

# ADVANCED MANUFACTURING PROBLEM-BASED LEARNING

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# NEWS

## A PROJECT OF THE NEW ENGLAND BOARD OF HIGHER EDUCATION (NEBHE)

Located in Boston, Mass.

[www.pblprojects.org](http://www.pblprojects.org)

FALL 2015

ISSUE SIX

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AM PBL is a project of the New England Board of Higher Education (NEBHE) and is funded in part by the National Science Foundation's Advanced Technological Education program (NSF ATE) DUE#1204941.

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NEW ENGLAND  
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## NEBHE Hosts AM PBL Capstone Showcase

The New England Board of Higher Education (NEBHE) hosted a Capstone Showcase for educator participants in its Advanced Manufacturing Problem Based Learning (AM PBL) project on July 13-14 at the Sheraton Framingham Hotel and Conference Center in Framingham, Mass. The Showcase gave participants a forum to discuss their findings from field-testing the AM PBL Challenges — multi-media curriculum modules for STEM education — and engage colleagues in planning for the future of the PBL Projects. Showcase guests included manufacturing industry partners, representatives from higher education, NEBHE staff members, high school administrators, members of the AM PBL Advisory Committee and other individuals interested in problem-based learning. Nine AM PBL participants who attended last summer's AM PBL Institute returned for the Showcase, and six of them presented posters.



*Professor Karen Supan of Norwich University in Northfield, Vt. stands with her Showcase poster. Supan field-tested the FastCAP and Hypertherm AM PBL Challenges with senior college students.*

The Showcase launched with a poster session and reception on Monday evening. The first round of Showcase poster sessions included AM PBL participants Karen Supan, professor of mechanical engineering at Norwich University, in Northfield, Vt.; Sharron Prairie,

[AM PBL Showcase continued on page 4](#)

## PBL Projects Develops Sixth AM PBL Challenge

On July 9, 2015, the PBL Projects team traveled to IPG Photonics in Oxford, Mass., to film the sixth AM PBL Challenge on the topic of laser cleaning of metals. Three employees from IPG — Vijay Kancharla, Darlene Parow and Arthur Amidon — met with the PBL Projects team.

The team spent a busy morning filming the three video segments that will be central to the new Challenge: a reenactment of the IPG team's introduction to the problem (Problem Statement), a brainstorming session that occurred after work on the problem had begun (Discussion) and the IPG team's solution for the problem (Organization's Solution). The solution was recorded in the applications laboratory where the PBL Projects team ob-



*IPG Photonics employees discuss laser cleaning of a metal substrate. Pictured (L - R): Vijay Kancharla, Arthur Amidon and Darlene Parow.*

served a laser cleaning system demonstration and learned of various methods to test and quantify the surface's cleanliness. This is the second Challenge developed with IPG

[Sixth Challenge Development continued on page 3](#)

# Deloitte and NEC Report on Advanced Manufacturing in New England

By Chris Averill

In January 2010, the New England Council (NEC) partnered with Deloitte Consulting, LLP to release a report on advanced manufacturing in New England debunking the myth that manufacturing is a dying industry and highlighting the significant potential for the creation of high-paying jobs in the region. Five years later, the Council has again worked with Deloitte to document the new technologies, processes, companies and renewed interest in what the future of manufacturing will look like.

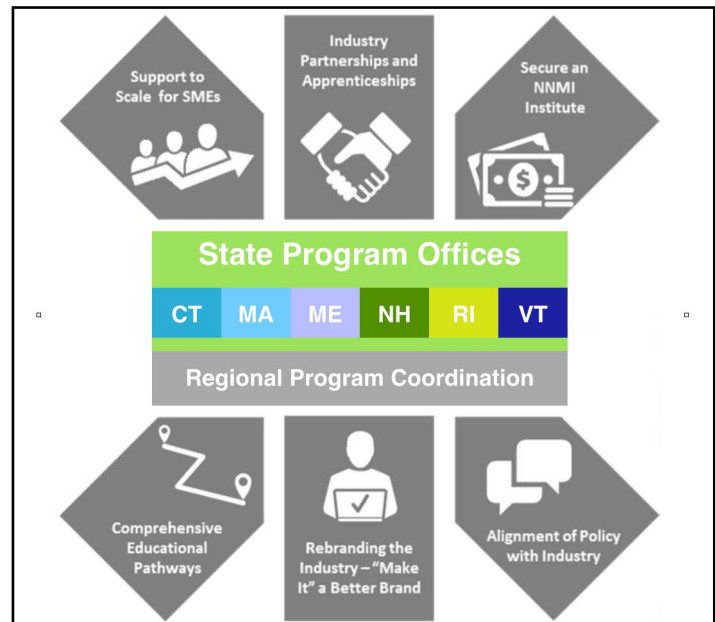
The Council received tremendous input on this report, including nearly 150 interviews with individuals comprising representatives from industry, higher education, technical assistance providers and state governments from all six states. The result is *Advanced to Advantageous: The Case for New England's Manufacturing Revolution*.<sup>1</sup> The Council is extremely proud of the work Deloitte undertook on a pro-bono basis in producing this study.

Where is the industry now? The report found that, overall, advanced manufacturing is a growing industry in New England, with the region being particularly strong in five key sectors: signal processing, navigation, optics and measurement; aerospace and defense; medical devices and biotechnology; semiconductors and complex electronics; and precision machining. Of the total manufacturing jobs in New England (640,640), nearly 60 percent (376,517) can be classified as advanced. Additionally, manufacturing remains an integral and vital driver of economic growth for the region; advanced manufacturing is responsible for \$62.6 billion in Gross Domestic Product (GDP) in New England.

Furthermore, the Council identified three key game changers transforming the advanced manufacturing landscape: additive manufacturing, or 3-D printing; digital design and manufacturing; and the Internet of Things. These are disruptive technologies that break traditional economic trade-offs within the manufacturing economy, and they all represent a new frontier of productivity and possibility for New England's advanced manufacturers.

NEC's six-point action plan (see graphic in next column) is supported by the recent announcement from the Obama administration of the sixth National Network for Manufacturing Innovation (NNMI) initiative led by the Research Foundation for the State University of New York (RF SUNY). The Department of Defense is awarding the new Manufacturing Innovation Institute for Integrated Photonics to a consortium of 55 companies, 20 universities and laboratories, 33 community colleges and other schools, 16 non-profit organizations and 20 states. Massachusetts' Quinsigamond Community College in Worcester will lead the community college effort. The Council remains supportive of efforts to bring an NNMI hub to New England during a future funding round and looks forward to working with industry, academia and others in accomplishing that goal.

## Six Point Action Plan for New England



*The New England Council's six-point action plan for New England presents actions to support small- and medium-sized manufacturers and align policy with industry.*

The report also recommends the development of comprehensive educational pathways that feature multiple on-ramps and off-ramps, transferability of credit and industry-recognized credentials, as well as increasing industry partnership and apprenticeship opportunities. Closing the skills gap means each state must build a holistic model for workforce development that begins with hands-on learning in the K-12 system, continues into higher education (including community colleges) and incorporates re-training the incumbent workforce. The work of NEBHE's AM PBL project, which brings real-world challenges to the classroom for collaborative problem-solving, is essential to changing the paradigm and exposing students to the concept of "making things."

One of the most critical recommendations in the report is the rebranding of manufacturing. Many people still have an outdated view of manufacturing as the four "D's": dirty, dark, dangerous and declining. While manufacturing has advanced over time, the general public has not been exposed to that transformation. Parents, teachers and guidance counselors need to see that today's manufacturing industry is made of the four "A's": advanced, advantaged, added-value and accelerating. Students should be exposed to the concept of "making" early on in their education.

The report is not only a roadmap for New England's sustained leadership in advanced manufacturing, it is also a call to action. While New England enjoys strengths that other areas of the country may not, all six states of the region must work together to ensure that it does not cede that advantage. ■

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<sup>1</sup> To view the full report, please visit: [http://newenglandcouncil.com/assets/Advanced-to-Advantageous\\_FINAL-Report\\_04-08-2015.pdf](http://newenglandcouncil.com/assets/Advanced-to-Advantageous_FINAL-Report_04-08-2015.pdf)

Photonics; the first was created during the PHOTON PBL project when the problem to be solved involved burn-in testing of kilowatt-class fiber lasers.

With output powers ranging from a few watts to 50 kilowatts and a range of ultraviolet through infrared wavelengths, fiber lasers are displacing older types of lasers in many applications. They require less cooling and have no consumables or moving parts. Applications of IPG's lasers include material processing (cutting, drilling, welding, marking and surface treating); medical and telecommunications; and other advanced applications such as laser trapping and cooling, remote sensing and nuclear plant decommissioning.

IPG Photonics is the world's leading developer and manufacturer of high performance fiber lasers and amplifiers. A global company with manufacturing facilities in the U.S., Germany, Russia and Italy, IPG has its world headquarters at the Oxford, Mass. campus. Since its founding in 1990, IPG has shipped more than 40,000 units to over 500 customers around the world.

IPG has also been active in promoting education worldwide, particularly in southern New England where the company sponsors internships at local community colleges. Additionally, IPG has been a tour site for local teachers with NEBHE's PHOTON, PHOTON2 and PHOTON PBL Projects, helping students envision themselves as employees. ■

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## Disseminating the PBL Projects

**June 29-July 2, 2015**

*PBL Keynote and Dumpster Optics Workshop  
ETOP, University of Bordeaux, Bordeaux, France*

AM PBL project Principal Investigator Nick Massa and Co-PI Judy Donnelly participated in the international conference on Education and Training in Optics and Photonics (ETOP), a biennial conference supported by the Optical Society of America (OSA), the International Society for Optics and Photonics (SPIE), the International Commission for Optics (IOP) and IEEE Photonics, a society of the Institute of Electrical and Electronics Engineers. ETOP 2015 was held at the Institute d'Optique at the University of Bordeaux, France and featured more than 120 papers plus workshops and demonstrations. Donnelly and Massa presented an invited keynote talk on problem based learning (PBL). Adapting the usual lecture presentation format, Donnelly and Massa led the audience through a PBL Challenge and invited members to chat with their neighbors about the Challenge problem. They also offered a two-hour PBL workshop attended by 10 enthusiastic teachers, some of whom were already using the PBL method in their classrooms. In addition, Donnelly presented a workshop on *Dumpster Optics*, lessons for the fifth-grade level that involve inexpensive and commonly found optics materials. Donnelly was assisted by Kathleen Robinson, manager of education services at SPIE.

**June 3-5, 2015**

*Create Your Own PBL Challenge Workshop  
U.S. DOL/ETA Region 1 YouthBuild Program, Boston, Mass.*

The PBL Projects team facilitated a follow-up workshop for the U.S. Department of Labor Employment and Training Administration (DOL/ETA), with YouthBuild educators and administrators from Hartford, Newark and Providence. Educators and administrators spent the two-and-a-half day workshop, held in Boston, adapting the PBL Projects materials (e.g. the Whiteboards and concept maps) to best fit their institution's needs and serve their students' varying learning styles. Participants collaborated with one another and with the PBL Projects team to further their plans for PBL implementation.



Nick Massa speaks with teachers during the ETOP PBL workshop. Pictured (L - R): Anna Voznesenskaya, National Research Univ of ITMO, St Petersburg, Russia; Gregory Topasna, Virginia Military Institute, US; Daniela Topasna, Virginia Military Institute, US; Maria Bondani, CNR-IFN, Como, Italy; Nicholas Massa, PI, PBL Projects.

*Dissemination continued on page 6*





AM PBL participant Marina Bograd of MassBay Community College in Wellesley, Mass. (left) shows her poster presentation to former PI Fenna Hanes (center) and NEBHE President Michael Thomas (right).

a chemistry and physics instructor at Williamstown High School in Williamstown, Vt., Marina Bograd, an engineering design professor at MassBay Community College in Wellesley, Mass.; and Stephen Bornhoeft, a computer and technology instructor at Westerly High School, in Westerly, R.I. Participants discussed their implementation of the AM PBL Challenges and displayed examples of student work, including completed Whiteboards, a PBL tool for structured problem solving.

Several participants displayed hands-on activities they created while field-testing. Bograd developed a CAD activity to supplement the IBM Challenge. She refined it with input from Stewart Foster, an employee of GlobalFoundries (formerly IBM) in Essex Junction, Vt., who helped develop the IBM Challenge.

Don Bossi, president of FIRST Robotics, a non-profit organization that sponsors an after-school robotics program to engage young people in STEM (science, technology, engineering and math), delivered Monday's keynote address. Bossi's remarks focused on two issues: the quantity of students in the STEM workforce pipeline and the qualifications with which students are graduating from high school and college. After showing a powerful graphic illustrating the "leaky" STEM pipeline — many students are siphoned out of the pipeline through a combination of lost interest and few STEM opportunities — Bossi remarked, "The year this study was done [2008], between ninth grade and college graduation, only four percent of our students actually ended up getting college STEM degrees. How do we stop the leak?" FIRST keeps the pipeline open by engaging students with diverse backgrounds and ensuring that students stay interested in STEM.

Bossi made a point of emphasizing that the STEM workforce needs a healthy resurgence of new employees to support industry interests. Bossi's question — "Will there be a sufficient pipeline of students who have the right background and the right training to be able to be the drivers of this innovation economy?" — is also a particular focus of NEBHE's efforts. Remarking on another common goal, Bossi stated, "As we all know, it's not just important enough to know science, technology, engineering and math, but it's important to know how to work as a team, how to pick up other 21<sup>st</sup> century skills that really determine impact and effectiveness in so many different settings."

Bossi credits the excitement and enthusiasm that FIRST generates as the key to keeping students interested in STEM. FIRST uses team competitions to make robotics accessible, engaging and relevant for students. It recruits mentors from industry and technology education to work with student teams at the elementary, middle and high school level. Treating robotics the way schools treat athletics — with enthusiasm and support — makes STEM education more approachable for students, who are more likely to pursue STEM fields as their careers.

"If we get kids excited and inspired, the education and the learning is much more likely to happen," Bossi said.

After Bossi's remarks, two students and two mentors on FIRST Robotics Competition (FRC) Team 4048 from Westborough High School in Westborough, Mass. spoke as a panel about their experience with FIRST Robotics Competitions. FRC Team 4048's student captain, Heesun Jun, remarked that before she joined the FIRST robotics team, she wanted to be an English major. Inspired by the fact that her own classmates built a 100+ lb. robot and disregarding her lack of an engineering background, Jun joined FRC Team 4048, nicknamed "Redshift," during her freshman year. After two years of acquiring robotics engineering skills, Jun became program manager. In her last year of high school, she tacked on the role of team captain in addition to remaining program manager. Jun's mentors supported her, saying, "If there's something you want to try, go for it. If you don't know about it, that's okay. Just take what you know and tackle the problem however you can." She now believes, "If there's any unknown in front of me, I have some skills that I can bring to solving a problem, and whatever I don't know is just another opportunity to learn and make myself grow."

Peter Nikopoulos, a sophomore at Westborough High School, spoke after Jun. For Nikopoulos, FIRST gives him an outlet to explore his inclination for taking machines apart and discovering how they work. Louis Lung, the lead mentor for Team 4048, and Mark Steudel, an employee at Raytheon and an industry mentor for the team, both commented on the fact that, like NEBHE's PBL Projects, FIRST values student-centered learning and capacity building and encourages students to solve problems with limited intervention from supervising adults.



Participants in FIRST Robotics Team 4048, nicknamed "Redshift," pose with Don Bossi, president of FIRST Robotics. Pictured (L - R): Peter Nikopoulos, Heesun Jun, Don Bossi, Louis Lung & Mark Steudel.

On Tuesday morning, AM PBL participants Charles McLaughlin, of Rhode Island College in Providence, R.I., and David Mangus, of the Hartford Academy of Engineering and Green Technology in Hartford, Conn., presented during the second round of poster sessions. Alexander Pancic, an engineering instructor at Brighton High School in Boston, followed their morning Showcase with a talk about using PBL in an engineering curriculum. Pancic enthused guests with his embracing of PBL and hands-on learning, mentioning the fact that his students, who were initially resistant to PBL methods, became eager adopters of PBL once they learned that their solution to the FloDesign Challenge impressed the very industry representatives who helped formulate the problem. An article by Pancic, [Creating an Engineering Curriculum](#), is featured in the AM PBL Spring 2015 newsletter.

Following Pancic's presentation, three industry panelists spoke about the role of PBL in workforce development. Panelists included Don Bossi of FIRST Robotics and Stewart Foster of GlobalFoundries, with Fenna Hanes of the New England Board of Higher Education speaking on behalf of Heather Graham, director in the U.S. DOL/ETA for Region I in Boston (see page 3). Kelli Vallieres, president and CEO of Sound Manufacturing in Old Saybrook, Conn., moderated the panel, remarking on the importance of teaching problem-solving, teamwork and communication skills not only to students but to employees as well.

Both Bossi and Foster mentioned collaboration and team-building in the manufacturing and STEM workforce. Foster acknowledged that many workplace problems are complex and that a structured problem-solving approach is necessary to ensure the company addresses the problem and not just the symptoms. Bossi advocated for a cultural shift that uses robotics competitions to celebrate the accomplishments of scientists and engineers rather than focus solely on celebrities and athletes. This change, Bossi noted, showcases the value of STEM education. Hanes added that expanding access to PBL benefits a wide range of students, citing NEBHE's work with the DOL/ETA YouthBuild program. YouthBuild participants, many of whom have failed in traditional academic settings, thrive when their education is student-centered and values their problem-solving skills. All panelists agreed that disseminating the PBL Challenges to a larger audience is key to scaling up the PBL Projects and preparing students to solve real-world problems.

Following the industry panel, three educators — Karen Supan, David Mangus and Charles McLaughlin — discussed their field-testing experience and the impact PBL has had on their students. Supan spoke about her senior students' eager adoption of the PBL curriculum after having problem-solving incorporated into a number of their classes. She testified to the power of PBL to build student confidence and critical thinking skills. By contrast,



Industry panelists discuss the role of PBL in the workforce. Pictured (L - R): Fenna Hanes, NEBHE; Don Bossi, FIRST; Stewart Foster, GlobalFoundries; and Kelli Vallieres, Sound Manufacturing.

McLaughlin, a teacher educator, knew that his students were not used to open-ended problem solving. Before beginning field-testing, he wondered how to put the responsibility for learning on his students, who were soon to become teachers. McLaughlin underwent a year of profound reflection on his own teaching after seeing how PBL positively improved student discourse. Mangus had a similarly powerful experience with PBL, stating, "You want to make education real. A student needs to see the problem. That drives a person's desire to learn, and learning is a discovery process; you remember things you discover, you don't necessarily remember things people tell you." Mangus went on to say, "It is really a change, and refreshing, to see this type of learning. This really is the way of the future: for us to get back in touch with what a child needs to know to be successful in life."

*"This really is the way of the future: for us to get back in touch with what a child needs to know to be successful in life."*

The Showcase concluded with two concurrent breakout sessions for participants and guests to discuss PBL implementation in more detail and brainstorm ways to disseminate the PBL Challenges to a wider audience. Several actionable ideas were raised during the discussion, including working on a school and district level as well as speaking to policy makers about PBL's workforce benefits. The AM PBL team has an exciting year ahead of it, with continued field-testing, dissemination and new collaborations. The team thanks the educators, administrators, industry representatives, AM PBL Advisory Committee members, NEBHE staff and individuals interested in PBL for contributing to a successful event filled with thought-provoking discussion. ■

**NEBHE and the AM PBL project team would like to thank the following Challenge partners for contributing time and resources to create the AM PBL Challenges:**

Cirtec \* FastCAP \* GlobalFoundries (formerly IBM) \* Hypertherm  
IPG Photonics \* Sound Manufacturing



## May 20, 2015

*National Alliance for Workforce Improvement 50th Anniversary  
Holiday Inn Hotel, Saratoga Springs, N.Y.*

PI Nicholas Massa and Co-PI Michele Dischino presented *PBL and Beyond: Taking Problem-Based Learning to the Next Level* at the National Alliance for Workforce Improvement's (NAWI) 2015 Annual Conference in Saratoga Springs, N.Y., aimed at creating pathways for educating qualified maker professionals. Massa spoke about his students' work with the PBL Challenges as well as industry relationships resulting from years of collaborative curriculum development between NEBHE and industry partners. Approximately 20 educators attended the workshop.



*Co-PI Judy Donnelly (left) and PI Nick Massa (right) present an Introduction to PBL Workshop for educator attendees of the SME Bright Minds program, co-located at EASTEC.*

## May 13, 2015

*SME Bright Minds Educator Workshop  
EASTEC, West Springfield, Mass.*

NEBHE presented an Advanced Manufacturing Problem-Based Learning (AM PBL) workshop at the Society of Manufacturing Engineering's (SME) conference held at EASTEC (Eastern States Exposition Center). The PBL workshop was part of the SME Bright Minds program, a forum for engagement and collaboration among educators, industry representatives, administrators, guidance counselors and students to support the future of the advanced manufacturing workforce. Participants in the workshop arrived from institutions across the Northeast region.

## April 9-10, 2015

*Introduction to PBL*

*Trident Technical College, Charleston, S.C.*

PI Nicholas Massa traveled to Trident Technical College in Charleston, S.C. to conduct a PBL workshop for local community college engineering technology faculty and high school STEM teachers. During the one-and-a-half-day workshop, teachers and faculty completed two PBL Challenges and collaboratively worked on creating their own PBL Challenge that would integrate math, physics and manufacturing engineering. Their Challenge, dubbed "Beer Run," involved working with a local craft brewery to develop a strategy for automating the loading and unloading of delivery trucks, thereby speeding up delivery and reducing cost and waste.

## April 9-10, 2015

*Northeast Campus Sustainability Consortium 2015 Conference  
University of Massachusetts Amherst, Amherst, Mass.*

Project Coordinator Becky Eidelman attended the Northeast Campus Sustainability Consortium's (NECSC) 2015 Conference, *Strengthening Ties for Collective Impact: Campus Sustainability in the Northeast Region*, hosted at the University of Massachusetts Amherst in Amherst, Mass. NEBHE is a partner with NECSC's conference, providing dissemination and support for the event as well as participating on the committee for giving student grants. The conference focused on concrete actions to bolster campus sustainability across New England, including efforts to support local agriculture on SUNY campuses, increase added-value foods for local farms in Franklin County, Mass. and source renewable energy for campus power at Cornell University. Keynote speaker Mitchell Thomashaw, president emeritus of Unity College and senior fellow at Second Nature, spoke of the challenges and opportunities facing college campuses across the country and the unique position that colleges are in to advance their own ecologically conscious agendas. NEBHE looks forward to continued collaboration with NECSC.

## March 26-27, 2015

*Create Your Own PBL Challenge Workshop*

*Kennebec Valley Community College, Fairfield, Maine*

PI Nick Massa returned to Kennebec Valley Community College (KVCC) in Fairfield, Maine to consult with Culinary Arts and Sustainable Agriculture faculty. He reviewed PBL implementation activities and helped the faculty develop strategies to continue to develop their own Challenges in collaboration with local industry partners. This visit, the first since a November 2014 workshop, marked continued consulting for the PBL Projects' partnership with the Center for Farm to Table Innovation, funded through a TAACCT-2 (Trade Adjustment Assistance Community College and Career Training) grant from the U.S. DOL/ETA. ■



*Robbi Johnson (left) of Trident Technical College in Charleston, S.C. speaks with educator participants in an Introduction to PBL workshop.*

Planning a conference or professional development workshop? If you'd like to invite Co-PIs from the PBL Projects team to speak at your event or conduct professional development for your colleagues, please contact Becky Eidelman at [reidelman@nebhe.org](mailto:reidelman@nebhe.org).

## CCSU Professor Brings PBL to Life

PBL has been instrumental in helping college students solve one of the most urgent problems affecting disabled young children: independent mobility. In April 2015, Dr. Michele Dischino, an associate professor at Central Connecticut State University (CCSU) in New Britain, Conn. and Co-PI on the AM PBL Project, introduced “Go Baby Go” to her students.

“Go Baby Go” was originally launched at the University of Delaware in 2006. The goal of the program is to give individuals and organizations the tools to modify ride-on cars for children whose movement fully relies on someone other than themselves. The ride-on cars provide independent mobility for children who require wheelchairs but are too young to receive them.

As an AM PBL Co-PI and a technology and engineering education professor, Dischino had previously introduced PBL to her students. She quickly realized that “Go Baby Go” would be a great complement to her PBL instruction by giving her students the opportunity to use PBL in a real-world application. Dischino saw this project as an opportunity to advance her students’ understanding of the value of teaching problem-solving skills, a teaching strategy she hopes they will carry into their own classrooms when they enter the teaching profession.

To launch the project, CCSU purchased toy cars for the eight children, all under the age of five, who had been selected by the Connecticut Children’s Medical Center Hospital in Hartford. About 25 CCSU and local high school student volunteers, under the guidance of Dischino and other CCSU technology department faculty, used the PBL Whiteboards — a structured problem-solving tool developed by the PBL Projects team — to formulate solutions. The entire process required intensive teamwork and problem-solving, including how best to make electrical modifications as well as custom support devices for each car, all of which had to be modified to meet the specific needs of eight children. For example, one car’s “on” button was placed behind its owner’s head, requiring her to lean back to power her car while simultaneously developing strength in her neck.

Dischino and CCSU plan to continue the program and expand it to other high schools in Connecticut. To learn more, visit: [www.udel.edu/gobabygo](http://www.udel.edu/gobabygo). ■



A child sits in her new toy car after engineering students retrofit it to meet her unique mobility needs during a “Go Baby Go” workshop.

## Field-testing the AM PBL Challenges

Field-testing of the AM PBL Challenges continues across the New England region. NEBHE has developed five multimedia Challenges with a sixth Challenge, developed with IPG Photonics in Oxford, Mass., forthcoming. Instructors field-tested the AM PBL Challenges using NEBHE’s online multimedia modules, teacher resources and student tools, completing teacher and student surveys after implementation. Feedback from “field-testing” allows for continuous improvement of Challenge modules.

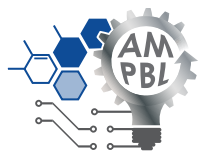
Earlier in the Spring 2015 semester, 12 AM PBL instructors field-tested the FastCAP, Hypertherm and IBM Challenges. During the remainder of the semester, field-testing of the Sound Manufacturing and Cirtec Challenges occurred in three high school classrooms. In total, over the course of the 2014-2015 academic year, 14 AM PBL instructors field-tested, including: one middle school teacher, eight high school teachers (including one from Romania), three four-year university professors (including two teacher educators) and two community college professors.

The PBL Challenges, which are ill-structured, open-ended, real life problems, are aligned to academic standards and hands-on components. A high school physics teacher from Vermont who field-tested the Cirtec Challenge remarked, “Two of the cross-curricular traits of all learners that we have chosen to adopt are: ‘Clear and Effective Communicator’ and ‘Creative and Flexible Problem Solver.’ The PBL Challenges are a perfect match for meeting these graduation requirements.” One of her students testified to this, saying, “My confidence in my engineering skills has been boosted from this challenge. I feel like I now am capable of solving any issue thrown my way.”

*“I feel like I am now capable of solving any issue thrown my way.”*

Another Vermont teacher who teaches a high school Material Properties and Testing course developed a hands-on component to help her students arrive at a solution for the Sound Manufacturing Challenge. To understand the limits of stress on materials and gain an understanding of material tensile testing, students applied math to calculate stress, strain and elongation. One of the goals of the AM PBL project is to engage students in STEM and encourage advanced manufacturing (AM) as a career. A comment from one of the students in the Material Properties class shows how the Challenges make AM appealing: “My favorite thing about the Challenge was learning about manufacturing because it’s not something you see very often as a high-schooler.”

The AM PBL project is now in its “no-cost” extension year. The project’s participating instructors will continue to field-test the Challenges during the 2015-2016 academic year, providing valuable feedback about PBL implementation in the classroom. These instructors are encouraged to develop hands-on activities for AM PBL Challenges and to create their own Challenges using the PBL Projects *Challenge Design Guide*. Their Challenges will be shared through the project’s Challenge Library, currently under development, which will be located at: [www.pblprojects.org](http://www.pblprojects.org). ■



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## Massachusetts STEM Summit 2015

The 2015 Massachusetts STEM Summit will take place on November 10 at the DCU Center in Worcester, Mass. Promoting science, technology, engineering and math (STEM) education and workforce development, the annual Massachusetts STEM Summit convenes the state's educators, business leaders, policymakers, parents, students and others to share strategies, initiatives, collaborations and ideas.

NEBHE will be participating as an exhibitor in this year's STEM Summit, whose theme is "Promising Practices, Proven Results." The STEM Summit is now in its second decade, and organizers are looking for Summit participants to share the "how" of STEM, including effective practices, tools and curricula. The PBL Projects team looks forward to hearing innovative ideas from peers and STEM stakeholders at this year's Summit as it prepares to launch the new PBL Resource Center with NEBHE.



*Jessica Anderson, Director of Community Involvement at EMC Corporation, addresses attendees at the 2014 Mass. STEM Summit.*

The 2015 Summit is hosted by the Massachusetts Business Roundtable, the Massachusetts STEM Advisory Council and the UMass Donahue Institute and is supported by businesses, educational institutions, government agencies and non-profit entities. To learn more, visit: <http://mass-stem-summit.org/> ■

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