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

Located in Boston, Mass.

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Please visit our website:

www.pblprojects.org

Program Staff:

Fenna Hanes

Project Principal Investigator
Sr. Director, Professional &
Resource Development
fhane@nebhe.org / ext. 129

Nicole Schepker

Project Coordinator
nschepker@nebhe.org / ext. 113

Sara Putnam

Project Assistant
sputnam@nebhe.org / ext. 137

NEBHE

45 Temple Place
Boston, MA 02111 USA
617-357-9620 (Extensions Above)



NEW ENGLAND
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NEBHE Hosts AM PBL Institute in Boston

Thirty-one science, technology, engineering and mathematics (STEM) educators from across New England attended the New England Board of Higher Education's (NEBHE) Advanced Manufacturing Problem Based Learning (AM PBL) Institute at Boston University's (BU) Photonics Center from July 27 – August 1, 2014 in Boston, Mass. The cohort included 26 STEM educators from high school, two- and four-year colleges and one middle school, as well as five STEM teacher education faculty members. To foster collaboration between secondary and postsecondary institutions, the AM PBL project recruited participants in pairs called Alliances, composed of secondary and postsecondary participants. Most of the AM PBL educators participated in the Institute with an Alliance partner.

The Institute opened with a dinner and reception on the 18th floor of BU's 10 Buick



AM PBL participants solved an industry Challenge during the AM PBL Institute at BU. Pictured (L - R): Lisa Hix, Keene State College, N.H.; Eunmi Yang, Stonehill College, Mass.; Artis Street, Jeremiah E. Burke High School, Mass.; Nathaniel Edmunds, Baxter Academy, Maine.

St. residence hall—overlooking Boston, Cambridge and the Charles River—where housing for the AM PBL participants, guests and project team was provided. AM PBL project Principal Investigator Fenna Hanes, BU's

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

Disseminating the PBL Projects Across the U.S.

The AM PBL project team has provided workshops and presentations on problem based learning (PBL) pedagogy and the PBL multimedia case studies called Challenges at conferences and educational institutions across the United States. The project's workshops and presentations served approximately 150 educators, including middle and high school teachers, college professors, administrators, and other educational professionals in science, technology, engineering and mathematics (STEM) disciplines.

PBL Projects workshops, events, presentations and other dissemination activities over the last six months are as follows:

August 19, 2014

PBL: Engaging Students in STEM

SPIE Optics + Photonics 2014

San Diego Convention Center, San Diego, Calif.

AM PBL Co-PI Judy Donnelly was invited to conduct a PBL workshop as part of the education program of SPIE's International Optics + Photonics conference in San Diego. During the two-hour workshop, Donnelly introduced NEBHE and the PBL projects before breaking attendees into small groups to work on NEBHE's PHOTON PBL PhotoMachining Challenge. Participants were very engaged as they worked to develop a process for laser stripping the coating from 50 micron wire.

[Dissemination continued on page 6](#)

The Disconnect Between Education and Preparation for the Workforce

By JD Chesloff

Preparation of manufacturing and STEM students has become a cause for attention and concern for many business leaders as they face a workforce that is “aging in place, with not enough replacement workers.” Many manufacturing business leaders state that the majority of their new hires are not recent graduates but workers already in the industry. Many employers cite difficulty finding recent graduates with applied problem-solving skills essential in the workplace as a reason for their reluctance to hire new graduates.

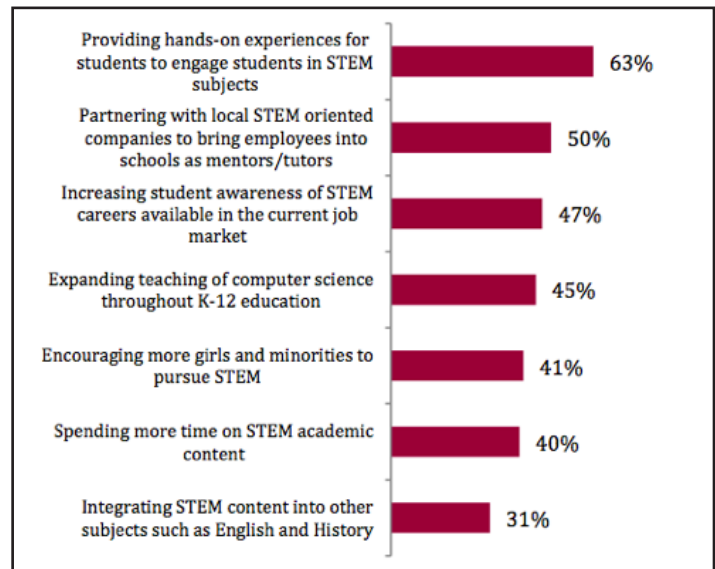
During the New England Board of Higher Education’s (NEBHE) Advanced Manufacturing Problem Based Learning (AM PBL) Institute at Boston University in July 2014, I presented the results of the survey, “Let’s get together: Massachusetts Business Leaders seek collaboration alignment with state’s education system,” to a group of secondary and postsecondary science, technology, engineering and mathematics (STEM) educators from across New England. The survey was performed by the MassINC Polling Group and commissioned by the Massachusetts Business Alliance for Education (MBAE), MBR, and Associated Industries of Massachusetts (AIM). I presented data and conclusions drawn from comments and criticism of the current education system by business associates, chief executives and HR administrators throughout various regions and industries in Massachusetts. To access the full report, please visit www.maroundtable.com.

The overall theme of responses was that business leaders are not satisfied with the K-12 public education system in terms of tests and reliability of its workforce preparation. The majority of business leaders surveyed (84%) highlighted a need for change in the education system. Many stated that reliance on statewide standardized tests and the “teach to the test” mentality, which encourages a lack of critical thinking, is not helpful for students’ future career success. In short, business leaders perceive a disconnect between education and preparation for the workforce. Students are graduating with an “unrealistic view of work-appropriate behavior” and, as a result, industry leaders say many entry-level positions are hard to fill because of these lack of “skills, professionalism and reliability of candidates.”

When these leaders were asked what would be most effective in helping students and candidates develop these skills, hands-on educational techniques in addition to more engagement from business was rated at the top. Increased industry-education partnerships with local STEM-oriented companies coupled with employees acting as mentors and tutors for students were also rated as “very effective.” Additionally, it was recommended that increasing student awareness of the profitable career paths offered in STEM would be helpful in engaging more students in the curriculum. In manufacturing, the worker shortage was blamed on a negative image of the field, a lack of awareness of available jobs, and a lack of alignment between the manufacturers’ needs and the education system.

To Improve STEM, Focus Mainly on Hands-on Experiences, and Partnerships:

% who said each idea would be “very effective” at expanding STEM



A large number of the Massachusetts Business Roundtable’s survey respondents felt that hands-on experiences and industry partnerships would be “very effective” in improving STEM education.

Despite the demand for industry-infused curricula and programming, a high number of respondents were unaware of many secondary and postsecondary initiatives in the state designed to address industry needs. This finding shines light on a potentially untapped resource for unfamiliar employers, and the need for educators and administrators to conduct further outreach with companies who might hire their graduates.

In this vein, respondents also believed that businesses bear a responsibility to better communicate with educators. Increased partnerships between academia and industry would allow educators to have a better grasp of what specialized skills are needed in the workforce. This could also help to provide students with more internship opportunities that may lead to jobs, insight into fields that they were previously unaware of, and further motivate STEM learning.

Replies from this survey highlight a need for educational change. Problem based learning (PBL), a method of teaching that thoroughly engages students in real world problems through which they learn both authentic skills and curriculum material, may be an effective strategy for decreasing this skills gap. In PBL, students apply critical thinking skills, become self-motivated to learn the content required to solve the problem, and take into account real world constraints such as cost and time, all while working collaboratively in a group. This study concludes that changes to the educational system to include PBL, hands-on training, and industry-education partnerships are needed investments for New England’s future workforce and the U.S. economy as a whole. ■

JD Chesloff is the Executive Director of the Massachusetts Business Roundtable. He may be reached at jdchesloff@maroundtable.com.

Alignment of the PBL Challenges to K-12 Standards is Underway!

The Challenges developed by NEBHE's previously funded NSF ATE projects PHOTON PBL and STEM PBL have been aligned to the Common Core State Standards (CCSS) for math and English language arts. Links to the alignment tables are available on the PBL Projects "Challenges" landing page www.pblprojects.org/challenges-nebhe/ and in the Teacher Resources accompanying each PBL Challenge. The tables contain links to the full text of each standard, as well as notes on text selection. The tables can be used online or downloaded in Microsoft Excel format.

Challenge Alignment to CCSS:

- Mathematics standards are Challenge-specific. Alignment information for the new AM PBL Challenges is forthcoming.
- The proposed English language arts alignment applies to all of the PBL Challenges, including those developed by the new AM PBL project.

To support students with a range of mathematics backgrounds, the PHOTON PBL and STEM PBL Challenges have also been aligned to video lessons and practice problems from Khan Academy, a free multimedia educational resource. Khan Academy alignment for the new AM PBL Challenges is forthcoming.

Moving forward, all of the PBL Projects' Challenges will be aligned to the Next Generation Science Standards (NGSS).

Visit <http://www.pblprojects.org/challenges-nebhe/> to access the standards alignment and math resources tables. ■

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NEBHE to Host AM PBL Workshop with the SME Bright Minds Program Co-located at EASTEC 2015

NEBHE will host an AM PBL professional development workshop for secondary and postsecondary educators, administrators, guidance counselors and industry representatives at the SME Bright Minds event located in West Springfield, Mass., on May 13, 2015 from 9:00 am – 12:00 pm.

SME (Society of Manufacturing Engineers), a nonprofit organization, has served practitioners, companies, educators, government and communities across the manufacturing spectrum for more than 80 years. Through its strategic areas of events, media, membership, training and development, and the SME Education Foundation, SME is dedicated to advancing manufacturing by addressing both knowledge and skill needs for industry.

Co-located at EASTEC, the SME Bright Minds Program is a bridge for engagement, collaboration, and communication between educators, industry, administrators, counselors and students to support the future of the advanced manufacturing workforce. Students and educators will see technology innovations first-hand and will have direct contact with one another to discuss paths to move manufacturing forward and ways to fill the workforce pipeline.

NEBHE's AM PBL workshop will provide educational experiences that will reinforce the value of education in manufacturing careers. In addition the Bright Minds initiative's student challenge sessions will take the technology and engineering portions of EASTEC's education program to the next level by showcasing real-world educational outcomes and results, and will highlight advances in manufacturing.

Participants in NEBHE's AM PBL workshop, Implementing a Problem Based Learning Curricula in Advanced Manufacturing, will learn how to use the AM PBL multimedia case study Challenges developed in collaboration with New England advanced manufacturers. These materials have shown that they enhance students' content knowledge, critical thinking skills, and ability to work in teams. Participating educators will also learn how to work with industry partners to enhance these skills in their students.

As a result of taking part in this workshop, participants will:

- Learn how to incorporate PBL in the classroom using NEBHE's Challenges.
- Gain access to NEBHE's PBL Projects and associated instructional materials.
- Enter a national network of experienced PBL practitioners via NEBHE's PBL listservs.

Registration is free for the Bright Minds program and PBL workshop. Registration will begin in early 2015. To learn more, visit <http://easteconline.com/>. ■



The project team posed for a photo with guest speaker W. Lowell Putnam on July 27, 2014 at the AM PBL opening reception. Pictured (L - R): Sara Putnam, Lowell Putnam, Nicole Schepker, Judy Donnelly, Fenna Hanes, Eva Shultis, Michele Dischino and Nick Massa. Co-PI James DeLaura is not pictured.

School of Engineering Senior Programs Coordinator Cali Ann Stephens and NEBHE's President & CEO Michael K. Thomas welcomed the project team, participants and guests. Guest speaker W. Lowell Putnam, Sole Trustee at the Lowell Observatory in Flagstaff, Ariz., captivated the audience with a presentation on the development, manufacturing, and construction of the Lowell Observatory's Discovery Channel telescope, linking STEM concepts to each aspect of the process, including the pivotal role technicians played in making the manufacturing, construction, and assembly of the telescope a success. Putnam then shared a number of amazing images of galaxies, nebula and stars taken by the telescope. Putnam remained long after his speech to connect with educators and offered to speak at schools throughout New England on these exciting topics.

All of the Institute classes were held at BU's Photonics Center. On Monday morning, a panel of faculty and students who used the PBL Challenges (multimedia case studies) developed by NEBHE's previous STEM PBL and PHOTON PBL projects spoke about obstacles and successes to implementation, and the efficacy of PBL. The panel included Jack Brinkerhoff, a recent graduate of Three Rivers Community College, Conn., now employed by MIT's Lincoln Laboratory; Matthew Budge, a middle school science teacher at Sharon Center School, Conn.; Steven Martin, an advanced manufacturing and woodworking technology instructor at Ponaganset High School, R.I.; Corina Mier y Teran, a science major at Stonehill College, Mass.; and Susan Mooney, professor of biology and program director of the Environmental Sciences and Studies program at Stonehill College.

"It is especially helpful hearing about the problems and uncertainties instructors faced when implementing PBL," one participant noted.

After the panel, Kelli Vallieres, president & CEO of Sound Manufacturing, an AM PBL Advisory Committee member and AM PBL industry partner, spoke about the role of PBL and continuous improvement in her company. Vallieres also described the Challenge that Sound Manufacturing developed with the AM PBL project, and what industry is looking for in graduates.

"The information I gained on what industry wants and needs will help set up my class curriculum," a participant reflected.

"Hearing from an industry partner really helps to put academic pursuits in context in the real world," said another.

In the afternoon, participants were grouped by region and with their Alliance partners (where applicable) to solve the PHOTON PBL Challenge "Blinded by the Light," which asks students to identify the dangers pilots face when a laser pointer targets an aircraft. Before adjourning for the day, participants shared their solutions and compared theirs to the organization's solution. Assessment strategies for PBL were also discussed.

On Tuesday morning and all subsequent mornings, the project team answered remaining questions from the previous day and introduced participants to the Teacher Resources for PBL. Guest speaker JD Chesloff, executive director of the Massachusetts Business Roundtable, reviewed the findings of a survey of Massachusetts businesses. The survey indicated that business leaders want teaching to be more focused on STEM and applied skills rather than standardized tests, and feel that STEM education can be improved through more hands-on learning initiatives and industry-education partnerships (see page 2). A participant noted that Chesloff's presentation was "relevant, broad in scope and engaging."

Participants spent the remainder of the morning through the afternoon in self-selected breakout groups solving either the PHOTON PBL PhotoMachining Challenge focused on developing a process for stripping the coating from 50 micron wire, or the AM PBL IBM Challenge centered on repairing a problem in a thin film etching process that was causing an area at the edge of the wafer to be under-etched. Participants shared their solutions and then watched videos that explained the organizations' solutions.

On Wednesday, participants again broke into self-selected groups to solve the AM PBL FastCAP Systems and Hypertherm Challenges, which focused on developing a uniform thin film layer on which to evenly grow nanotubes, and minimizing the number of solder defects in a wave soldering process, respectively. AM PBL Challenge partners Jamie Beard, counsel & director of operations for FastCAP Systems, and Heather Dunn, senior



AM PBL Co-Principal Investigators Judy Donnelly and Nick Massa introduced AM PBL participants and Institute guests to the Challenges.

director of special programs for CIRTEC Medical Systems, presented their company's work as well as their need for technicians. Participants appreciated hearing directly from Challenge partners and learning about their hiring and internship needs.

Of this presentation a participant said, "I love that you have found a variety of vibrant women to speak to us about STEM and what businesses want to see in employees."

On Thursday, Co-PI Nick Massa reviewed student assessment strategies, and Project Assistant Eva Shultis introduced participants to implementation and facilitation strategies for PBL.

Co-PI Judy Donnelly and Project Coordinator Nicole Schepker introduced participants to the project's Design Your Own Challenge Template and shared strategies on where and how to connect with industry partners. During a pre-workshop webinar, participants were asked to come to the Institute with topics they would like to turn into real world Challenges. Armed with the template and their own ideas, participants began developing ideas for their own Challenges individually, in pairs, or with their Alliance partners.

After lunch the group toured Boston University's Engineering Product Innovation Center (EPIC), a training center for undergraduate and graduate engineers in developing and manufacturing innovative products. Laboratory Supervisor Joseph Estano directed the tour, which covered a machine shop and materials science laboratory, EPIC's equipment, the program and sponsors, and the degree programs that access the Center.

After the EPIC tour, participants returned to the Photonics Center to finish working on their Challenges. PI Fenna Hanes and Co-PI Michele Dischino met with the five teacher educators to discuss how they planned to implement PBL in their teacher education courses.

Later that evening, a closing dinner was held for participants in the Photonics Center's Colloquium Room overlooking Boston, giving participants another opportunity to network. Participants also received a certificate of completion for their participation in the AM PBL Institute.

On Friday, participants met for a half-day session to discuss remaining questions related to field-testing AM PBL Challenges, developing their own Challenges, and communications.

Participants' implementation stories will be shared in the AM PBL Teacher's Resources, and the new Challenges they have developed will be added to NEBHE's existing PBL Challenge library.



AM PBL participants and staff took a group photo at the Institute's closing dinner on July 31, 2014 at BU's Photonics Center.

STEM Teacher Educators Participate in the AM PBL Institute

The goal of the AM PBL project is to increase the pipeline of middle and high school students prepared and motivated to pursue engineering technician and other STEM careers. A key strategy to address this goal is to increase the number of STEM teacher education faculty and, as a result, pre-service teachers capable of developing and delivering PBL instruction.

This strategy was successfully developed and implemented at Central Connecticut State University (CCSU) during the previous STEM PBL project. The two courses developed, an undergraduate course (TE-399) for pre-service teachers and a graduate course (TE-506) for in-service teachers, continue to be offered at CCSU.

Five STEM teacher educators joined 26 high school and college STEM educators for the one-week AM PBL professional development Institute at Boston University the week of July 27, 2014. The teacher educators came from the University of Bridgeport, Conn.; Stonehill College, Mass.; Rhode Island College; University of Southern Maine; and Norwich University, Vt.

The goal for these faculty members is to model the CCSU courses and adapt existing courses in their own institutions to include PBL. The result will be that when their pre-service and in-service teachers enter the classroom they will be able to implement PBL to give their students the problem-solving, critical thinking and teamwork skills required in industry.

Now that the teacher educators are back at their home institutions, they will implement some of the existing PBL Projects' Challenges with their students, create and implement their own Challenges, and begin to adapt current courses to include PBL. ■

NEBHE and the AM PBL project team would like to thank the following organizations for contributing material donations to the AM PBL Institute:

Gemba Shop * IBM * Manufacturing Stories * Regional Center for Next Generation Manufacturing *
Society of Manufacturing Engineers * Sound Manufacturing * Vermont Technical College

After the workshop, several participants stayed to ask questions and learn more about PBL and how they might introduce the teaching method in their own countries. The 20 attendees were graduate students and faculty from England, Scotland, Mexico, Germany, Ukraine, Canada, Latvia, India and the US, plus two K-12 teachers local to San Diego.

July 24, 2014

PBL in Advanced Manufacturing: Transforming 21st Century Technician Education

*High Impact Technology Exchange Conference (HI-TEC)
Hyatt Regency Chicago, Chicago, Ill.*

Co-PI's Nicholas Massa and James DeLaura delivered a presentation to 45 attendees on how NEBHE developed classroom-ready PBL Challenges that provide secondary and postsecondary instructors and students the opportunity to solve authentic advanced manufacturing problems provided by industrial partners. Participants learned how the PBL Challenges were developed in collaboration with industry to include current advanced manufacturing practices in fields such as aerospace, optics, precision measurement, medical devices, and nanotechnology.

May 22, 2014

PBL in Advanced Manufacturing: Implementing a Transformative Workforce Preparation Strategy

*National Association for Workforce Improvement (NAWI)
Mt. Hood Community College, Gresham, Ore.*

Co-PI Massa and Project Coordinator Nicole Schepker presented NEBHE's AM PBL project and Challenges to a group of 10 secondary and postsecondary instructors and industry representatives at the 49th Annual NAWI conference. Participants learned how the authentic AM PBL Challenges were developed in collaboration with industry, how the Challenges were aligned to the Society for Manufacturing Engineering's (SME) Four Pillars of Manufacturing Technology, and viewed an AM PBL Challenge developed with FastCAP Systems, a nanotechnology company.

May 12, 2014

PBL Implementation Strategies for STEM Courses

*STEM Smart: Pathways to Middle Skill Occupations and Beyond
Olin College, Needham, Mass.*

The National Science Foundation (NSF) organized a series of eight STEM Smart conferences to showcase successful STEM initiatives. NSF's STEM Smart conferences are an outcome of the National Research Council's 2011 report, *Successful K-12 STEM Education: Identifying Effective Approaches in Science Technology, Engineering, and Mathematics (STEM)*. The report is available at <http://successfulstemeducation.org/about/nrc-report>, and resulted from the convening of a panel of experts who surveyed preK-12 schools that are highly successful in STEM education.

NEBHE's PBL Projects initiative was invited to present at the STEM Smart conference held at Olin College in Needham, Mass. The PBL team, including PI Hanes, and Co-PIs DeLaura and Massa, delivered a presentation on the PBL Projects to more

than 40 interested individuals focusing on community colleges, career and technical education, and middle-skills preparation.

March 31, 2014

PBL in Advanced Manufacturing: Transforming 21st Century Technician Education

Three Rivers Community College (TRCC), Norwich, Conn.

AM PBL Advisory Committee member and Challenge partner Kelli Vallieres is a member of the Eastern Advanced Manufacturing Alliance (EAMA), a group of manufacturers in eastern Connecticut with the goal of promoting manufacturing as a career option and ensuring that employee professional development and training are available at the local level. With EAMA's mission in mind, Vallieres and AM PBL Co-PIs DeLaura and Donnelly facilitated a PBL workshop with about 20 eastern Connecticut technical education high school teachers and middle school instructors. After introducing NEBHE and the PBL Projects, the participants worked through a PBL Challenge to gain an understanding of the change in pedagogy students face when they are first given a PBL assignment. The full-day workshop also included a tour of the TRCC manufacturing lab and a lunch provided by the Regional Center for Next Generation Manufacturing (RCNGM). Future PBL professional development activities for eastern Connecticut are being planned.

March 15, 2014

Engaging Students with PBL: You Light Up My Life!

*American Association of Physics Teachers New England Meeting
Salem State University, Salem, Mass.*

Co-PI Donnelly and Project Coordinator Schepker delivered a "learn by doing" workshop to 10 physics high school and college educators. Educators worked in teams to solve a real-world open-ended STEM PBL problem using NEBHE's "Whiteboard" method. Participants solved a STEM PBL Challenge developed with RSL Fiber Systems, a lighting design company, and received access to NEBHE's online PBL Challenges, student and teacher resources, and strategies for assessing and implementing PBL. Research results on teacher and student reactions to PBL and implementation stories from teachers who have successfully used PBL in their classrooms were made available to participants.

March 13, 2014

Introduction to PBL

*Center for Teaching and Learning Series
Trinity College, Hartford, Conn.*

There is a growing interest at Trinity College's Center for Teaching and Learning to introduce more student-centered teaching strategies into the curriculum. As a result, PI Hanes and Co-PI DeLaura introduced about 12 faculty members to NEBHE's PBL methodology, multimedia PBL Challenges, teacher resources—such as technical background, assessment strategies and a guide to creating your own Challenges—and student resources such as Whiteboards for solving problems.

PBL Projects Presented At European STEM Education Conference



PHOTON PBL project participant Elena Vladescu presented her work with the PBL Projects at inGenious in Split, Croatia.

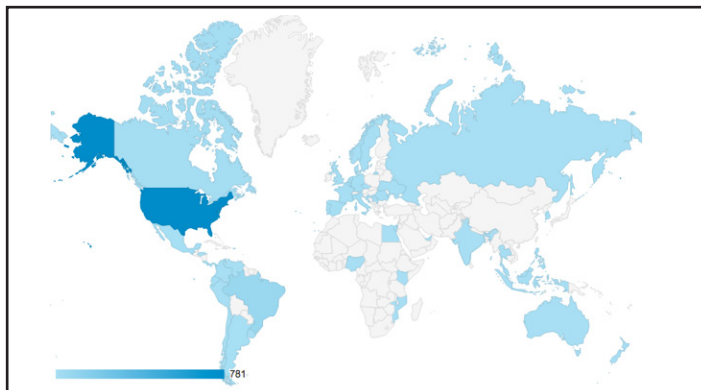
Elena Vladescu, a participant in the PHOTON PBL project and a high school teacher in Romania, has been participating in the European project titled inGenious, launched by European Schoolnet and the European Roundtable of Industrialists. inGenious's main objective is to increase the links between science education and careers, by involving up to 1,000 classrooms throughout Europe.

Since her initial participation with the PBL projects in 2006, Vladescu has implemented the PBL Challenges with her physics students. Her students are able to complete the Challenges because they are fluent in English. Vladescu was invited to give a presentation about her work with PBL at the 3rd inGenious summer school from August 22 - 24, 2014 in Split, Croatia. More than 180 participants representing 28 European countries attended the event.

More information about the inGenious program can be found at: <http://www.ingenious-science.eu/web/guest/home>. ■

PBL Projects Across the Globe

Since April 1, 2014 the PBL Projects website has been viewed in countries across the globe. The Google Analytics map below indicates the percentage of visitors per country in which the PBL Projects website has been viewed over the period of April 1, 2014 - September 22, 2014. The ten countries with the most views (in order of number of views) were the United States, Brazil, Canada, Spain, Italy, Croatia, Argentina, Portugal, Germany and Ecuador.



Google Analytics map indicating percentage of visitors per country to the PBL Projects website from April 1, 2014 - September 22, 2014.

Learn and engage! Visit the PBL Projects YouTube Channel, called [NEBHE PBL Projects](#), follow us on Twitter [@PBLProjects](#), and view our gallery of photos and videos at <http://www.pblprojects.org/gallery-page/>. ■

The AM PBL Challenges Are Live!

Five of the New England Board of Higher Education's (NEBHE) Advanced Manufacturing Problem Based Learning (AM PBL) Challenges—real world multimedia case studies developed with advanced manufacturing industry partners in New England—are now live on the web.

AM PBL Challenges have been developed with IBM in Vermont, FastCAP Systems in Massachusetts, Sound Manufacturing in Connecticut, CIRTEC Medical Systems in Massachusetts, and Hypertherm in New Hampshire. The table at right identifies each Challenge's industry partner, real world application and problem statement (called the Challenge statement).

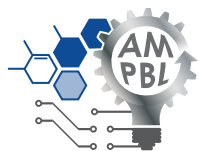
Recruitment of an industry partner with whom to develop the sixth AM PBL Challenge, focusing on design for manufacturability and life cycle assessment, is in process. Please contact PI Fenna Hanes for more information at fhanes@nebhe.org. ■



The AM PBL Challenges

Real-World Application	Industry Partner	Challenge Statement
Microchip Manufacturing/ Semiconductors	IBM	IBM has a problem with a thin film etching process causing an area at the edge of the wafer to be under-etched. How can IBM locate and repair the problem?
Nanotechnology	FastCAP Systems	FastCAP's carbon nanotubes need a uniform thin film layer for even growth, but the sputtered coating is bunching into clusters. How can they make the thin, even metal films they need?
Sheet Metal Fabrication	Sound Manufacturing	Sound Manufacturing needs to manufacture a sheet metal panel with many connector cutouts spaced closely together. Can metal be cut and bent beyond existing metal and machine standards without increasing the failure rate?
Medical Devices	CIRTEC Medical Systems	CIRTEC needs to ramp up production of power packs for an implantable medical device from 300 per year to 5000 per year. How do you go from a one-person operation to full-fledged production?
Advanced Quality Systems	Hypertherm	Hypertherm is experiencing too many defects in its wave solder process. How can Hypertherm minimize the number of solder defects?

Access the AM PBL Challenges at <http://www.pblprojects.org/challenges-nebhe/>



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NEBHE Developmental Math Demonstration Project—An Update

NEBHE's Developmental Math Demonstration Project (DMDP) is a Lumina Foundation funded three-year grant that has completed its second year of implementation. The 13 community colleges across the region involved in the pilot are using Khan Academy in Developmental Math (DM) courses. The instructional models include self-paced, emporium-based courses, flipped classrooms and traditional instructor-led DM courses. In addition, some colleges are using Khan Academy to help students take a college placement math test called Accuplacer.

Based upon usage surveys, a majority of students responded that Khan Academy has "helped me feel more confident when it comes to understanding and doing math" (69%) and "I would recommend Khan Academy to my other friends in college" (71%). However, students were quick to share that Khan Academy was not a perfect tool—technical hiccups, unannounced changes to the website and personal learning pref-

erences were all cited as reasons why Khan Academy may be a good supplemental tool, but "no substitute for an actual teacher."

In the last year of the grant, NEBHE is working with Khan Academy to address the technical "hiccups" cited by students. NEBHE will provide additional technical assistance and training to faculty and showcase best practices and classroom strategies used by participating faculty in the form of instructional resources and project meetings.

Classroom resources developed by NEBHE and project findings can be found online at www.nebhe.org/devmath. NEBHE's PHOTON PBL and STEM PBL Challenges are also aligned to video lessons and practice problems from Khan Academy. Alignment for the AM PBL Challenges is forthcoming. Please see the standards alignment article on page 3 of this newsletter to learn more. ■

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