's free materials include

- *Protein is Ca\$h* laboratory manual;
- Virtual Industrial-Scale Upstream Processing module; and
- Virtual Laboratory-Scale Downstream Processing module.

“NBC2 continues to be the ‘go to’ organization for curriculum, various texts, laboratory equipment and e-training videos for the program. The faculty and staff in the department continue to rely on the wealth of knowledge and support that NBC2 offers.”

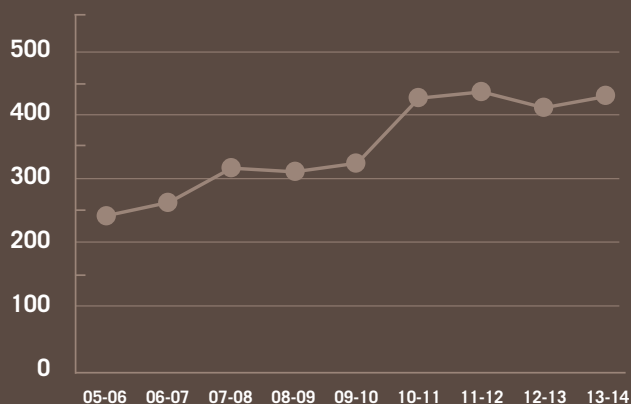
*Kris Gorman, Biomanufacturing Department Chairman
Erie Community College*

A technician adjusts a gas input line on a 20-liter bioreactor.



NBC2 Hub Programs Address Biomanufacturing Workforce Needs

Enrollment in biomanufacturing programs at NBC2 hub community colleges has steadily increased in response to the demand for highly skilled technicians.





VESTA

Viticulture and Enology
Science and Technology Alliance

MISSOURI STATE UNIVERSITY | SPRINGFIELD, MO

www.vesta-usa.org



KEY ACTIVITIES

- Offers certificates and AAS degrees in viticulture, enology, and wine business entrepreneurship.
- Complements industry-validated online courses with field experiences in vineyards and wineries.
- Embeds current and emerging practices and technologies in its educational program.

VESTA'S Unique Program Grows

VESTA continues to attract students with its combination of instructor-guided online instruction and face-to-face lessons by industry professionals at vineyards or wineries.

In 2014-15, VESTA's online course enrollment reached 729, a 135% increase since 2009. Almost two-thirds of the students were pursuing certificates or degrees; 40% were women.

Credentials awarded to VESTA students between 2011 and 2015 included 145 viticulture and 35 enology certificates, as well as 26 AAS degrees in viticulture and 43 in enology.

VESTA increased its wine business entrepreneurship courses to six in 2015 and plans to add eight more courses in 2016.



Students analyze for titratable acidity in fermented juices during field practicums.



A vineyard manager harvests Chambourcin grapes in Kansas.



VESTA Cultivates Grape & Wine Industry Workforce

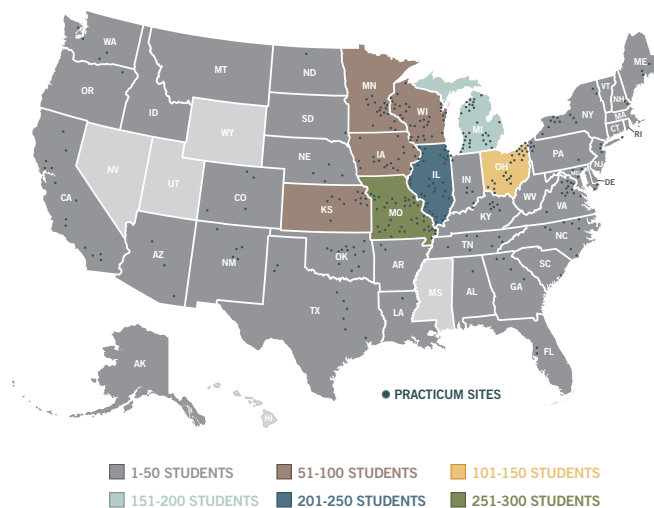
VESTA influences the grape and wine industry in a multitude of ways. This impact is evidenced by student success stories that include people who are currently working in the industry and are sponsored by their employers; individuals who have advanced their careers in the industry after completing VESTA courses; and entrepreneurs who have established commercial vineyards and wineries after obtaining technical certificates or degrees. Successful VESTA entrepreneurs have also hired students who are enrolled in the VESTA program.

Collaboration with employers, academic institutions, extension agents, and current or former students is enabling VESTA to identify and develop occupational competencies for 32 distinct jobs in the industry. These standardized competencies will enable owners or operators to refine hiring and promotion practices; employees and students to focus their educational pursuits; and educators to develop and refine viticulture and enology educational programs.

VESTA is increasing its visibility and impact as it partners with regional and national industry conferences to provide professional development workshops. More than 200 people participated in these programs in 2014-2015.

VESTA Expands Field Sites for Students

VESTA has 437 field sites where students apply the knowledge gained in online courses and develop critical hands-on skills.



“VESTA fills a needed niche in the Midwest...I have been able to learn from experienced wine makers and grape growers....This includes the informative VESTA instructors....In the field I learned what the reality is in managing a vineyard.”

*Lucas Snodgrass, Vineyard Manager
Lambs and Vines Winery*

*AAS in Viticulture, Missouri State University-West Plains
Master of Science in Plant Science, Missouri State University*





ENERGY & ENVIRONMENTAL TECHNOLOGIES



ATEEC Indirectly & Directly Impacts Students

ATEEC impacts students by empowering educators through its website, the primary tool for information and product dissemination for ATEEC and other ATE environmental and sustainable energy technology initiatives. More than 400 instructional materials, publications, and occupational/workforce analyses are available free of charge.

ATEEC directly engages students by introducing them to environmental and energy technology concepts through the Interactive Learning Lab and the Nahant Marsh Education Center, located on a 513-acre wetland along the Mississippi River. The lab provides students with hands-on activities in the biodiesel, energy efficiency, solar power, and wind energy fields. The center's accelerated curriculum prepares students for outdoor recreation and natural resources management careers.

KEY ACTIVITIES

- Partners with business, industry, government agencies, professional organizations, and academic institutions.
- Defines technician knowledge, skills, and competencies.
- Collects, validates, and broadly disseminates exemplary education materials.
- Supports and mentors institutions with environmental science and sustainable energy technology programs.

ATEEC workshops provide hands-on experiences for educators to learn about environmental and energy technology.





“ATEEC has long been a leader in training and education for the clean-tech industry. Using its innovative curriculum and state-of-the-art delivery technologies, it is helping fulfill the need for a well-trained workforce for the energy and environmental industries.”

Matthew Gardner, Managing Partner
Sustainserv

ATEEC Identifies & Examines Workforce Trends

One of ATEEC’s core functions is to define and analyze workforce trends in the environmental and energy fields in order to bridge the gap between academia and industry. ATEEC recently convened a panel of environmental technology experts to update its *Defining Environmental Technology* report. It also developed online versions of the Environmental Technology and the Water Management career charts with salary information, labor statistics, and links to relevant college program websites.

To help develop educational programs that align with business needs, ATEEC provides DACUM (Developing A Curriculum) and Job Task Analysis workshops and services free of charge. ATEEC partnered with Palm Beach State College to define the smart grid technician occupation and link technical knowledge between traditional and new technologies.

ATEEC Provides Best Practices Resource

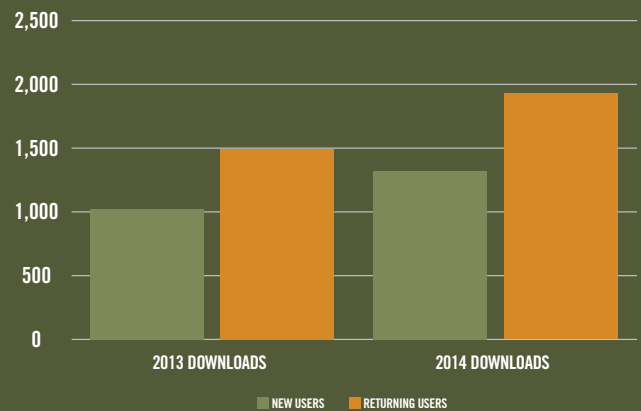
ATEEC recently produced the *Best Practices Guide for Developing Educational Programs: Environmental and Energy Technology* manual for academic institutions starting new programs or strengthening existing programs. While this publication is written with environmental and energy technology in mind, it is applicable to any academic program seeking to integrate industry needs.

Educators and students gain hands-on experience about water technologies at ATEEC workshops.



More ATEEC Products Downloaded

ATEEC’s product downloads—an overall impact indicator—rose 28% for returning users and 35% for first-time visitors in one year.





BEST

Building Efficiency for a
Sustainable Tomorrow Center

LANEY COLLEGE | OAKLAND, CA

www.bestctr.org



KEY ACTIVITIES

- Advances building technician education in collaboration with national research laboratories and subject-matter experts.
- Provides professional development and mentoring services to help colleges establish courses and programs.
- Leverages industry and government partnerships to improve instructional labs and establish skill standards.

BEST Supports Programs in Building Automation & Energy Efficiency

Professional development workshops and mentoring have enabled 10 colleges across the country to launch new programs in building automation systems (BAS) and to develop new courses and content in energy management. Through participation in the BEST Center network, colleges have access to model courses and curricula online, design specifications for high-quality instructional laboratory installations, and heavily discounted lab supplies and equipment.

Through its partnership with Lawrence Berkeley National Lab, BEST provides its network of faculty with access to cutting-edge research in advanced lighting technology, whole building energy analytics, and the role of technicians in sustainable operations.

A student verifies proper operation of a commercial variable air volume box.





Industry Collaboration Benefits Instructional Programs & Labs

Partnership with industry is critical to achieving BEST's mission. From technician credentialing to curriculum development, BEST's strategic efforts aim to transform the building technician workforce:

- “Knowledge Map” for High Performance Building Technicians, based on a national curriculum development meeting sponsored by the Department of Energy, is helping BEST create the foundation for development of a technician certification. The certification will be designed for community college graduates from BEST-network colleges that will align their curricula with nationally validated skill standards.
- BEST leads a California-wide effort to provide advanced, high-performance technician training to industry incumbents. The project is also supported by the state's three largest investor-owned utilities and recognizes California's national leadership in enacting policies to produce zero net energy buildings.
- Workshop sponsorships, donations, and equipment discounts help BEST network colleges invest in their instructional labs. Companies are also collaborating with BEST to develop internship programs that ensure students receive hands-on experience with the most current technologies.

Technicians inspect a commercial chiller to repair or replace components before failure occurs.



BEST Knowledge Map for High Performance Building Technicians

Skill requirements for new technicians are evolving, expanding, and deepening rapidly to keep pace with modern building technologies.



ENGINEERING

BUILDING SYSTEMS



ENERGY EFFICIENCY & SUSTAINABILITY

HEALTH & SAFETY



CODES & STANDARDS

“I excelled through Laney College’s program and landed a job at Carrier. Now a top-paid journeyman technician with a prosperous career ahead, I purchased my first house in 2009 at the age of 20. I am living my dream.”

*William Escobar, Commercial HVAC Technician
Carrier Corporation*



KEY ACTIVITIES

- Develops and refines curricula.
- Implements technical educator professional development.
- Assesses and evaluates embedded, targeted research of curriculum and professional development strategies to ensure student, faculty, and industry goals are attained.
- Disseminates cross-educational collaborations regionally, nationally, and internationally.

CREATE Bridges Industry Certifications with Renewable Energy Education

CREATE has expanded renewable energy credit offerings at seven California community colleges in close partnership with industry and certification agencies. Enrollment in renewable energy courses has increased from 1,500 to 4,550 students from 2010 to 2014.

CREATE Works with At-Risk Youth

CREATE collaborates with Lompoc High School STaRS Engineering Academy to support up-to-date renewable energy curriculum, develop 2+2+2 pathways, and provide real-world modules and equipment to at-risk students. This effort integrates renewable energy technologies in classrooms and at girls STEM summer camps. Many of the 600 participants have transferred to community colleges and universities and are studying STEM fields.

College of the Desert student examines a wind turbine gear box.





“Participating in CREATE activities has given me a much better appreciation of how other countries value renewable energy technologies and energy efficiency not only for their own improved energy independence but for the environmental benefits of lower carbon emissions and reduced global climate impacts.”

*David Boden, Professor of Geoscience
Truckee Meadow Community College*

CREATE Seeds Flipped-Classroom Renewable Energy Modules

CREATE has seeded the growth for the flipped-classroom approach for online renewable energy courses with its faculty’s development of more than 100 modules on DC circuits, motors, hydraulic systems, and other energy-related topics.

CREATE’s modules contain activity-based exercises that support students as they learn at their own pace. These modules are linked on the CREATE website to the Big Bad Tech Channel that has more than 900 followers; the modules have received 42,881 views. These online lectures reduce textbook and travel expenses.

CREATE Leads International Renewable Energy Network

CREATE developed the Renewable Energy Network, an international learning community of technical educators, to improve curricula and pedagogy by sharing best practices in content, teaching, certifications, articulation, and career pathways. This initiative has advanced the skills and competencies in renewable energy disciplines in the US, Australia, New Zealand, Denmark, Germany, and Caribbean countries.

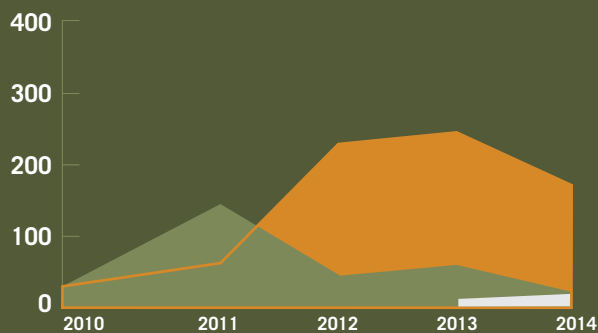
Through an online learning portal, faculty share and disseminate curricula and other learning materials. Fourteen US educators have participated in the international professional development trips to Australia, New Zealand, Denmark, Germany and the Caribbean, and returned with lessons they have shared with more than 2,000 students.

Wind turbine technicians prepare to climb the turbine tower.



CREATE Kid Wind Teacher Workshops Result in More Student Participation

The 298 teachers educated at CREATE Kid Wind workshops have involved 717 students in regional competitions and 25 students in national competitions.



- STUDENTS IN NATIONAL COMPETITIONS WON IN 2013 & 2014
- STUDENTS IN REGIONAL COMPETITIONS
- FACULTY EDUCATED



KEY ACTIVITIES

- Offers systematic response to the demand for skilled nuclear technicians.
- Maintains a secure learning repository of more than 1,100 learning objectives.
- Provides standardized curriculum, problem-based learning (PBL), problem-based research (PBR), and hands-on labs for nuclear technicians.
- Creates academic and career pathways for students and incumbent technicians.

RCNET Readies Nuclear Technician Workforce Pipeline

RCNET's nuclear program enrollments have increased by 200% since 2010. Graduation numbers have grown from 362 in 2010 to 596 in 2014, a 164% increase. In total, 2,447 students have graduated from partner institutions. More than 1,900 RCNET-affiliated program graduates have found work at one of RCNET's 91 industry partners since the inception of the grant.

RCNET has also developed merit-based competitions to increase awareness about nuclear careers. The enrollment of 650 high school students in nuclear programs indicates RCNET programs are fostering interest among younger students.

In response to a 2015 survey of nuclear industry trainers, RCNET has teamed with 10 nuclear technician founders and leaders to create a biography textbook that encourages graduating technicians' "ownership" for their profession.



RCNET graduates are tested on nuclear welding standards.



RCNET Expands Breadth of Technicians' Knowledge & Skills

RCNET's curriculum helps relieve nuclear educators, individual trainers, and subject-matter experts from the burden of creating academic content. RCNET's curriculum frees them to focus on their core mission: teaching. As a result, retention, graduation, and employment rates have increased among RCNET-affiliated programs. By continuing to offer professional development on applying data to these key metrics, RCNET expects more optimization going forward.

To date, 44 two-year colleges have utilized RCNET's curriculum repository. These colleges educate more than 1,500 nuclear technology students each year.

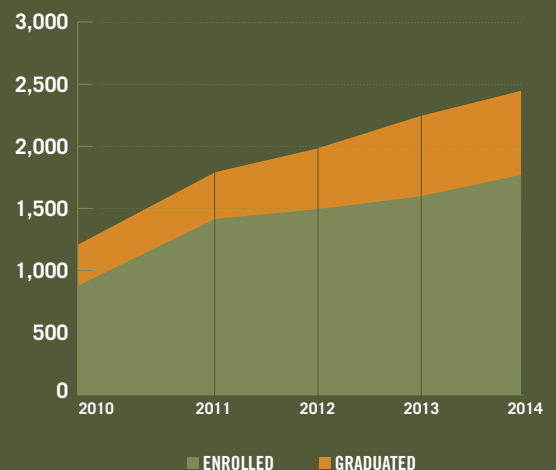
Nuclear fields beyond the energy sector remain hotbeds for job opportunities with 65,000 openings expected by 2030. Key partnerships formed at the academic, agency, and industry levels capitalize on this opportunity and help ensure the US has a skilled nuclear workforce going forward. To create a more sustainable and extensive platform that addresses future workforce needs, RCNET is expanding its curriculum development to cover the nuclear-related aspects of other fields and tailoring its core curriculum to meet these emerging needs. These fields include environmental management, manufacturing, as well as life and plant sciences.

A nuclear technician tests electric circuits during a plant shut-down.



Enrollments & Graduations Increase in RCNET Programs

Enrollment and graduation increases in RCNET-affiliated programs help meet the expected need for 65,000 skilled workers by 2030.



“RCNET's innovative and continual support is inspiring young minds by providing frequent creative learning opportunities for a new generation of energy workers that will meet our nation's power needs.”

*Stacey Presnell, Instructional Technologist/Nuclear Technology Program Coordinator
Energy Northwest*





ENGINEERING TECHNOLOGIES



CAAT

Center for Advanced
Automotive Technology

MACOMB COMMUNITY COLLEGE | WARREN, MI

www.autocaat.org

Center for Advanced
Automotive Technology
C · A · A · T



CAAT Prepares Students for Careers in Emerging & Advanced Automotive Technologies

CAAT awarded seed funding to community colleges, universities, and secondary schools—several of which integrated industry collaborations—to improve and disseminate programs that prepare the workforce nationally for technical development jobs in advanced automotive technology.

CAAT reaches thousands of middle and high school students each year through career exploration labs, in-classroom STEM Labs, and career academies. CAAT held an Automotive Design and Engineering Career Expo sponsored and staffed by General Motors, Ford, and Chrysler that was attended by more than 1,200 middle and high school students. CAAT is also a major sponsor of Robotics, Engineering and Technology Day events attended by more than 2,500 middle and high school students annually.

KEY ACTIVITIES

- Develops advanced automotive technology curricula.
- Provides seed funding for developing and adapting courses and modules that advance the preparation of automotive technicians, engineering technologists, and designers.
- Offers professional development for educators and industry professionals.
- Provides outreach activities to middle and high school students.



Students assemble a battery pack for an electric roadster project.

CAAT Partnerships Drive for Next Generation Workforce

As a regional center with national impact on advanced automotive technology, CAAT partners with educational institutions and industry to drive the skills needed for the next generation of automotive technicians, engineering technologists, and designers.

CAAT has leveraged these partnerships to

- develop through the National STEM Consortium an Electric Vehicle Development Technology certificate program, completed by 53 students; (The curricula developed are offered as free and open educational resources on CAAT's website as well as Carnegie Mellon's Open Learning Initiative.)
- provide high voltage safety training on hybrid and electric vehicles to more than 300 emergency first responders;
- develop virtual reality training modules in conjunction with CA²VES for classrooms without access to hybrid and electric vehicles;
- offer an annual advanced automotive technology conference featuring top industry and media speakers on the latest developments in vehicle electrification, weight reduction to improve fuel economy, and automated/connected vehicles; and
- conduct webinars designed to bridge the gap between industry and education.

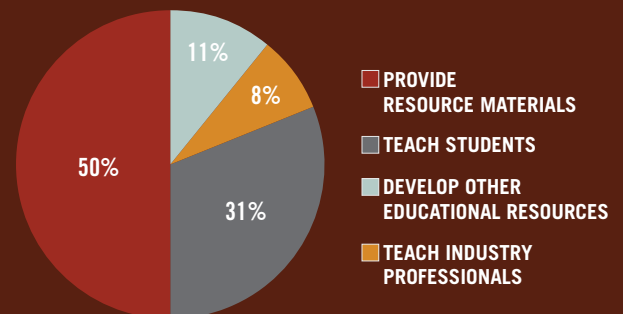
Nearly 750 students, educators, industry professionals, and government representatives have participated in CAAT's free conferences and webinars.

Technicians monitor a scan tool that utilizes a vehicle's computer for diagnostic tests.



CAAT Resource Library Usage

Since its inception in late 2012, CAAT's website has been visited more than 34,000 times by more than 25,000 unique visitors. In addition, thousands of classroom-ready educational materials have been downloaded from CAAT's free, online resource library.



“What drew me to the program was its focus on electric vehicle development. Electric vehicles are the future and this is new technology, the future essentially ... this program is a great way to jump-start a new career.”

*Mike Swanson, Subsystem Test Engineer
General Dynamics Land Systems Defense & Space Division
Awarded Electric Vehicle Development Technology certificate in 2013*



KEY ACTIVITIES

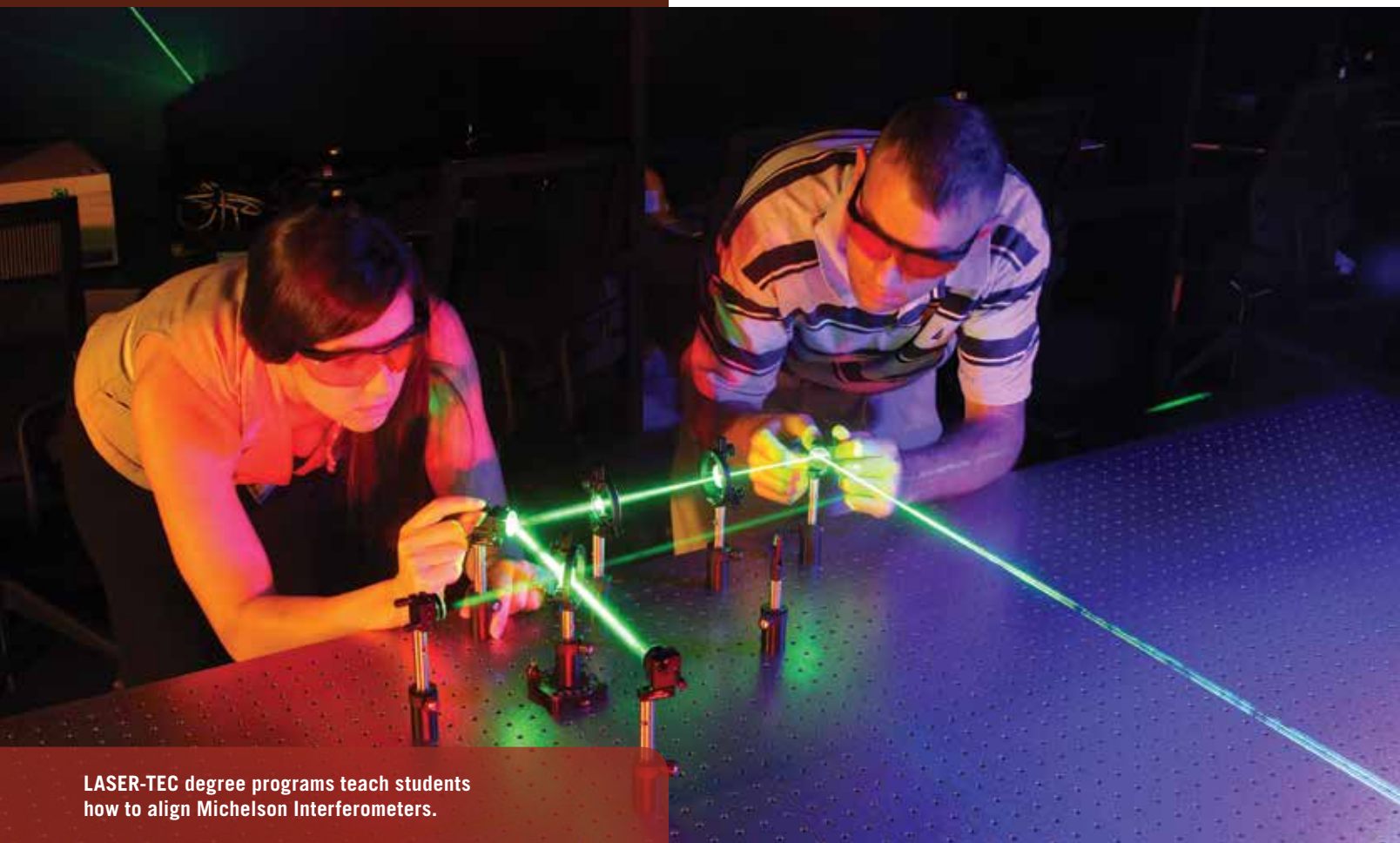
- Offers guidance and \$10,000 in equipment grants to colleges starting laser or fiber optics courses.
- Provides free faculty professional development opportunities and instructional laboratory materials.
- Develops K-12 light and optics toolkits with detailed lesson plans and video support.

LASER-TEC Leads Laser & Fiber Optics Education Programs in Southeastern US

LASER-TEC anchors a broad educational infrastructure in the Southeast to enhance and promote careers in lasers and fiber optics. The center and its partner colleges offer degree and workforce programs, as well as professional development for educators.

LASER-TEC also publishes and distributes the textbook *Fundamentals of Fiber Optics*. LASER-TEC makes this free textbook available through colleges to reduce fiber optics students' expenses.

During 2014-15, LASER-TEC's second year of operation, its partner colleges graduated 62 students with associate's degrees in lasers and fiber optics or in photonics-related fields. Many of these graduates had multiple employment offers with starting annual salaries ranging from \$35,000 to \$47,000.



LASER-TEC degree programs teach students how to align Michelson Interferometers.

“Our physics students have been actively engaged in the lab activities supported by the Light and Optics Exploration Kit developed by LASER-TEC. As an experienced physics and math teacher, I couldn’t be more excited about the potential benefits of partnership with LASER-TEC.”

*Karlheinz Haas, Physics and Calculus Instructor
The Pine School*

LASER-TEC Recruits Students

Recruiting students to laser and fiber optics careers involves LASER-TEC in efforts to inform the general public, and key audiences, such as teachers, about the important role of lasers and light-based technologies in many 21st century innovations. Laser additive manufacturing, for instance, has enabled the creation of metal parts that were previously not possible for the aerospace, automotive, and medical industries. Lidar, a remote-sensing technology, and other optical technologies enable drones, self-driving vehicles, and an array of transportation innovations.

LASER-TEC Serves Incumbent Technicians

Since 2014, LASER-TEC has educated more than 100 incumbent technicians from 25 different companies, organizations, local utilities, and academic institutions. Industry’s remarkable support of LASER-TEC includes more than \$100,000 in equipment and more than \$10,000 of in-kind contributions.

LASER-TEC Informs Teachers

LASER-TEC hosts free one-day STEM workshops to help K-12 teachers learn how to integrate light and optics lessons into existing curricula.

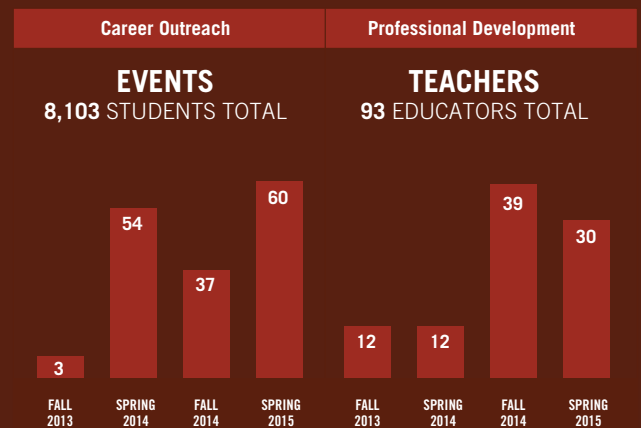
LASER-TEC also helps teachers through its partnership with Corning Optical Communications. The company’s Fiber IQ program added 12 faculty members thanks to LASER-TEC. The educators’ colleges may now purchase high quality, fiber optic instruments at significantly discounted prices.

An incumbent technician tests fiber optic equipment during a LASER-TEC training program.



LASER-TEC Impacts Students

From fall 2013 to spring 2015, LASER-TEC impacted 8,103 students at outreach events and 9,967 students taught by the 93 educators who participated in LASER-TEC workshops.





KEY ACTIVITIES

- Researches trends on the ocean workforce.
- Organizes regional and international underwater robotics (ROV) competitions.
- Conducts technology-rich professional development.
- Operates SeaMATE, a social enterprise that employs community college students.
- Offers at-sea technical internships for students.

MATE Integrates Workforce Research into Programs

MATE was instrumental in working with its partner community colleges to create nine new degree programs aligned with workforce research and trends. MATE's workforce research, jointly funded by the ONR, NOAA, NASA and NSF, has produced knowledge and skill guidelines for seven marine technical occupations.

The center has also helped 29 of its partner colleges develop, update, and revise courses and programs. Approximately 9,000 students have enrolled in marine technology-related programs at its community college partners over the last 14 years; more than 4,000 of these students have earned technology certificates or degrees.

A college student intern repairs a marine sensor at sea.



MATE Creates Workforce-Ready Employees

MATE provides students with work experiences and helps them develop workforce-ready attitudes through its underwater robotics (remotely operated vehicle or ROV) competitions, at-sea internship program, and SeaMATE. SeaMATE is a social enterprise that puts community college students to work manufacturing ROV kits for K-12 schools.

Featured in a documentary, book, and Hollywood film, MATE's ROV competitions use underwater robots as a platform to engage students in STEM and demonstrate how these disciplines are applied in the real world.

MATE's ROV competitions require students to organize themselves into a company structure with each student taking on a specific role (e.g. CEO, CFO, engineering lead, marketing lead, etc.). Through the process students develop skills in project management, technical writing, communication, teamwork, entrepreneurship and leadership. The students prepare technical reports, marketing displays, and engineering presentations that are delivered to working professionals. They use rubrics to evaluate the students' work.

Ocean and other technology-related employers use the competition to find and recruit new talent. To date, the MATE Center and its regional partners have coordinated 14 international and 180 regional ROV competitions that have involved more than 15,000 students in grades 4-16.

“The MATE competition sparked my interest in ocean engineering. Now I have my own ROV manufacturing company, and it's no coincidence that four of the engineers and technicians we've hired are also former MATE competitors!”

*Eric Stackpole, Co-founder
OpenROV*

MATE At-Sea Interns Anchored in STEM Careers

MATE has longitudinal data on 252 students who participated in its At-Sea Internship Program. Most of the former interns now work in STEM careers; 42% in marine STEM fields.

106

work in marine STEM fields

66

work in non-marine STEM-fields

22

are teachers of a STEM subject

58

are continuing their education

Marine technicians retrieve an oceanographic buoy.





MatEdU Builds Educators' Capacity to Teach Materials Science

As a National Resource Center, MatEdU promotes the leadership capacity of educators in materials science. It focuses on the current and future needs of manufacturing technicians relative to the materials they use.

To prepare technicians who understand the “science of stuff,” MatEdU develops peer-reviewed modules (59 as of 2015), disseminates labs, and demonstrates pedagogy for teaching about an array of materials and their diverse uses.

Significant materials science resources are available in MatEdU's digital library; the modules alone had 7,965 page views in 2014-15. In response to educators' input, MatEdU is creating a digital handbook of instructional materials by topic.

KEY ACTIVITIES

- Expands online collection of high-quality instructional resources.
- Promotes dissemination strategies that increase website awareness and online engagement, support strategic partnerships, and expand professional development opportunities for educators and technicians.
- Leverages partnerships to achieve strategic scalability of MatEdU.

MatEdU Guitar Building Workshops teach students about different types of materials.



Core Competencies Guide MatEdU Work

MatEdU's work is guided by the core competencies it created with industry and multiple education sectors in materials science and six related industry sectors or topics.

For example, MatEdU partnered with the Guitar Building Center at Sinclair Community College, another ATE initiative, to develop a crosswalk of the Guitar Building Institute (GBI) competencies with three job skill sets used by Boeing. This crosswalk will help teachers, students, and industry understand the connections and relevance between the skills gained through the guitar-building curriculum and those required in the workplace.

MatEdU Offers Practical Guidance for New Programs

The Materials in STEM Workshop (M-STEM) is MatEdU's annual forum for K-20 educators who teach in STEM disciplines to share their effective classroom strategies and labs. Industry participation ensures participants' awareness of current techniques, equipment, and hiring practices. The workshop's three-day strand offers a replicable model for teaching new skills through a comprehensive topical approach.

To help colleges develop and build their own manufacturing labs, MatEdU created a Learning Environment Worksheet and Project Timeline Template.

“It was the best of any kind of workshop. Well run. It did a great job showing what real STEM is. It's truly all the STEM things put together. They really pressed that. The whole presentation and support that we got was great.”

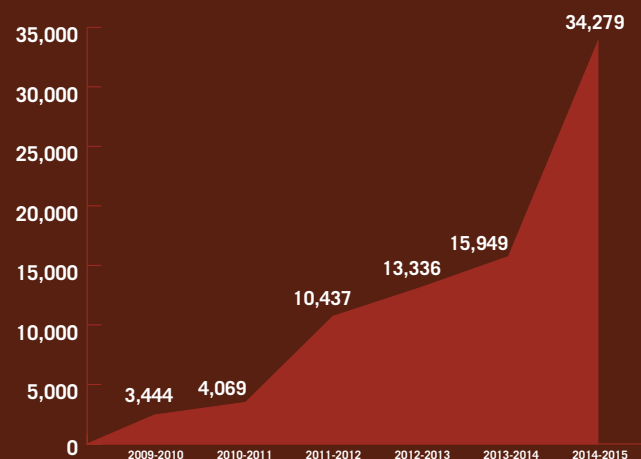
*Scott Davidson, Industrial Technology Instructor
Rainier Middle School*

Educators replicate the size, shape, and hardness of natural materials at M-STEM 2015.



Website Traffic Doubles in One Year

MatEdU's web sessions dramatically increased in 2014-15 with more social media activity and an endorsement agreement with the Materials Research Society.





MPEC

Midwest Photonics
Education Center

INDIAN HILLS COMMUNITY COLLEGE | OTTUMWA, IA

www.midwestphotonics.org



KEY ACTIVITIES

- Provides professional development for college and high school instructors.
- Delivers photonics industry-related education.
- Creates enhanced educational and equipment-sharing partnerships.
- Coordinates student internships, job shadowing, co-op programs, and field experiences.
- Assists institutions with lab development.

MPEC Colleges Provide Photonics Technician Education

Students learn about lasers, geometric optics, physical optics, electronics, mechanical optics alignment, laser applications and analysis, and CNC laser programming. MPEC programs emphasize hands-on activities with industrial lasers, optical components, beam analyzers, and spectrum analyzers. Students learn to assemble, install, operate, calibrate, repair, maintain, and test laser systems and optical equipment in a variety of applications.

With its partner colleges, MPEC is expanding and improving technician education by building on Indian Hills Community College's (IHCC) 28 years of experience educating technicians. IHCC has nearly 100% job placement. Its 554 photonics graduates have launched careers at 135 companies in 36 states.

A student utilizes a beam splitter to create beams that align parallel microscope objectives.



MPEC Prepares Technicians that Industry Values

The technology of photonics utilizes lasers and optics in advanced manufacturing, health sciences, communications, homeland security, construction, military, research, and other applications. A survey by three ATE centers estimates US demand for new photonics technicians will be 823 annually through 2017. Currently, the ratio of jobs to photonics graduates is 5:1.

To meet Midwest employers' needs, MPEC facilitates the expansion of photonics programs in its nine-state network of community colleges and high schools. Nine MPEC-partner institutions now offer the comprehensive technical and life skills that employers seek in photonics technicians. They accomplish this by utilizing the recommendations of their industry advisory committees to guide program and curriculum development. MPEC educators' contact with industry experts keeps them up to date about the skills and knowledge that students need to become successful employees.

MPEC educators also learn from each other. For example, MPEC-partner Wright State University shares its expertise in laser applications for micromachining and additive manufacturing. Education and industry partners share insights to improve instruction of life skills such as teamwork, problem solving, and dependability.

“My laser and electro-optics technology degree from Indian Hills Community College provided me with the technical theory and the practical hands-on experiences that I needed to begin my career as a laser optical engineer associate.”

*Jared Bruce Mills, Laser Optical Engineer Associate
University of Nebraska-Lincoln Diocles Extreme Light Laboratory*

A technician operates an ultra-high-intensity laser system in the Extreme Light Laboratory.



Laser Program Graduates' Annual Salary Ranges

Entry-level salaries for MPEC photonics program graduates range from \$37,400 to \$62,400; average entry-level salaries for 2013-2014 graduates were \$47,800.



2013 / 2014



KEY ACTIVITIES

- Promotes photonics education, including the use and application of lasers, electro-optics, and precision optics.
- Develops and distributes standards-based curricula, teaching materials, and student-recruiting resources.
- Delivers professional development for faculty and employed technicians.
- Shares research and effective practices.

OP-TEC Expands Awareness of Photonics Career Pathways

Photonics systems technicians (PSTs) work in industries that use photonics devices to meet production or mission goals. PSTs develop, operate, and maintain photonics devices, and integrate them into larger systems where photonics is an enabling technology.

OP-TEC creates and distributes standards-based teaching materials, planning guides, and monographs on successful practices. Its professional development courses prepare hundreds of educators to teach photonics.

OP-TEC awards grants to colleges for summer camps, Saturday academies, and dedicated recruiters to inform students, teachers, and parents about photonics career opportunities. OP-TEC's 30 college partners provide pathways to successful careers for high school students and adults with an emphasis on outreach to women, minorities, and veterans.

OP-TEC affiliated programs combine technical knowledge and hands-on skills.



“We have been working with OP-TEC over the last several months. They have been extremely beneficial in getting this program [at Gallatin College] started and on track. We really couldn't have done it without them.”

*Trenton Berg, Lead Photonics Engineer
Bridger Photonics, Inc.*

OP-TEC Fuels the Photonics Workforce With Well-Prepared Technicians

More than 20,000 photonics technicians work in US businesses, labs, government agencies, hospitals, defense industries, and educational institutions. These enterprises need 800 new photonics technicians each year. However, two-year colleges graduate fewer than 350 photonics majors annually. Photonics employers have responded by retraining incumbent workers or hiring unprepared applicants, or moving offshore.

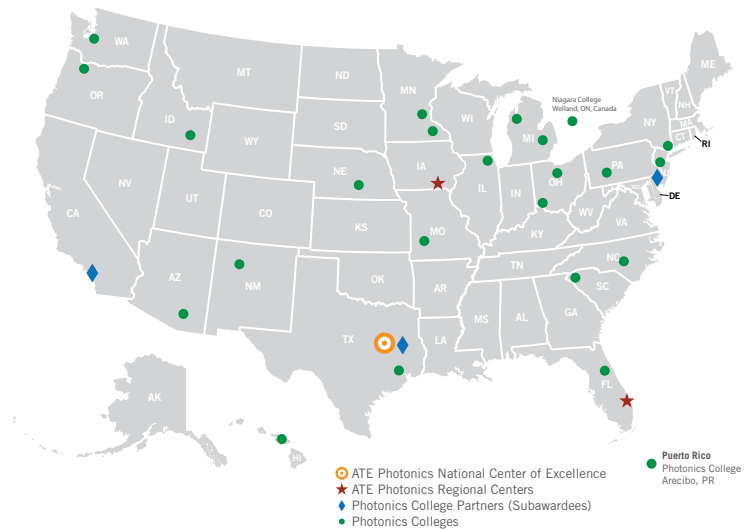
To help meet the urgent workforce need and maintain US competitiveness, OP-TEC supports new two-year degree programs and strengthens existing ones by creating secondary-to-postsecondary “pipelines” to increase the number and diversity of photonics students.

OP-TEC is helping to establish regional photonics centers to broaden career opportunities for deserving students. OP-TEC’s partnership with the regional centers also provides more opportunities for students to use industrial-grade equipment, for faculty to access supplemental funding opportunities, and for colleges to recruit adjunct faculty from more industry partners.

OP-TEC is also leading a national initiative to broaden the knowledge and skills of employed technicians through online courses and capstone lab experiences at colleges near their work or homes.

OP-TEC Enables Growth of High Quality Photonics Technician Education Programs

OP-TEC provides student recruitment tools, professional development, standards-based curriculum, instructional materials, and technical assistance to help its 30-college network meet workforce needs.



Precision optics technicians create, measure, coat, and integrate components into electro-optical systems.





National Center for Supply
Chain Technology Education



KEY ACTIVITIES

- Implements pathways throughout the US to increase the number of skilled supply chain technicians to meet the growing national need.
- Develops and delivers professional development related to supply chain technologies.
- Disseminates information about best practices and careers to students, educators, and industry.

SCTE Showcases New Supply Chain Careers

Supply chain technicians install, operate, support, upgrade, and maintain the software, hardware, and automated equipment and systems that support the supply chain. The supply chain encompasses commercial enterprises such as retail, pharmaceutical, and food processing businesses, as well as various public sector operations. SCTE showcases new career opportunities in this field that are crucial to so many industries.

SCTE released a free e-textbook, *Introduction to the Automated Warehouse*, that provides a comprehensive overview of the systems found in automated warehouses or distribution centers. Students in programs such as mechatronics or industrial maintenance have another career opportunity as supply chain technicians.



Assignments in the supply chain technology lab prepare students by mimicking workplace challenges.

SCTE Helps Colleges Address Supply Chain Workforce Growth

Based on its research, SCTE estimates that 589,931 supply chain technician jobs will become available between 2015 and 2025. In a 2013 national survey, nearly 80% of the businesses surveyed employed at least one supply chain technician.

These findings are the basis of SCTE's advocacy for community colleges to add supply chain certificate and degree programs. To help colleges start new programs, SCTE collaborated with industry to develop a model program that prepares students to work in automated warehouses. SCTE's model program focuses on the skills necessary to be successful in facilities throughout the US. It emphasizes critical thinking, problem solving, and a hands-on teamwork approach to learning. Educators can work directly with their local employers to customize SCTE's model program to meet their particular needs.

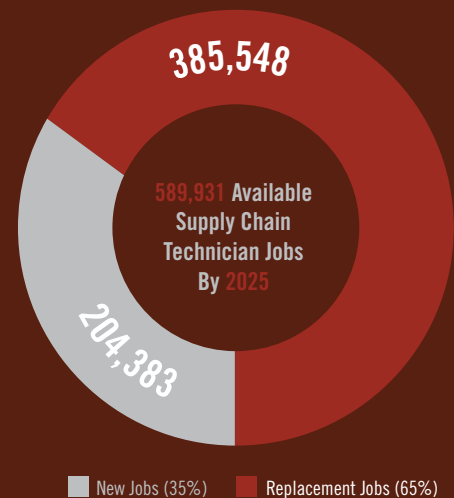
The West Hills Center of the Community College of Allegheny County is the first SCTE collaborator to offer a Mechatronics Associate in Science degree with with a specialization in supply chain technology. The program, partially funded through the US Department of Labor Employment and Training Administration, has been touted as a model for the nation.

Technicians are instrumental to the efficient operation of automated conveyor systems found in distribution centers.



Supply Chain Technician Job Openings

Between 2015 and 2025, 589,931 supply chain technician openings are expected with 204,383 new jobs and 385,548 replacement jobs from retirements and promotions.



“There is a need for a person who installs, upgrades or maintains the software, hardware or material handling equipment which supports the supply chain; the National Center for Supply Chain Technology Education is helping us to meet this need.”

*Phil Jones, Senior Project Manager for Distribution Engineering & Facilities, Vendor Relations
Target Corporation*



Students Earn Stackable Credentials in Maritime Technologies Pathway

The new SMART Center maritime technologies pathway, based on the registered apprenticeship model, features stackable academic credentials leading to an associate degree in maritime technologies and nationally recognized industry credentials.

The success of the SMART Center maritime technologies pathway led to the US Department of Labor's request for the center's input on revisions to the Transportation, Distribution and Logistics Competency Model. SMART has used this model to shape its programs of study and certifications.

The SMART Maritime and Transportation Institute alumni, who are secondary school STEM teachers and guidance counselors as well as college faculty, have created 55 new academic programs and modules.

KEY ACTIVITIES

- Creates effective pathways featuring stackable academic and industry credentials for maritime and transportation industry technicians.
- Expands awareness of challenging STEM-based technician careers in the maritime and transportation industry.
- Models and fosters productive partnerships between educators and industry employers.



Maritime engineering technology students hone their skills in a national RoboBoats competition.

Award-winning Maritime Trades Training Program Has High Employment Placement & Retention Rate

Since 2012 the Maritime Trades Training Program has provided 363 course completers—93% of the 388 people who enrolled in the courses—with full-time employment and the opportunity to apply for academic credit for their training. Two years later, 308 or 85% of the completers were working for the same employer.

The SMART Center seeded the Maritime Trades Training Program with five community college partners and industry leader Newport News Shipbuilding. This scalable program received the National Exemplary Program Award from the National Council for Workforce Education.

SMART Center Expands Credentialing

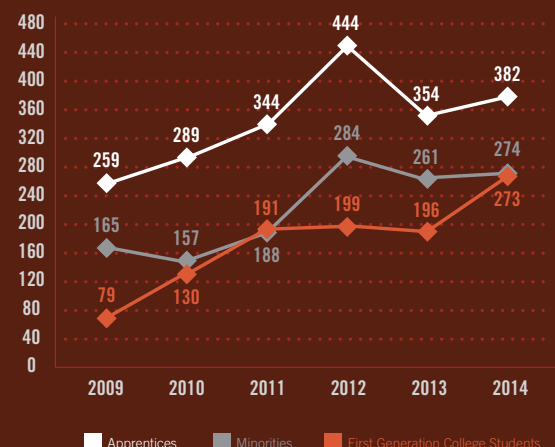
The SMART Center has created the first-of-its-kind crosswalk mapping the US Coast Guard's maritime industry seagoing credentials to academic credit. This innovation is being rolled out at San Jacinto College in Houston, Texas, and has the potential to increase college enrollment for veterans and merchant mariners nationwide. The center's professional development courses have also provided industry credentialing and academic credit for 39 technicians and instructors, who in turn have impacted the education of more than 8,250 students.

A mentor shows a student apprentice how to measure precision machining angles.



Maritime Pathways Courses Attract Diverse Populations

Maritime course enrollments increased dramatically for apprentices, minorities, and first-generation college students at Tidewater Community College since the SMART Center started in 2010.



“The SMART Center's Maritime Technologies Pathways are innovative, and sustainable programs that align with the needs of the maritime and transportation industries. We look forward to expanding these pathways and strengthening our relationship with the SMART Center in the coming years.”

*Al Konetzni, Vice President, General Manager
Oceaneering International, Inc. – Marine Services Division
Vice Admiral, US Navy (Retired)*



SpaceTEC Certifications Put Students on Career Trajectory

Charles Schenkbecher, an Eastern Florida State College graduate, SpaceTEC® intern, and SpaceTEC Core Certified Aerospace Technician®, says, "The two years I spent in the aerospace technology program were awesome.

"The experiences I had were essential to setting me on a career path in the industry. I cannot speak highly enough of the terrific instructors in the program, as well as the staff at SpaceTEC. Their insight and knowledge of the aerospace industry were not only enlightening, but truly enriched the learning experience. At Eastern Florida State, and at SpaceTEC, I found an outstanding group of individuals that truly helped me to succeed."

An aviation student measures rivets on a mechanical assembly test piece.

KEY ACTIVITIES

- Provides the only FAA-recognized national performance-based certifications for aerospace technicians.
- Offers certification exams that validate critical technical skills desired by high-technology companies.
- Facilitates the awarding of semester credit hours by the American Council on Education (ACE) for all SpaceTEC® certifications.



SpaceTEC Helps Veterans Transition to Civilian Workforce

As the US military reduces the active duty force, developing pathways to civilian occupations remains an important focus of SpaceTEC. The center's programs, which have been accredited by the International Certification Accreditation Council, assist service members and veterans achieve industry-endorsed, nationally recognized credentials that smooth entry to civilian careers.

The Veterans Technical Education Connection (VetTEC®) enables veterans to find meaningful employment with living-wage jobs. Through VetTEC, the SpaceTEC National Resource Center has been working to establish partnerships in key areas at Department of Defense, Veterans Administration (VA), and educational institutions. SpaceTEC is also aligning technical military occupational specialties with SpaceTEC and CertTEC certifications.

SpaceTEC has developed a user-friendly website that will serve as a one-stop, streamlined source of information about the many resources available to active duty military, transitioning service members, and veterans. By linking to the appropriate Credentialing Opportunities Online (COOL) or VA benefits pages, the portal provides connections to college partner programs, information on preparation materials, technical training programs, and American Council on Education (ACE) credit-by-certification. ACE grants semester hours for all SpaceTEC certifications.

CertTEC examiners demonstrate a team bucking rivet installation.



SpaceTEC Certification Activity Across Multiple Technologies in 2015

The ratio of attempts versus certifications awarded reflects both the rigor of the exams and the preparation of the students taking them.

| Actual Certifications | Certification Attempts |
|---|------------------------|
| SpaceTEC Core | |
| 7 | 7 |
| SpaceTEC Concentrations | |
| 1 | 1 |
| CertTEC Aviation Mechanical Assembly | |
| 24 | 70 |
| CertTEC Basic Composites | |
| 9 | 25 |
| CertTEC Basic Electricity & Electronics | |
| 842 | 1,084 |

“The requirement to demonstrate BOTH knowledge and ability to do is the missing link in technology education. That’s the reason I need (and others need) ... performance testing.”

*Mark McDougal, Retired Instructor
Tennessee College of Applied Technology – Hohenwald*





INFORMATION TECHNOLOGIES



KEY ACTIVITIES

- Defines and strengthens academic and career pathways in computer science, information technology (IT), web technologies, and big data.
- Improves students' problem-solving skills and employability.
- Facilitates internship opportunities.
- Conducts research on industry trends and workforce needs.

BATEC Strengthens IT Technician Pipeline

BATEC's comprehensive strategy addresses recruitment of underrepresented populations and development of academic pathways. The center promotes understanding of the dynamic nature of IT knowledge, skills, and attributes. It supports intensive curriculum adaptation and development and initiates pedagogical transformation.

BATEC seeks to increase the robustness of the IT technician pipeline and the capacity of individuals moving along it by reaching out to underrepresented and at-risk student populations, and encouraging substantive dialogue among the key stakeholders.

Productive interactions among stakeholders in education, industry, government, and community have resulted in stackable credentials and seamless pathways from high schools to two-year and four-year degree programs.



A student assembles a Raspberry PI during a BATEC workshop.



BATEC's Research Identifies IT Career Opportunities

Employers depend on a robust supply of qualified and capable talent in order to grow their businesses and achieve their strategic objectives. To address this need, BATEC conducts research to improve understanding of IT middle-skill career pathways. For example, in 2015 BATEC personnel co-authored *Middle Skill Employment: Understanding the Opportunities and Skill Requirements for an IT Workforce* with Burning Glass Technologies.

This collaboration analyzed the dimensions and characteristics of the workforce opportunities for middle-skill IT professionals. The resulting report includes total employment, number of middle-skill positions, number of new jobs, and average compensation on national and regional bases. Its outline of workforce characteristics covers job responsibilities, technical skills, professional skills, and industry certifications.

The nine occupational groups examined in this report constitute an important cross section of the labor market. Together, they accounted for 1.7 million job postings in 2014, or about 10% of all job postings. BATEC's in-depth analysis of national and regional labor markets has fostered discussions about the underlying dynamics of middle-skill employment and an opportunity to rethink how to source new talent.

“BATEC provides a venue for us to voice our opinions, to discuss our priorities, and to address the needs for the future technology worker.”

Tom Hopcroft, President & CEO,
University of Nebraska-Lincoln Diocles Extreme Light Laboratory

Faculty learn about ethical hacking during BATEC's Summer Institute.



BATEC Drills Down on IT Job Data

In *Middle Skill Employment* BATEC analyzes Burning Glass Technologies' IT job postings data and offers insights into nine specific occupations.

| IT OCCUPATIONS THAT GREW SIGNIFICANTLY 2010 to 2014 | GROWTH |
|---|--------|
| INFORMATION SECURITY ANALYSTS | 92% |
| SOFTWARE DEVELOPERS | 70% |
| HEALTH INFORMATION SPECIALISTS | 41% |
| WEB DEVELOPERS | 41% |
| DATA ENGINEERS | 32% |
| USER SUPPORT SPECIALISTS | 29% |
| NETWORK SUPPORT SPECIALISTS | 27% |
| COMPUTER SYSTEM ANALYSTS | 22% |
| COMPUTER PROGRAMMERS | 10% |



CTC

National Convergence Technology Center

COLLIN COLLEGE | FRISCO, TEXAS

www.connectedtech.org



CTC-BILT Partnership Grows Convergence College Network

The National Convergence Technology Center (CTC) engages the Business and Industry Leadership Team (BILT) quarterly to co-lead the center's work. BILT members validate job skills to steer curriculum, and the results are used by local college BILT teams to affect curricular changes. This process helps produce readily employable graduates.

Under the BILT's leadership, CTC supports the Convergence College Network (CCN) that now numbers 46 colleges nationwide. Through this "community of practice," the center and more mature CCN members mentor colleges across the country. Data from colleges indicate that active involvement in CCN improves enrollment numbers.

KEY ACTIVITIES

- Co-leads all activities with its Business and Industry Leadership Team.
- Fosters collaborations among a network of 46 institutions to share processes and curricula.
- Delivers comprehensive professional development through Working Connections.
- Provides access to virtual labs and virtual internships models.

An instructor provides hands-on help for a NetRider student.



BILT Helps Produce Career-Ready Graduates

CTC's unique BILT model has been adopted by numerous colleges both in and out of the CCN network and beyond the IT discipline. Asking IT business people to co-lead with CTC's leaders has created a highly engaged national group that is ready and willing to support two-year college IT programs. With BILT members' help aligning curriculum and forecasting workforce needs, CTC—in partnership with colleges nationwide—delivered the right technical skills to produce 2,508 documented program graduates in 2014.

Because the job skills analysis process informs curriculum on a regular basis, graduates are highly qualified and readily hireable. This means businesses can limit ramp-up training costs for new hires, who historically are not productive during their first months of employment.

BILT members also mentor students by providing guidance on creating portfolios, writing résumés, building interview skills, and supporting virtual internship teams. These interactions give students glimpses into real-world practices. The experience strengthens students' employment prospects with the soft skills that employers want. Thanks to BILT involvement, graduates are hired, stay employed, and later gain promotions.

A student practices hands-on router configuration in a classroom convergence lab.



“The BILT has inspired industry leaders and faculty to unite in an effort to build students into the very best workforce-ready employees.”

*Matt Glover, CTO
Le-Vel LLC*

CCN GRADUATE INCREASE

*TOTAL GRADUATES FROM EIGHT REPRESENTATIVE CCN MEMBER SCHOOLS



REPRESENTS 50 STUDENTS

The number of graduates increased at eight of the top-performing institutions in the Convergence College Network (CCN) from 250 graduates after one year of involvement in the CCN to 500 after two years in the CCN.



KEY ACTIVITIES

- Serves as the national, unifying voice for two-year college geospatial technology (GST) programs.
- Coordinates a community of practice.
- Provides professional development and curriculum resources.
- Develops core competencies.
- Increases the number and diversity of well-qualified geospatial technicians.

10 Model Courses Are Most Up-to-Date Curriculum

GeoTech Center developed 10 model courses based on the competencies within the Department of Labor Geospatial Technology Competency Model (GTCM). The courses constitute the most up-to-date and workforce-aligned GST curriculum that exists today. Each model course includes lecture notes, screencasts, video components, course outlines, syllabi, assessments, sample assignments, learning modules, case studies, and textual resources.

A dozen colleges deliver the courses face-to-face, online, or in hybrid formats. The center mentors rural, suburban, urban, Hispanic-serving, and Native American colleges.

Since April 2013 its website has had 65,000 views, and nearly 3,000 unique hits from every US state and 147 countries.



Students check an unmanned aerial vehicle before beginning a mapping project.

Center Uses Geospatial Technology Competency Model To Align Curriculum with Workforce Needs

Since 2008 GeoTech Center has served as the national, unifying voice for two-year college GST programs. The center coordinates collaborations between colleges, universities, and industry to expand the GST workforce by providing professional development opportunities, teaching and curriculum resources, career pathways, and model core competencies for GST technicians and technologists.

As demonstrated by its work with the US Department of Labor on the GTCM, GeoTech Center is recognized by industry as a leader in GST education. The GTCM enables managers and human resource officers to delineate the skills and abilities required by entry-level GST occupations and academia to align GST curriculum with workforce needs.

GeoTech Center has Memorandums of Agreement with several professional organizations, including the American Society for Photogrammetry and Remote Sensing, AmericaView, US Geospatial Intelligence Foundation (USGIF), and GIS Certification Institute. These agreements ensure that the professional GST community is being certified in the most up-to-date workforce competencies.

The Certified GIS Professional Credential and other certification examinations have been developed in large part by these professional organizations using the GTCM.

“GeoTech Center works tirelessly with USGIF to enable the global Geospatial Intelligence (GEOINT) workforce to learn about and train to use GEOINT analyses, tools, and technology. We consider our partnership essential to the overall maturation of the GEOINT discipline.”

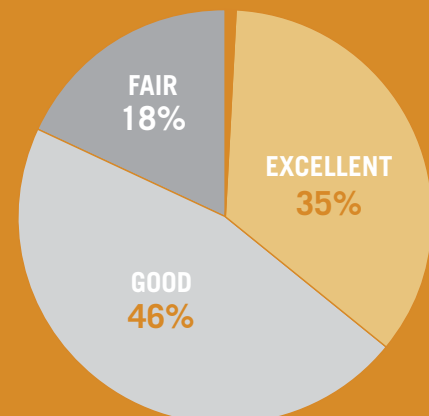
*Darryl G. Murdock, Vice President of Professional Development
United States Geospatial Intelligence Foundation*

With a GPS antenna a technician determines a precise position at a quarry.



GeoTech Center Webinars Receive Positive Ratings

Of the 300 participants in nine GeoTech Center webinars in 2015, 86% planned to disseminate info to students and colleagues.







LEARNING, EVALUATION & RESEARCH



ATECENTRAL



KEY ACTIVITIES

- Acts as an information hub and archive of ATE resources, events, and initiatives.
- Provides tools, training, and documentation for online resource dissemination and digital library collection building and maintenance.
- Highlights the ATE program through publications, presentations, and social media.

ATE Central Supports & Amplifies ATE Community Efforts

Created to support and amplify the valuable work of the National Science Foundation's ATE community, ATE Central's services include publications like the ATE Central Connection newsletter as well as open source software, mobile apps, and the ATE Outreach Kit. ATE Central's archive helps ATE grantees leverage work already done, share new deliverables, and inform new audiences.

Through the ATE Central map interface, educators can discover potential collaborators in their regions and across the nation. With the ATE PI Meeting App individuals at the annual ATE Principal Investigators Conference easily access meeting-related materials and connect with other attendees via their mobile devices.

The ATE@20 blog spotlights ATE innovations like Seminole State College's career pathways workshop.





ATE Central Promotes & Preserves ATE Innovation

The ATE Central portal offers a digital showcase of the ATE program for educators, employers, and the general public. By providing a single searchable location to the full spectrum of ATE resources, ATE Central encourages cross-disciplinary learning and helps highlight the cross-disciplinary nature of ATE's technician education and professional development programs.

Sustaining and preserving the valuable work done through the ATE program have always been of critical concern to the ATE community. To address this need, ATE Central's sustainability workshops and webinars bring together best practices from within and beyond the ATE community. This collaborative learning environment supports ATE principal investigators' development of effective sustainability strategies.

ATE Central's archiving service assures that the valuable resources created under ATE funding will be accessible even after project and center funding sunsets. The newest National Science Foundation ATE Request for Proposals requires projects and centers funded after 2015 to archive their deliverables with ATE Central. As a result, educators in the future will continue to learn from and build on the diverse STEM education materials created with ATE funding.

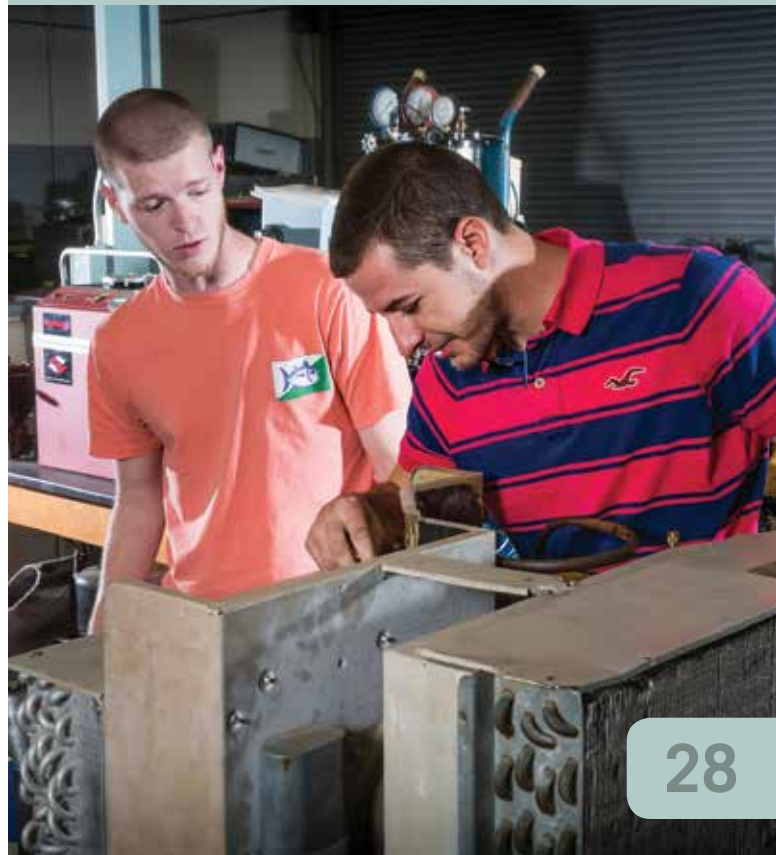
NEW ATE RESOURCES

ATE Central collects and showcases hundreds of events and resources from the diverse disciplines covered by ATE projects and centers.

| | |
|-----|---|
| 150 | Advanced Manufacturing Technologies |
| 139 | Agricultural and Environmental Technologies |
| 62 | Bio and Chemical Technologies |
| 72 | Micro and Nanotechnologies |
| 170 | Engineering Technologies |
| 94 | Information and Safety Technologies |
| 113 | General Advanced Technological Education |

August 2014 to July 2015

Through its resource collection, ATE Central showcases valuable ATE materials for classroom use.



“ATE Central's archive represents important progress in protecting the diverse and valuable resources being created through the National Science Foundation's Advanced Technological Education program.”

*Kate Wittenberg, Managing Director
Portico*



DeafTEC



KEY ACTIVITIES

- Provides professional development for teachers and employers that facilitate increases in the number of deaf and hard-of-hearing STEM technicians.
- Offers an online clearinghouse of information related to technician careers.
- Leads a national STEM dual-credit program.
- Partners with community colleges to provide support for student veterans with a hearing loss.

DeafTEC Shares Best Practices

DeafTEC offers professional development to teachers on best practices for improving access to learning in the classroom and strategies for teaching English and math to deaf and hard-of-hearing students. Offered by DeafTEC regional partners in California, Florida, Illinois, and Texas, these workshops improve the access of deaf and hard-of-hearing students, as well as all students in the classroom, to STEM education and STEM careers. In three years, the 59 partner educators who received training through DeafTEC provided workshops to more than 1,000 high school and community college educators.

DeafTEC's national dual-credit program offers credit-bearing college courses to deaf and hard-of-hearing high school students. More than 50 high school teachers from 25 schools in 12 states have received DeafTEC instruction to teach STEM college-level courses. As a result, more than 500 deaf and hard-of-hearing students have earned 1,200 college credits.



Computer-aided drafting technology students, who are deaf, examine a 3D model of a building.

DeafTEC's Industry Partners Help to Open Doors to Deaf Employees

DeafTEC's industry partners learn how to offer workshops on how deaf and hearing people can successfully work together. In three years, 20 workshops have been offered to 200-plus employees. These partners also offer career awareness activities and internship opportunities that will help deaf students transition from school to work.

DeafTEC Provides Valuable Resources

DeafTEC's comprehensive online resources serve various national audiences with the goal of moving students into STEM programs and on to STEM careers. DeafTEC website resources

- provide employers with best strategies for integrating deaf individuals into the workplace;
- develop deaf and hard-of-hearing individuals' math skills;
- incorporate writing into STEM classes;
- offer teachers best practices for instructing deaf students;
- supply teachers, counselors, parents, and students with STEM career information; and
- provide a standardized STEM American Sign Language (ASL) Video Dictionary.

Because of the high incidence of hearing impairments among veterans returning from military service, DeafTEC is also developing resources for community college instructors to address the unique academic challenges that student veterans with hearing loss confront in STEM programs.

“DeafTEC's Working Together: Deaf & Hearing People workshops have been instrumental to our supervisors, managers, and human resources staff, helping us integrate deaf and hard-of-hearing individuals into the workplace.”

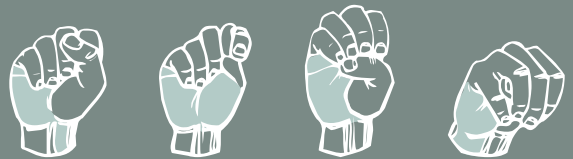
*Rene' Derringer, Manager of Compensation & Benefits
Solar Turbines Incorporated*

A deaf lab technician works in a pharmaceutical lab.



DeafTEC Standardizes ASL Signs for STEM Terms

DeafTEC received Dow Chemical Company support to create a STEM ASL Video Dictionary with an ASL linguist and STEM experts.



S T E M



KEY ACTIVITIES

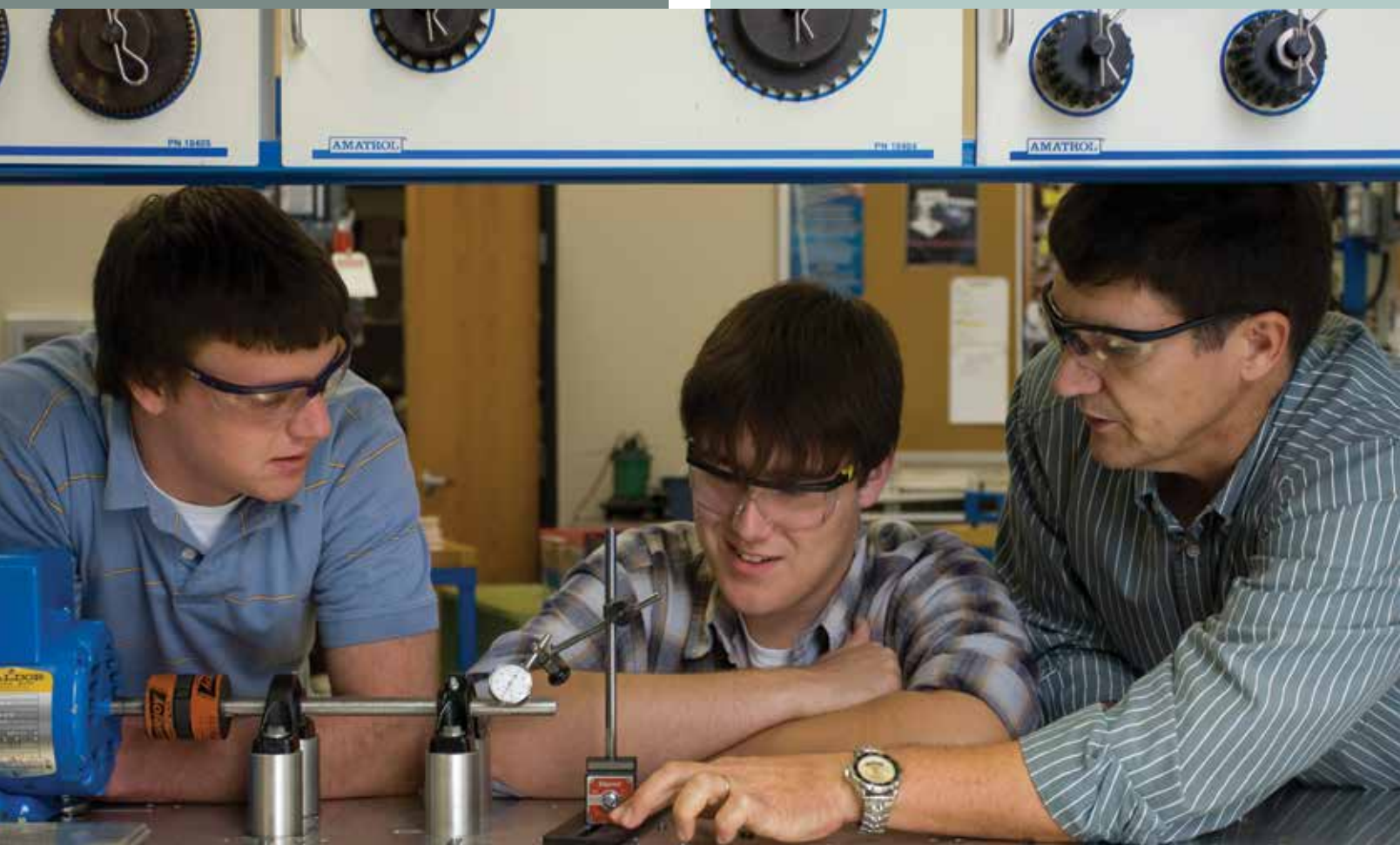
- Strengthens the ATE program's evaluation knowledge base.
- Expands the use of exemplary evaluation practices.
- Supports the continuous improvement of technician education throughout the nation.

EvaluATE Builds Capacity at ATE Colleges

EvaluATE helps ATE centers and projects develop their capacity to conduct useful and high-quality evaluations for their NSF-funded work. Sound evaluations provide information that enables grantees to be accountable to NSF. Moreover, they provide evidence of projects' and center's impact on students. These results help other educators and industry to identify ATE innovations to replicate.

The percentage of ATE principal investigators who formally evaluate their projects has increased from 84% of 167 in 2005 to 94% of 225 in 2015. In 2015, 91% of ATE grantees reported that they refined some aspect of their activities based on evaluation results.

EvaluATE collects data on student involvement in ATE-supported programs to document the program's reach.



“EvaluATE is a valuable source of guidance on evaluation for the ATE community and the resource we depend on for expertise and best practices in evaluating ATE projects and centers.”

*Elaine Craft, Mentor-Connect Principal Investigator
Florence-Darlington Technical College*

Webinars & Blog Help Develop Evaluative Culture

Strong audience response has reinforced EvaluATE's use of high-quality webinars to develop an evaluative culture in the ATE community. EvaluATE's series of 90-minute, mixed-media webinars—offered in partnership with MATEC—attracts hundreds of participants annually. In recent years the audience for EvaluATE's programs has grown to include administrators and grant development personnel at ATE and non-ATE colleges, as well individuals involved in evaluation at federal agencies, consulting firms, state and local governments, nonprofit organizations, and foundations.

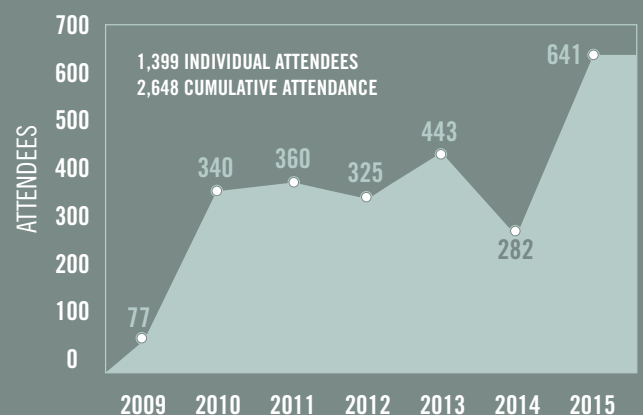
EvaluATE's weekly blog features writings by an array of ATE authors, including principal investigators (PIs), evaluators, grant writers, and others involved in STEM education evaluation. Topics include evaluator-PI relationships; presenting and using data; research; survey question development; partnerships; strategies to improve survey response rates; small project evaluation; professional development evaluation; institutional data sources; indicator development; gender evaluation; formative evaluation; evaluation procurement; evaluation for grant writers; embedded assessment; social network analysis; theory of change; and data visualization—among others. The blog prompts authors to reflect on their experiences with evaluation and to share their perspectives and lessons learned as well as the tools they used.

EvaluATE's instruction, resources, and tools help educators assess their impact on technician education and workforce development.



EvaluATE's Successful Outreach Evident in Webinar Attendance Growth

EvaluATE's webinar attendance continues to grow dramatically, with new and returning participants.





SC ATE Leads Improvements in Teaching & Faculty Development

Since 1995, SC ATE has been impacting student success by helping community and technical colleges expand excellence in programs, teaching, and leadership in technician education.

SC ATE's innovative, real-world, problem-based learning (PBL) curricula improves student success in engineering and industrial technology programs.

SC ATE develops faculty through PBL Instructional Leadership Institutes and the Mentor-Connect Leadership Development and Outreach Projects.

Through TeachingTechnicians.org, SC ATE expands its impact on student success by providing all community college faculty with alerts to free and low-cost faculty professional development programs provided by ATE centers and projects, technician education resources, and a collection of proven practices.

SC ATE promotes diversity and collaboration in technology programs.

KEY ACTIVITIES

- Publicizes ATE faculty development opportunities.
- Offers innovative mentoring and leadership development opportunities for community college faculty.
- Provides a Compendium of Research on Technician Education.
- Promotes problem-based learning curricula.
- Develops, implements, and shares program improvement strategies.





SC ATE Builds Nation's Technician Education Capacity

SC ATE impacts the workforce by building the nation's technician education capacity with solutions for issues common to all disciplines of technician education. As a flagship “go-to/return-to” resource for answers and solutions related to technician education, SC ATE encourages participation in the ATE program. Its activities support the engagement of more institutions and faculty in proactively advancing technician education to meet local and regional needs.

SC ATE stimulates on-going faculty development, as it creates and shares successful student recruitment and development strategies. The center also provides and promotes use of innovative curricula that address industry needs for technically proficient workers who work well in teams and demonstrate excellent communication, critical-thinking, and problem-solving skills.

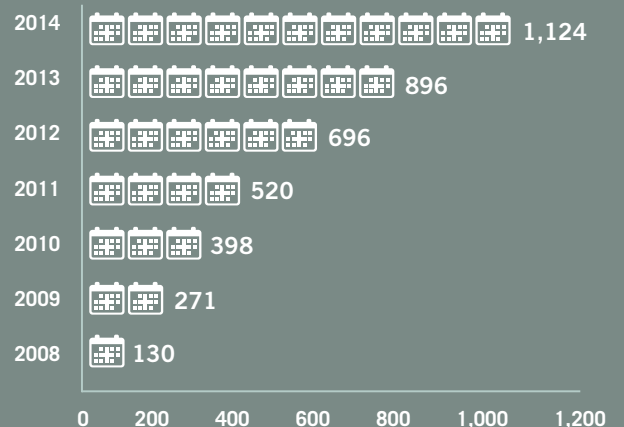
SC ATE leverages its broad national network by serving as a dissemination partner for ATE grant-funded initiatives to spread and encourage use of additional advancements in technician education and resources developed by others. SC ATE stimulates effective knowledge transfer to help ensure the development of the next generation of STEM leaders who continue to focus on advanced technological education.

Network systems management technicians support computer networks and systems in industry, education, and government agencies.



Events Postings Increase on TeachingTechnicians.org

SC ATE links faculty development providers and seekers with more than 1,100 faculty development events on TeachingTechnicians.org



“Nucor Vulcraft has had great success when working with Florence-Darlington Technical College (FDTC) in search of new teammates. Being an FDTC engineering technology graduate myself, I know firsthand the knowledge students gain prepares them for taking the next steps in joining the workforce.”

Mark Jones, Drafting Supervisor
Nucor Vulcraft-SC





MICRO & NANO TECHNOLOGIES



KEY ACTIVITIES

- Creates a sustaining model for ATE resource centers.
- Collaborates with institutions nationwide to offer faculty professional development.
- Partners with industry to offer STEM outreach programs.

A student prepares for an aerospace manufacturing career at the Maricopa Skill Center.

MATEC NetWorks Sustains Its Work

MATEC Networks has achieved sustainability of its resource center activities through institutionalization at the Maricopa Community Colleges and through financial support from the sale of its products and services.

The majority of MATEC NetWorks' webinars and national conferences are now done in collaboration with ATE centers such as EvaluATE and ATE Central, ATE projects such as Mentor-Connect, and nonprofit organizations such as the American Association of Community Colleges. In this way the center's core strengths are leveraged to impact large numbers of educators and industry members across the country. In 2015 the center produced or co-produced 36 webinars for 3,133 registered participants. It co-produced the High Impact Technology Exchange Conference (HI-TEC), a four-day national event with more than 600 participants.





“The HI-TEC conference provided great opportunities to interact with faculty and administrators from colleges across the country and to gain insight into innovative classroom and laboratory methods that are being utilized in technology programs.”

*Robert Decker, Engineering Technologies Program Director
Mohawk Valley Community College*

Assessment of STEM Outreach Program Finds Promising Outcomes

The center has collaborated since 2004 with the SEMI Foundation to develop and produce High Tech U, a STEM career awareness program for high school students. The program is offered at industry sites and exposes students to real-world learning activities that are relevant to their STEM studies.

In 2014 the center surveyed former participants to gauge High Tech U's impact. For this retrospective study, 1,410 students who completed the program between 2006 and 2010 were identified. Of the 252 students who responded to the phone survey, 56% were male, 44% were female. Amazingly 90% of the 252 are currently enrolled or have finished their higher education. Of the 252 survey respondents, 68% (171) persisted in STEM education. When compared to data from the National Center for Education Statistics, which shows that about 14% of college students complete a STEM major, the High Tech U alumni, who participated in the survey, completed their education in STEM at a rate nearly four times higher than this national norm.

Many of the students reported that High Tech U's introduction to high-tech workplaces reinforced their motivation to pursue STEM majors and careers.

A technician at Nichols Precision checks a critical dimension.



Significant Majority of High Tech U Students Pursue STEM Careers

High Tech U students complete their education in STEM at a rate about four times higher than the national norm.

252 SURVEY RESPONDERS

68% (171)

REPORTED A CAREER PATH IN STEM

OF THE 110 WHO REPORTED EMPLOYMENT

76% (88)

ARE EMPLOYED IN STEM CAREERS

NATIONALLY, 14% OF COLLEGE STUDENTS COMPLETE STEM MAJORS.



NACK Network Assists Nanotech Program Development

NACK Network has assisted more than 300 postsecondary institutions in developing nanotechnology programs through guidance in planning and design, instruction at educator workshops, and distribution of adaptable curriculum materials.

More than 1,200 students have completed nanotechnology workforce education programs nationwide, many of whom are contributing their nanotechnology knowledge to companies across the US. According to 2013 and 2014 industry surveys by NACK, more than 200 companies nationwide are employing graduates from NACK partner institutions in microtechnology and nanotechnology-related positions. All of the surveyed companies plan to hire technicians with nano-scale fabrication skills by 2018.

Students gain valuable hands-on industry endorsed skills through NACK Network programs.

KEY ACTIVITIES

- Serves industry by enabling nanotechnology workforce development education at community and technical colleges across the US.
- Advances development of international nanotechnology skill standards.
- Propagates a network of remote equipment access providers.
- Cultivates diversified modes of dissemination of nanotechnology course materials.





ASTM Recognition Next for NACK's Core Skills

A strong nanotechnology-based industry must have a workforce skilled in synthesis, fabrication, and characterization at the nanoscale. NACK is currently engaged with ASTM International to institutionalize NACK's industry-approved core skills into ASTM standards. Nanotechnology workforce education standards have been approved and published. They are at ASTM's website www.astm.org.

NACK Offers Nanofabrication Tools Professional Development

NACK piloted the Remotely Accessible Instruments for Nanotechnology (RAIN) network to provide secondary schools and community colleges with web access to state-of-the-art, nano characterization and nanofabrication tools. A survey of 30 educators participating in the pilot remote access (RA) sessions showed that 90% would recommend RA to their colleagues; and 87% of the 600 students participating in this survey found remote access more engaging than traditional textbooks.

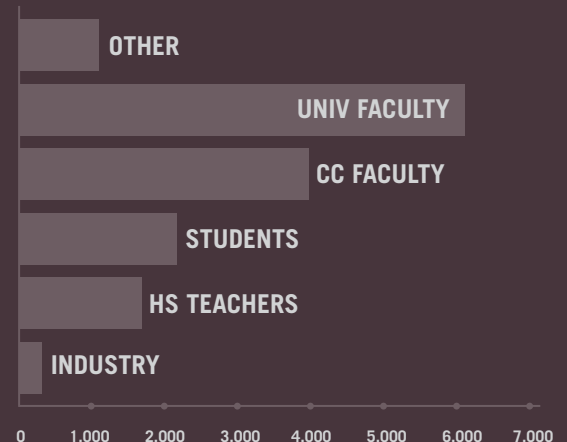
NACK also offers professional development workshops and webinars for educators to help them develop a deeper understanding of nanotechnology and what is necessary to teach it in a meaningful way. To date, 1,360 educators have attended these workshops. More than 5,600 individuals have registered for NACK's webinars, accessed archived webinars at nano4me.org, or watched them on YouTube.

A NACK program graduate analyzes chromatography samples at Restek Corporation.



Key Audiences Access NACK Network Education Materials

University and community college faculty downloaded 11,000 NACK materials from January 2012 to June 2015.



“Students are trained in environments and with equipment that is specifically used in nanotechnology; indeed, they are able to operate and repair equipment that most four-year and advanced degree STEM graduates would have had little or no exposure to in their educational experience.”

Les Ivie, President and CEO
F Cubed, LLC



KEY ACTIVITIES

- Develops technicians for emerging technology careers.
- Partners with industry to coordinate student outcomes that meet industry requirements.
- Helps educators infuse nanoscience concepts into traditional classes as well as technical programs.
- Offers professional development opportunities for educators.

Nano-Link Builds Nano & STEM Career Pipelines

To create a pipeline of students interested in nanotechnology and science in general, Nano-Link reaches out to high school educators. Its 60 workshops and seminars have been attended by 1,200 educators. More than 450 of these teachers report reaching 65,000 students by using Nano-Link materials, activities, and experiments. The teachers have used these Nano-Link resources in physics, chemistry, biology, career education, math, and English classes.

Of the 831 high school students surveyed since 2014, 73% agreed or strongly agreed that use of Nano-Link educational content increased their interest in learning about nanotechnology, and 72% agreed or strongly agreed they had increased interest in learning about science-related careers.

A student learns to use a scanning electron microscope.





Nano-Link Builds Science Knowledge to Address Future Nano Workforce Needs

Nano-Link is an alliance made up of 14 high schools, two-year colleges, and universities. It focuses on faculty, students, and the public to increase awareness of nanotechnology and the multitude of career options available.

Acknowledging the multi-disciplinary aspect of nanotechnology, the alliance also develops and defines the competencies required for a career in nanotechnology. As a result, Nano-Link partner colleges prepare students to meet the needs of employers in diverse industries such as energy, material science, biotechnology, food industry, agriculture, electronics, and medical device manufacturing.

Program graduates are employed at more than 35 companies nationwide. They serve as research assistants, lab managers, instrument operators, test technicians, customer service representatives, quality control technicians and manufacturing technicians. Some work independently, performing multiple jobs at companies that range in size from very small to large. Others are on research teams working with scientists and engineers.

Nano-Link facilitates student success and lifelong learning: 60% of 120 graduates between June 2006 and June 2014 continued their education after attaining a two-year degree. Many of these individuals have attended courses while working full time.

Nano-Link workshops provide educators with replicable hands-on experiences and modularized content.



Nano-Link's Embedded Approach to Educational Content

Nano-Link uses implementation of topic-specific modules and college-level labs to instigate institutions' development of nanotechnology certificate, diploma, and degree programs.

Guidance, Tutorials, Syllabi, Slides,
Tests, Quizzes

Courses
Lectures & Labs
Major Categories
Semester Long
College

Lab Experiments
Experiment/enhanced activity
Deeper concepts - 2 to 4 hours
College

Module
Activity Based
Topic Specific
1 hour
Multiple Grade Levels

“The nanoscience program has allowed me to gain experience and knowledge in an advanced technical field far sooner in my academic journey and career path than any four-year degree. I now have the advantage over most graduates.”

*Samantha Zahratka, Associate Engineer
AVEKA, Inc.*



NEATEC Facilitates Experiential Learning

NEATEC works with high schools and two-year colleges to enhance the students' skills in nanotechnology, semiconductor processes, and photovoltaics. It also facilitates industry internships.

From September 2014 to August 2015,

- 27 high schools used the NEATEC Learning Modules to instruct 500 students;
- 45 community college students attended NEATEC workshops;
- 130 students participated in co-ops and job shadowing with General Electric;
- 20 students participated in 20-week, clean room-focused internships with the State University of New York (SUNY) Polytechnic Institute and GLOBALFOUNDRIES; and
- six students participated in 16-week paid internships with the National Institute of Standards and Technology (NIST).

KEY ACTIVITIES

- Provides workshops for two-year college and high school educators and students.
- Develops NEATEC Learning Modules in nanotechnology for high school science and technology courses.
- Partners with industry to create experiential learning opportunities for students.
- Offers colloquia.



A high school instructor who received NEATEC's professional development teaches nanotechnology concepts.



A Hudson Valley Community College graduate prepares silicon wafers for oxidation at GE Global Research.



Industry Turns to NEATEC for Training

NEATEC teaches GLOBALFOUNDRIES' new technicians workmanship and mechatronics, a blend of mechanical, electrical, and computer technologies.

NEW EMPLOYEES TRAINED AT GLOBAL FOUNDRIES



WORKMANSHIP AND MECHATRONICS TRAINING

READY TO WORK

“Being selected for the NIST Internship was a life changing experience. The facility and staff allowed me to gain a great deal of knowledge and skills which led me to where I am today—a semiconductor tool engineer.”

*Mike Kennedy, Semiconductor Tool Engineer
Applied Materials, Inc.*

NEATEC Teaches Technicians

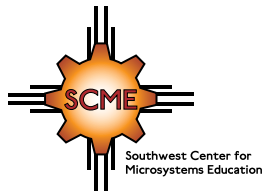
NEATEC has developed a strong relationship with semiconductor industries in New York and Western New England. Since 2014, 600 technicians employed by GLOBALFOUNDRIES, a full-service semiconductor manufacturer, have attended NEATEC training programs. These programs covered mechatronics, workmanship skills, pneumatic technology, and radio frequency technology. From January 2014 to December 2015 NEATEC's two contracts with GLOBALFOUNDRIES resulted in 60 full weeks of technician training.

NEATEC's Workforce Development Begins in High Schools

NEATEC offers professional development short courses to high school teachers to prepare them to use its learning modules. More than 50 teachers from 25 schools attended these courses in 2014-2015 and received hands-on kits to teach nanotechnology. The teachers learned how to use atomic force microscopes and various electronics in science and technology classrooms.

NEATEC also created an introductory nanotechnology course that is offered by the SUNY Polytechnic Institute's College in High School program. Students who complete the course earn college credits.

To broaden public awareness of nanotechnology and semiconductor career opportunities, NEATEC offers colloquia and participates in job and science fairs.



SCME Adds Microsystems Concepts to STEM Instruction

Biannual surveys of SCME professional development recipients show that SCME hands-on kits and other educational materials are impacting high school, community college, and university students. These surveys found that students have used SCME materials for more than 310,000 hours since 2012.

Approximately 300 community college and four-year college students completed a certificate or associate degree in a technology program that included microsystems educational components. Half of these students continued their education, while the other half found employment. Approximately 10% were early leavers, individuals who left before completing their degree because they found a job.

KEY ACTIVITIES

- Offers professional development via a hands-on, clean room workshop network, web-enhanced distance learning, and workshop series.
- Disseminates microsystems and nanotechnology educational lessons via YouTube channel, classroom MEMS activity kits, and conference workshops.
- Assists technical programs' inclusion of advanced micromanufacturing.

Engineering students team up with technicians, a requisite in the high-tech workplace.





Micro-Pressure Sensors Make Useful Vehicles for Applied Learning

To prepare students for microsystems industry needs, SCME's educational materials and professional development activities focus on micro-pressure sensors. The center has developed more than 50 learning modules that include dozens of hands-on activities that teach about micro-pressure sensor design, fabrication, and applications.

SCME's micro-pressure sensor workshops and supporting curriculum have been successfully transferred to five other educational institutions. By offering these multi-day workshops in clean rooms in various locations, SCME makes advanced micromanufacturing education more available to students, educators, and employers. These workshops cover chemical safety, surface and bulk micromachining processes, sensor operation, electronics, microdevice characterization, crystallography, and microelectromechanical systems (MEMS) applications.

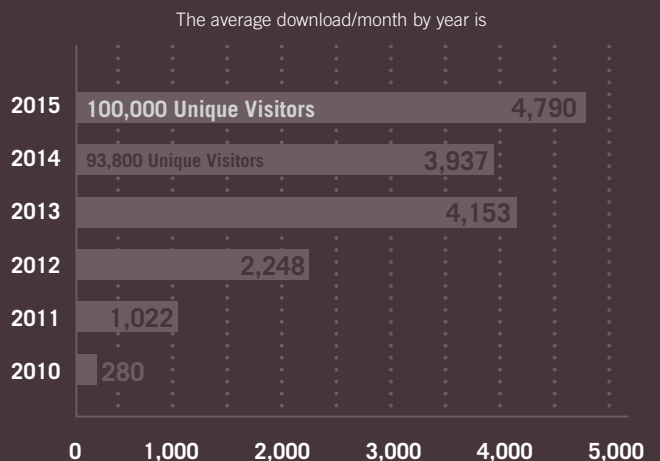
SCME provides its entire curriculum including presentations, animations, instructor and student guides, hands-on classroom activities, and a dozen related, hands-on kits so that professional development participants can take their clean room experience into regular classrooms. More than 100 educators have participated in the clean room workshops; another 400 participants have attended 40 other workshops during the current grant.

A technician inspects a MEMS wafer containing thousands of individual devices.



Use of SCME Website Spreads

With more unique visitors to SCME's website, the subset of visitors who download microsystems education documents has increased too.



“The SCME is THE place to find qualified micro and nanotechnologists. Aspiring next generation micro and nanotechnologists need look no further than the SCME for up to date training.”

Todd Christenson, Founder and Chief Technology Officer
HT MicroAnalytical, Inc.



KEY ACTIVITIES

- Educates nanotechnology students to meet industry needs through hands-on instruction and high-quality instrumentation.
- Creates internship opportunities for students to work directly with industry.
- Offers high-quality professional development opportunities to high school and community college educators.

SHINE Promotes Nanotechnology in Pacific Northwest

SHINE promotes nanotechnology education throughout the Pacific Northwest region. Since 2012, SHINE has reached more than 5,000 students and educators with hands-on nanotechnology demonstrations at outreach events and science fairs. SHINE helped with the development and delivery of introductory nanotechnology courses at three partner high schools, impacting 309 students from 2012 to 2015.

SHINE has also excelled in delivering high quality professional development opportunities for educators. In 2015, SHINE launched its SHINE Fellows Institute, a scalable professional development program. The program supports educators as they develop curriculum and facilitate training workshops for other educators in their geographic areas.

A student looks at a microelectromechanical systems (MEMS) device.



Nanotechnology Lab Serves Students & Industry

SHINE's Nanotechnology Lab at North Seattle College, provides students and industry with access to state-of-the-art equipment, such as an atomic force microscope, a confocal microscope, a profilometer, and a scanning electron microscope. Small companies and start-ups use the Nanotechnology Lab to access expensive equipment for their fabrication and characterization needs. As a result, student interns who work in the lab gain valuable experience identifying and analyzing materials that are used in commercial and industrial products. From 2014 to 2015, eight student interns were mentored by industry representatives, and received an additional 100 hours of hands-on experience using the equipment to collect data for the companies using the lab.

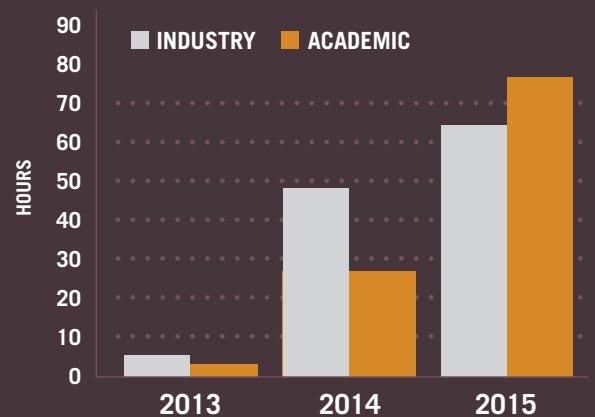
SHINE has been a leader in developing its lab facilities to support education and industry beyond its immediate geographic area. As an active member of the Remotely Accessible Instruments for Nanotechnology (RAIN) Network, SHINE allows students and educators to control nano and micro instruments in the Nanotechnology Lab from their own classrooms. From 2013 to 2015 SHINE hosted 20 remote access sessions for 32 educators and 363 students from across the country.

A nanotechnician disassembles a circuit board to analyze its heavy metal content using x-ray fluorescence spectroscopy.



Nanotechnology Lab Use Increases

SHINE maintains strong partnerships with educators and local companies that use its Nanotechnology Lab at North Seattle College.



“North Seattle College’s nanotechnology program gave me an edge when I was looking for a career. I received hands-on training that strengthened both my technical and soft skills. Thanks SHINE for helping me transition into a career with endless opportunities.”

*Jeanine Pebbles, Senior Engineering Technician
Lawrence Livermore National Laboratory*





SECURITY TECHNOLOGIES



ACE

Advanced Cyberforensics
Education Consortium

DAYTONA STATE COLLEGE | DAYTONA BEACH, FL

www.cyberace.org



ACE Engages Students in Cybersecurity & Cyberforensics

ACE holds cyber camps for ninth-to-twelfth graders to promote cybersecurity skills and encourage enrollment in STEM fields in college. To recruit and retain more female students, ACE revised its camps. This resulted in a 44% female participation rate in the summer 2015 camp attended by 60 students. Altogether more than 250 students have completed one of the six camps conducted since 2013.

For college students ACE offers five courses consisting of 150+ video lectures and scenario-based assignments. Students learn to combine "real-life" technical skills with advanced report writing, a skill that is often lacking among technicians in advanced technology fields.

High school students use teamwork during an ACE cyber camp competition.

KEY ACTIVITIES

- Offers comprehensive curriculum to bootstrap course offerings at 12 partner institutions in Florida, Georgia, and the Carolinas.
- Provides online faculty professional development.
- Creates workshops and certificate programs for workforce retraining.
- Partners with K-12 schools and other organizations to engage students.





DOD Recognizes Quality of ACE Courses

With Daytona State College's recent accreditation as a Center of Digital Forensics Academic Excellence by the US Department of Defense's Cyber Crime Center's Academic Alliance, ACE has external evidence of the high quality of its curriculum. More than 1,500 college students have completed at least one of ACE's five courses since 2012.

ACE Provides Resources for Faculty Development

Cyberforensics is an emerging field, and as such, there is a shortage of faculty members with the necessary skill set. ACE provides faculty development through a series of four self-paced, online courses. Faculty members are urged to use the resources on its learning management system—video lectures, assignments, and quizzes—to bootstrap course offerings at their home institutions. In 2015 ACE's learning management system had 110 registered educators from 58 institutions across 25 states. ACE also provides institutions with mentoring and funding for cyber-related activities. Professional development and additional funding have resulted in new courses in cyberforensics being offered at ACE institutions, as well as cyber camps for college and high school students.

A technician uses a hardware write-blocker while creating a forensic copy of a hard drive.



ACE Expands Cyberforensics Knowledge

ACE has been developing cyberforensics skills among faculty and students since 2012.

“The Advanced Cyberforensics Education Consortium has partnered with non-profit organizations to provide 9-12 grade students with real-world, practical, and engaging educational programs. These programs educate and enable students to transition seamlessly into cybersecurity degree programs, careers, and other areas of technical mentorship.”

Lee V. Mangold, Vice President
Florida Cyber Alliance

of partner institutions

12

in 4 states

of ACE course completers

1,500

of faculty in training

110

in 25 states

of K-12 competing in cyber camps

250



KEY ACTIVITIES

- Cultivates a highly skilled cyber workforce.
- Helps reverse offshoring and outsourcing.
- Develops and disseminates high quality cybersecurity curricula.
- Offers faculty development programs to eight states.
- Creates physical system and mobile communication device centers of excellence.

CSEC Advances Cybersecurity & Homeland Defense

CSEC's centers of excellence serve as hubs for education and economic activity in strategic technology areas such as physical systems, secure coding, and mobile communication devices.

In addition to educating 1,500 security degree majors, CSEC institutions helped 721 incumbent workers upgrade their physical system and cybersecurity skills during 2014-15. These workers included Department of Defense employees and federal, state, and local law enforcement personnel. They completed intense multi-day programs in mobile and embedded device forensics that align with industry certifications. Due to their expertise and hands-on experience, CSEC graduates are highly sought after by business, industry, government, the military and intelligence community.

Oklahoma State University Institute of Technology students assess a telecommunications network's performance.





“Demand for highly trained cybersecurity industry professionals is at an all-time high ... It is imperative that we support and establish strong educational programs which aim to develop cybersecurity professionals so that we can keep pace in combating this global concern.”

Scott Fry, Director of Workforce Development
MidAmerica Industrial Park

Faculty Expertise Supports Economic Development

CSEC began in 2004 with 11 cybersecurity instructors at eight Oklahoma institutions. As a result of its successful initiatives, CSEC now has 43 active two-year program sites in eight states with 111 active faculty members offering courses based on CSEC's core information assurance and forensics curriculum. Altogether 408 faculty have attended CSEC professional development; they have developed 70 distinct courses.

CSEC institutions offer rigorous cybersecurity curricula encompassing information assurance principles, secure electronic commerce, network security, enterprise security management, and digital forensics. CSEC is now creating centers of excellence in automation and control systems and mobile communications device. The University of Tulsa also developed three state-of-the-art forensics courses, and five CSEC institutions have developed automation and control systems curricula.

CSEC's centers of excellence serve as hubs for education and outreach activities in strategic technology areas, providing launching points for job growth and spin-off companies.

CSEC graduates maintain retinal scanners and operate other security system equipment.



CSEC Delivers Security-Credentialed Technicians to the Workforce

Students enrolled in CSEC programs can earn industry certifications, associate or bachelor degrees.





Multifaceted Approach Prepares Students for Cybersecurity Careers

CSSIA uses a three-pronged approach to student success.

Its virtual teaching and learning environment engages students in experiential learning. By working in CSSIA's safe "sandbox" environment separate from colleges' networks, students across the US are learning the skills required in today's challenging cybersecurity profession.

By developing and expanding student cybersecurity skills competitions, CSSIA enables students to leverage the knowledge and skills they learn in classrooms and to hone their workforce abilities.

CSSIA's partnerships with the Association of Computer/Information Science Engineering Departments at Minority Institutions and the Society for Advancement of Chicanos/Hispanics and Native Americans in Science connect minority and underrepresented populations to cybersecurity workforce opportunities.

KEY ACTIVITIES

- Operates a national faculty development academy that provides innovative cybersecurity curriculum.
- Conducts research on the use of virtual reality in cybersecurity instruction.
- Develops outreach and support of a national pipeline that encourages enrollment of minority, female, and veteran populations.



In cybersecurity competitions students defend networks from attacks like those that companies face.



CSSIA Virtual Environment Provides Instructors with Up-to-Date Resources

CSSIA prepares the next generation of cybersecurity practitioners by incorporating current technologies, equipment, and products into its virtual teaching and learning environment. The virtual teaching and learning center continuously evolves and partners with major vendors to provide instructors with resources that incorporate technologies, equipment, and products used in today's information systems.

The CSSIA virtual teaching and learning environment has been adopted by 250 educational institutions. Instructors at these institutions impact more than 10,000 students enrolled in cybersecurity courses, certificate programs, and two-year degrees. Students who use the virtual environment develop problem solving, network defense, and troubleshooting skills that are critical for today's cyber workforce.

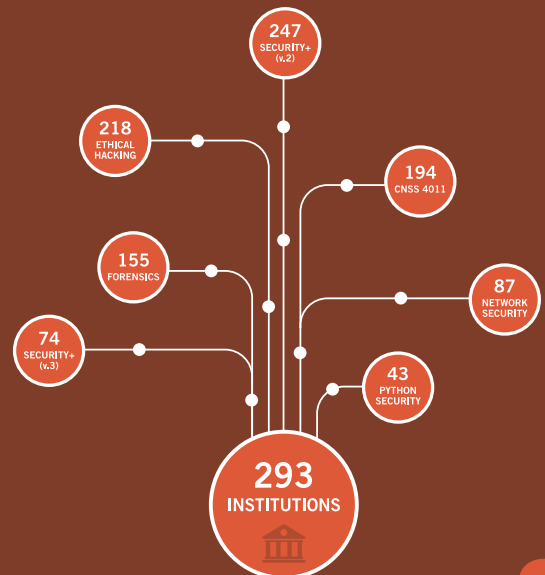
CSSIA's virtual gymnasium is also utilized by several national cybersecurity student competitions. These competitions connect students with employers, who assist with these events. Employers evaluate students' knowledge, technical skills, teamwork, and problem solving in the cyber attack situations posed within the dynamic competition environment. Aside from the opportunity to interact with employers, the competitions broaden students' employability by enabling them to incorporate virtualization in their learning.

Technicians review specifications on equipment being deployed.



Use of CSSIA Courses Spreads

Since 2011, 293 higher education institutions have utilized one or more of CSSIA's courses.



“In today's environment where data breaches make daily headlines, well-trained, qualified cybersecurity practitioners need a place to learn their trade. Centers like CSSIA provide the research, focus, and resources that enable our nation's cybersecurity programs to be effective.”

*Nathan Evans, Cyber Operation and Analysis Lead
Argonne National Laboratory*



NCC

National CyberWatch Center

PRINCE GEORGE'S COMMUNITY COLLEGE | LARGO, MD

www.nationalcyberwatch.org



NCC Collaborations Benefit Students

NCC cultivates collaboration by coordinating broad national networks that involve students, schools, alumni, industry, and government partners.

Thousands of students and hundreds of faculty participate in the annual National Cyber League (NCL). This event provides an ongoing virtual training ground for collegiate students and faculty to develop, practice, and validate cybersecurity knowledge and skills. These high-fidelity simulation environments contain content aligned with industry certifications.

The National Cybersecurity Student Association advances students' educational and professional development with activities, networking, and collaboration.

Model transfer pathways include lateral and reverse transfers, as well as transitions between two-year and four-year institutions.

KEY ACTIVITIES

- Leads collaborations to strengthen cybersecurity education workforce.
- Sets educational, training, and assessment standards for the information security field.
- Validates cybersecurity skills using performance-based assessments.
- Develops new skills-based learning curricula tied to job roles and industry certifications.

College students from the Mid-Atlantic region setup and harden networks at the Collegiate Cyber Defense Competition.





NCC Increases Quantity & Quality of Community College Information Security Programs

By fostering a culture of collaboration and innovation amongst industry, government, and academia, NCC's leadership has increased the quantity and quality of community college information security programs nationwide.

This large network has more than 200 partners from higher education institutions, public and private schools, businesses, and government agencies. It focuses on a coordinated approach for advancing cybersecurity education and strengthening the national cybersecurity workforce.

For example, NCC-led initiatives

- facilitated new and updated information security degree and certificate programs. Thanks to the national effort, programs are mapped to federal work roles and industry-recognized professional certifications;
- helped set public and private-sector information security standards related to job roles and a common lexicon; and
- developed a comprehensive support and technical assistance system for institutions that need to re-designate, as well as those that are new to the National Security Agency/Department of Homeland Security National Centers of Academic Excellence in Cyber Defense program.

“With resources and technical assistance provided to us by the National CyberWatch Center, we were able to obtain our re-designation as a National Security Agency/Department of Homeland Security National Centers of Academic Excellence in Cyber Defense Two-Year Education through 2021.”

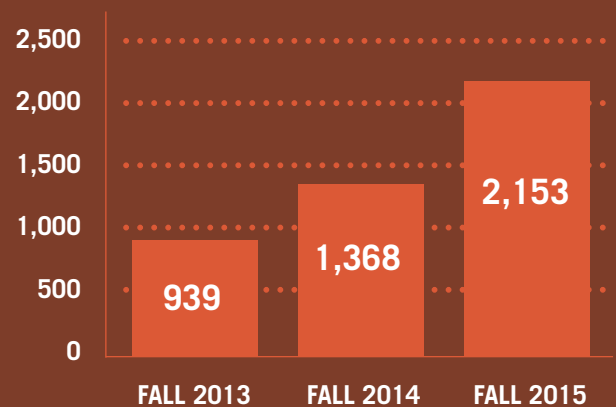
*Aaron Tanaka, Professor of Computing, Electronics & Networking Technologies
Honolulu Community College*

Students add physical security to a mock pharmaceutical dispensary for a cybersecurity simulation.



National Cyber League Participation Grows

College students' participation in the National Cyber League grew at a steady pace from 2013 through 2015.





CWW Puts Students on Path for Success

In 2014, 1,407 students enrolled in security programs at CWW core institutions—Whatcom Community College; California State University, San Bernardino; California State Polytechnic University, Pomona; Coastline Community College. Of these students, 341 completed the program, and 985 are still enrolled; 71% were minorities.

Since its inception in 2011 CWW has offered 17 skill-building workshops for 267 member-college faculty. Topics have included Certified Ethical Hacker and forensics. Faculty also received mentoring to build courses using virtual repositories for images. CWW makes new curriculum resources, such as 13 open source courses on critical infrastructure security and resilience, available to faculty via its website.

Students in an industrial control systems security class identify programmable logic controller vulnerabilities.

KEY ACTIVITIES

- Leads academic institutions' efforts to strengthen cybersecurity education and workforce infrastructure in 14 western states.
- Facilitates student participation in inter-collegiate cyber defense competitions.
- Maps curriculum to national standards.
- Mentors and provides resources to faculty.
- Involves industry partners as speakers, for internships, and in regional cyber risk summits.





“As a founder of two West Coast-based information security businesses it’s crucial that CWW exists to help fill the talent gap that currently exists.”

*Kris Rides, CEO & Founder
Tiro Security, LLC*

CWW Builds Capacity

During the fall 2014 National Cyber League competition, students participated online in a “capture-the-flag” exercise using skills that included web application exploitation, network traffic analysis, recon, scanning, and enumeration to find and retrieve files containing passwords (flags). Of the 1,368 students who participated—a 48% increase over the previous year—1,040 (76%) captured at least one flag. Through participation in such competitions, students develop and validate cybersecurity skills that are valued by employers.

CWW has expanded its membership and services into 14 states, contributed to increasing the number of Centers of Academic Excellence for two- and four-year institutions, supported the development of a thriving cybersecurity education community, and enhanced the cybersecurity workforce through these combined efforts.

CWW Shares Expertise with Industry

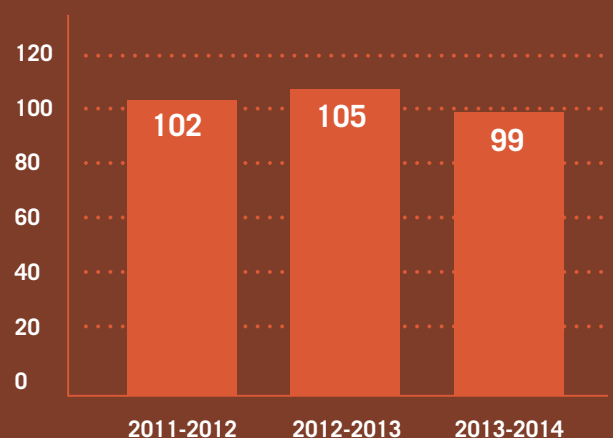
CWW’s positive economic impact extends to its work with various industry sectors to help employers protect their companies from cyber attacks. In 2014 three core CWW institutions held Cyber Risk Summits. A total of 605 people attended including CEOs, CTOs, and personnel from businesses’ human resources, accounting, and legal departments. Participants learned how to assess their companies’ vulnerabilities and develop risk mitigation solutions.

Troubleshooting is a key skill covered in CWW’s curriculum.

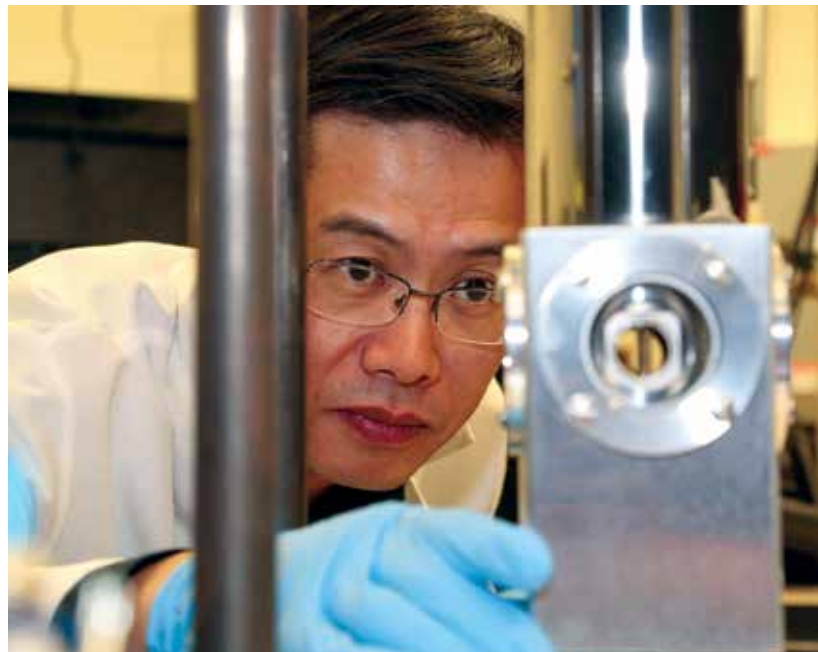


CWW Increases Student Internship Placements

CWW has consistently exceeded its goal of placing at least 25 additional students each year in internships beyond the 54 interns it had placed annually when its ATE grant started.



FACES OF ATE





FACES OF ATE

ATECENTERS





This publication was prepared by the ATE centers with support from the National Science Foundation under grant **DUE-1261893** to the Academic and Student Affairs Division of the Maricopa County Community College District. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the editor and the principal investigators of the ATE centers. They do not necessarily reflect the views of the National Science Foundation.

For information about the ATE program, visit www.nsf.gov/ate. For additional information about the ATE centers and projects, visit www.atecenters.org, www.atecentral.net, and www.aacc.nche.edu/ateprogram.

Paper copies may be obtained by contacting MATEC, 4110 E. Wood Street, Suite 1, Phoenix, AZ 85040
Email: Impact@atecenters.org | Phone: 480.731.8050
Please cite this publication as: Patton, Madeline, ed. *ATE Centers Impact 2016-2017*. Tempe, AZ: Maricopa County Community College District, 2016.

This publication may be downloaded at:

WWW.ATECENTERS.ORG

EDITOR: MADELINE PATTON

GRAPHIC DESIGNER: STU RODBERG

PROJECT DIRECTOR: MICHAEL LESIECKI

COPY EDITOR: JANET PINHORN

THE EDITOR WOULD LIKE TO ACKNOWLEDGE THE INPUT OF THE ATE CENTER DIRECTORS, THEIR STAFFS, AND THE NSF PROGRAM OFFICERS. ADDITIONAL THANKS TO THE AMERICAN ASSOCIATION OF COMMUNITY COLLEGES FOR ITS HELP DISSEMINATING THE PUBLICATION.

COPYRIGHT 2016

ATECENTERS

The Advanced Technological Education (ATE) program endeavors to strengthen the skills of technicians, whose work is vitally important to the nation's prosperity and security. In ATE centers and projects, two-year colleges have leadership roles and work in partnership with universities, secondary schools, business and industry, and government agencies to design and carry out model workforce development initiatives.

For more information about the ATE centers visit

www.atecenters.org